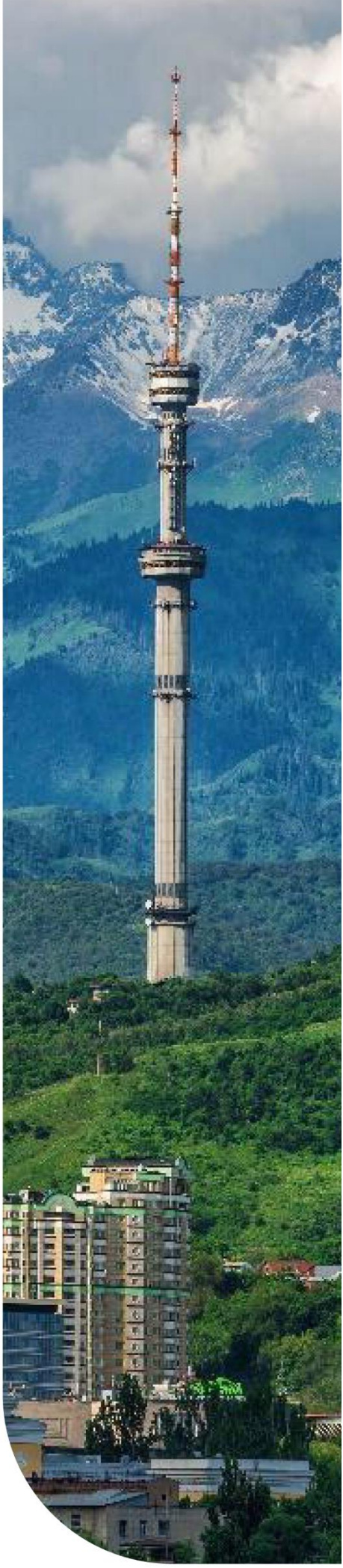
# Green City Action Plan for the City of Almaty



October 2022

## Document prepared and owned by Akimat of Almaty city

## Project supported by

European Bank for Reconstruction and Development

Federal Ministry Republic of Austria Finance

## Document developed with the contribution of

Resources & Waste Advisory Group

ARCADIS Design & Consultancy for natural and built assets

EcoSocio Analysts WORKPLACE, ENVIRONMENTAL AND SOCIOECONOMIC ASSESSMENTS

## Disclaimer



*This action plan has been funded by the Federal Ministry of Finance - Republic of Austria.*

# Executive summary

The Akimat of the city of Almaty joined the EBRD Green Cities framework in order to build a better and more sustainable future for the city and its residents. The present Green City Action Plan (GCAP) is a key development milestone for Almaty. The action plan pursues a comprehensive assessment of the environmental and urban development challenges the city is confronted with, having a focus on seven urban sectors: land use, transport, water and wastewater, waste management, energy, buildings and industry. This process was carried out in a systematic way following the EBRD GCAP methodology.

The GCAP is a compendium of implementable projects aimed at improving the environmental conditions in the city and the social wellbeing of all its citizens. It concludes the findings of a thorough data collection and analysis of the quality of the environment and resumes a city environmental baseline which reveals the environmental and sectoral challenges for the city. These challenges have been prioritized through a technical analysis and stakeholder consultations and concrete actions were developed to address them. The document gives an overview of all necessary investments in the upcoming 5-10 years, which would guide the city to achieve transformation and to become the green innovation hub of Central Asia.

The GCAP will significantly contribute to the development and achievement of sustainable solutions and good practice examples and ideas that can be replicated at regional level. All the actions included in this GCAP are focusing on Almaty city and on how they are embedded in the surrounding landscape. Still, since Almaty is the main city within the Almaty Agglomeration structure, the measures foreseen in the GCAP will be implemented in line with both city and regional context and needs. Moreover, the actions are designed in line with the objectives of creating a functional regional entity which has in its centre a green city, with sustainable solutions for public transport, waste management, air quality, climate resilience. Evidently there may be some specific to implementing actions in the more dens populated city of Almaty compared to the lower population numbers in the further Almaty Agglomeration.

Whilst developing the GCAP, we have followed a process including data collection, verification, analysis and consultation with all stakeholders involved. This process allowed to define the most important measures to engage in. Given the available data and time series trends for the state indicators, coupled with expert knowledge of the local context and sectoral meetings held with stakeholders, it can be concluded that the priority environmental challenges of Almaty are related to air quality, drinking water quality, water bodies, green spaces, GHG emissions and climate change resilience.

The relevant key findings following the GCAP elaboration process are summarized in:

- Clear evidence of the air pollution
- Obsolete utility networks and facilities
- Tariffs for urban services do not fully cover their costs
- More integrated approach is needed in the municipal governance
- Almaty development is partially hindered by gaps in national legislation
- Strong basis to implement green city actions
- Strong engagement from local stakeholders.

The environmental challenges are determined by the pressures coming from different sectors. Thus, GCAP analysed seven key sectors and determined which are the main aspects that need to be addressed to improve their performance and reduce the pressure on the city's environment.

The **energy** sector calls for investments in transition of Almaty Energy Complex from coal to lower-carbon alternatives and improvement of energy efficiency in the public and residential sectors, as well as rehabilitation and modernization of district heating infrastructure. Key challenges in the **industry** sector refer to insufficient implementation of energy efficiency measures and renewable energy investments, low level of compliance regarding wastewater pre-treatment and industrial waste management. The **transport** sector needs improvements in public transport (renewal of public transport fleet, dedicated lanes for public transport, higher frequency of buses). One of the priorities is to improve the PT-connections between suburbs and city centre and diversification of modal transport with a focus on promoting modal shift toward more sustainable and greener transport, including promoting decarbonisation and micro mobility development. **Buildings** (both public and residential) require major investments in terms of energy efficiency and promotion of heat pumps and solar heating for residential buildings which are in areas not connected to district heating. The prevalent coal-based heating and electricity consumption (sourced from fossil fuel) in residential buildings causes a major concern for the environment. Actions targeting the **water** sector will tackle the issues of high losses in the water supply and sewerage networks, lack of future projections on water scarcity, and the poor condition of the only existing public WWTP. The assessment of the **land use** sector highlighted issues regarding the low percentage of green space per capita, insufficient link between green infrastructure and blue network, absence of future scenario analysis for the risks of mudflows, and the highly regulated rivers, decreasing the permeability of the city. Finally, the **waste management** requires the development of an Integrated Waste Management Strategy, circular green-waste management and inclusion of a C&D waste management system. Although Akimat of the city of Almaty has already initiated steps for source separation, an established system for separate collection of recyclables is not in place yet.

In order to address the key environmental and sectoral challenges, GCAP sets four strategic objectives to guide us during GCAP implementation and defines 30 short-term actions to be realized in the first 5 years. These actions are interlinked and will serve more than one objective, and result in improvements in multiple sectors. Each short-term action has its targets, implementation steps, stakeholders involved, and compiled budget estimations. A special emphasis is given to environmental, gender and social benefits of the actions. Also, smart solutions are recommended. Moreover, this GCAP envisages a separate smart action regarding a unified city digital platform, which will provide an up-to-date view of the situation in the city so that any measures planned can be simulated and tested.

It was estimated that the total CAPEX of implementing these short-term actions is at EUR 1.28 billion EUR (approx. 626.7 billion KZT). This funding will need to come from a variety of sources, including the city's own budget, International Financing Institutions (IFIs), private banks and private business investment. The total annual estimated potential for $CO_2$ savings, if all the actions are implemented, is at about 1.54 million tonnes of CO2/year.

Most of the actions are policy and investment oriented with clear links across the actions. Some investments are included in policy actions, other investments in green infrastructure are presented as separate actions. For instance, Action 11 on multimodal hubs is an investment action. Action 18 on increasing the water permeability of the city is also an investment action. Action 27 on development of a water saving plan is only a policy action, however followed by investment actions on leakage reduction and on water runoff delay. There is only 1 policy action that is not clearly linked to investment, Action 10 on Transit Oriented Development, which is a long-term initiative and crucial for the city and some activities on this needs to be started now.

The core priority actions included in the GCAP target the smart development of the city; decarbonization of the district heating network; energy efficiency in public and residential buildings that will support the adoption of small-scale renewable energy sources such as photovoltaic, solar water heaters or heat pumps; circular green waste management; transport sector development; development of blue-green infrastructure projects; modernization of the water and wastewater sector including the development of a water saving plan and provide incentive towards becoming a green innovation hub of Central Asia. The GCAP will help the

city to steer the development process by understanding the interlinks between different sectors and how the investments should be correlated to achieve best results as efficiently as possible. The GCAP implementation process will be constantly monitored and evaluated and will consider all the lessons learnt during the implementation period.

# Contents

1

## List of figures



## List of tables



## List of acronyms

| | |
|---|---|
| AMR | Automated Meter Reading |
| BAT | Best Available Technologies |
| BMS | Building management system |

| | |
|---|---|
| BRT | Bus Rapid Transit |
| CDW | Construction and Demolition Waste |
| CDT | Citywide Digital Twin |
| CHP | Combined Heat and Power |
| CNG | Compressed natural gas |
| DH | District Heating |
| EBRD | European Bank for Reconstruction and Development |
| EE | Energy Efficiency |
| EPR | Extended Producer Responsibility |
| GCAP | Green City Action Plan |
| GDP | Gross Domestic Product |
| GII | Green Innovation Incubator |
| GIIP | Green Innovation Industrial Park |
| ICT | Information & Communication Technology |
| IFI | International Financing Institution |
| IoT | Internet of Things |
| KZT | Kazakhstani tenge |
| LEZ | Low Emission Zone |
| LPG | Liquefied petroleum gas |
| LRT | Light Rail Transit |
| MBT | Mechanical Biological Treatment |
| MRT | Mass Rapid Transit |
| MSW | Municipal Solid Waste |
| NDC | Nationally Determined Contribution |
| NH4 | Ammonium |
| NOx | Nitric oxide |
| nZEB | Zero Energy Buildings |
| O&M | Operation and Maintenance |
| OGPI | Office for Green Project Implementation |
| PM | Particulate matter |
| PPA | Purchasing Power Agreement |
| PPP | Public Private Partnership |
| PSR | Pressure-State-Response |
| PT | Public Transport |
| RDF | Refuse-derived fuel |
| RES | Renewable Energy Sources |

| | |
|---|---|
| SO | Strategic Objective |
| SOx | Sulfur oxide |
| TOD | Transit Oriented Development |
| UNDP | United Nations Development Program |
| WEI | Water Exploitation Index |
| WHO | World Health Organization |
| WWTP | Wastewater Treatment Plant |

# Introduction

World-wide, the rapid growth of urban populations generates serious environmental challenges to which local solutions need to be conceived. According to the United Nations, around half the world's population now lives in urban areas, with this figure likely to exceed 68% by 2050. To meet the rising demand for services, cities require vast amounts of resources, which, in turn, has a significant impact on the urban environment. For example, cities currently account for up to 75% of energy use and 70% of greenhouse gas emissions worldwide.

To address these challenges, the EBRD developed the EBRD Green Cities programme, with the aim of building a better and more sustainable future for cities and their residents. The programme does this by identifying and prioritising environmental challenges, which are then connected with sustainable infrastructure investments and policy measures.

The Akimat of the city of Almaty has expressed a desire to take a systematic approach to addressing its urban environmental challenges. Therefore, the Akimat decided to develop its own Green City Action Plan (GCAP). The GCAP pursues a comprehensive assessment of the environmental and urban development challenges the city is confronted with, having a focus on seven urban sectors: land use, transport, water and wastewater, waste management, energy, buildings and industry. This planning was carried out in a systematic way, while considering social concerns and including gender aspects. A special emphasis was given to digital/smart solutions that can be applied while guiding the city through the transformative process of becoming a green city.

Thus, the GCAP is a dynamic document, a step-by-step guide to implementers and urban specialists, through which environmental challenges are tackled, and sustainable, green infrastructure can be developed. We strongly believe that this strategic plan will allow the city to fulfil its goal of becoming a green urban zone where citizens will find economic opportunities, access to improved services and employment as well as equal participation and representation. It will also empower its decision-makers, officials and the community as a whole to transform Almaty into the green innovation hub of Central Asia.

**Structure of the document**

When developing this document, our endeavour was to produce a coherent, well-structured action plan, to make it comprehensive, yet easy to read, understand and use.

The document is structured in three main sections:

**Section I. City overview and environmental baseline** provides a city overview, a comprehensive background in terms of the methodology used and adapted to specifics of Almaty, and the baseline. The section consists of several chapters, as follows:

> ***Chapter 1.*** City overview – presenting the main demographic, social and economic features of the city;
>
> ***Chapter 2.*** Methodology – detailing how the EBRD's GCAP methodology was adapted to the specifics of Almaty, including the process of stakeholder consultations;
>
> ***Chapter 3.*** Baseline – providing highlights on the policy framework, findings of the data collection and analysis, as well as environmental and sectorial challenges faced by the city;

**Section II** is the core part of the document; it presents the **Green City Actions** developed on the basis of the findings in Section I. The section consists of several chapters, as follows:

> ***Chapter 4.*** The Green City vision and strategic objectives, detailing the 4 strategic objectives for addressing the issues and turning Almaty into the green innovation hub of Central Asia;
>
> ***Chapter 5.*** GCAP Actions – detailing the 30 defined actions which are trans-sectorial and multi-purposed, meaning that most of them refers to more than one sector and contributes to more than one strategic objective. The chapter also lists long-term actions completing the detailed short-term actions.
>
> ***Chapter 6.*** Summary of GCAP actions with financial details

**Section III** presents the plan for the **monitoring of the implementation of the actions**. The section includes:

> ***Chapter 7.*** Description of the Monitoring Framework

Almaty
Green City Action Plan

# Section 1 City overview, methodology and environmental baseline

1

# 1 City overview

## 1.1 Social, administrative and economic aspects

Almaty is the former capital of the Republic of Kazakhstan with a population of 2,012.6 thousand people (as of 1st of October 2021, without the outskirts)[1]. It is the largest city in the country and a major commercial and cultural centre with many small and medium-sized businesses.[2]The city is located at the foothills of the Tianshan Mountains at the altitude 660-1300 m, in the valley of 4 rivers: Big and Small Almatinka, Yesentai and Kargaly. The mild climate and practical absence of wind are due to the presence of the mountains. The climate encourages a wide range of apple tree varieties to flourish; thus, it is also known as the city of apple trees.

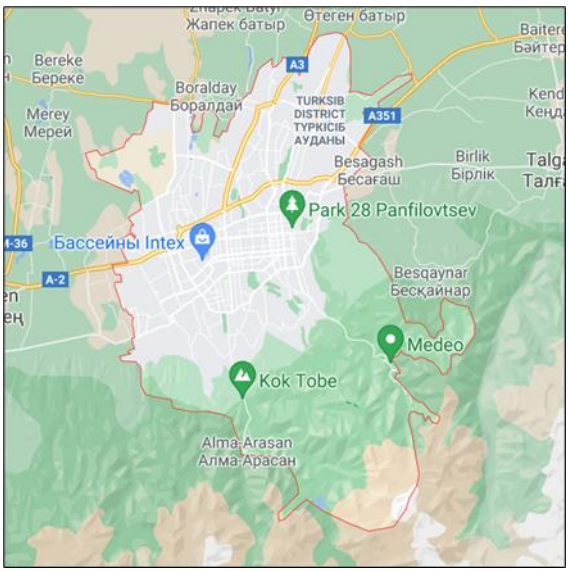



*Figure 1 Geographic map of Almaty[3]*

Over the past 10 years the city area has doubled its size. The population grew by more than a third in the city proper, and the city's satellite settlements add another million to the population (Almaty Agglomeration). The population growth rate is the highest in the country, mainly due to urbanization or migration from other regions. By 2035 the population of the city is expected to reach 3,775 thousand. The city population is young as 65% of residents are under the age of 40 and 46% are under the age of 30[4].

The Almaty Agglomeration, whose core is the city of Almaty, includes several cities and districts. According to the Interregional Action Plan for the Almaty Agglomeration development until 2030 (issued by the RK Government, February 28, 2020), the cities and districts are: Esik City and 14 rural areas of the Enbekshikazakh district; 6 rural areas of the Zhambyl district; Otegen-Batyr Village and 8 rural areas of the Ili district; Kaskelen City and 10 rural areas of the Karasay district; Talgar City and 10 rural areas of Talgar

[1] Almaty official statistics: https://stat.gov.kz/region/268020. Population with the outskirts approx.: 2.9 million people.
[2] Kazakhstan is divided into 14 Regions (Oblasts). Four cities, Baikonur, Shymkent, Almaty and the capital Nur-Sultan are considered separate entities and are not part of the regions they are surrounded by. Nur-Sultan and Almaty cities are administratively independent cities with a status comparable to an oblast. Almaty Region has an area of 224,000 km$^2$, while Almaty Agglomeration – 9,400 km$^2$
[3] Source: Google maps
[4] See: www.stat.gov.kz

region; KonayevCity and 2 rural areas, administratively subordinated to the Konayevcity administration; Gate City.

These territories are included in the 1.5 - hour transport accessibility from the city of Almaty (no more than 110 km along the main communication lines). The Almaty Agglomeration covers an area of 9,400 km$^2$. The boundaries of the suburban zone and the zone of special urban planning regulation of the city of Almaty are established by the Decree no.1097 of the RK Government, dated October 22, 2010. The population of Almaty Agglomeration as of September 1, 2019 is 3,103,600 people.

Almaty city has eight districts (rayons), as follows: Alatau, Almaly, Auezov, Bostandyk, Medeu, Nauryzbay, Turksib and Jetysu (figure below).


*Figure 2 Administrative division of Almaty*[5]

The infrastructure is notably better developed in the historical centre and in areas closer to the mountains that surround the city from the South and the East, than in the outskirts of the city. The historical centre is home to 60% of educational institutions, 17 out of 19 theatres, 31 out of 33 museums, 13 out of 18 parks and most offices and medical facilities.

Almaty contributes significantly to the economic development of Kazakhstan. The city pays 23.4% of all taxes in the country. Almaty was ranked 1st in the country in terms of Gross Regional Product (GRP), accounting for 19.5% in 2019 (13.5 trillion tenge/approx. 27.6 million EUR[6]). The GRP per capita was 7,183.9 thousand tenge/approx.14,721 EUR in 2019. It is also the centre for the development of small and medium-sized businesses.[7]

[5] Source: The green space as a driver of sustainability in post-socialist urban areas the case of Almaty city. See: https://journals.openedition.org/belgeo/28865?lang=de
[6] The exchange rate as of February 16, 2022: 1 EUR=488 tenge. This exchange rate is applied for all values presented in this report including cost estimates for actions.
[7] Almaty Development Program 2025.

The share of sectors in the total GRP, 2019: industry 4.8%, agriculture 0.05%, construction 2.2%, trade 35.7%, financial and insurance activities 8.7%; transport 5.6%, information and communication 4.6% and others 38.4%. Trade and services are the main sectors that determine the development of the city's economy.[8] The national government is supporting Almaty Agglomeration to increase its local agricultural production and processing capacity, to enhance reliance and to allow for the sector to rely on organic farming with the use of compost and biological pest control.

According to the Almaty official statistics, the average monthly salary is 236,208 tenge / 484 EUR (2020), excluding small businesses engaged in entrepreneurial activities. The average salary of the residents of the outskirt districts like Nauryzbay is half of that recorded in Medeu District.[9]

In the national context about 60% of the country's export income is related to oil, thus its economy is very dependent on world oil prices. Likely related to plummeting oil prices, in 2014 Kazakhstan's GDP growth started to decline, dropping to 1.2% in 2015 and then to 1.1% in 2016. Major contributors to GDP at national level are services (57.4%) and industry (26.8%).[10]

**Gender aspects**

The ADB gender assessment in 2018[11] ranked Kazakhstan high in key gender and development indicators, with a female Gender Development Index (GDI) of 0.795, compared with 0.790 for men. This cumulative GDI of 1.006 places Kazakhstan in Group 1, indicating high equality between women and men. Kazakhstan steadily reduced its Gender Inequality Index (GII) value from 0.405 in 2000 to 0.202 in 2015, bringing it lower than the 0.279 average for Europe and the other Central Asian countries. Gender parity in education transfers to practically equal employment opportunities with women constituting 53.9% of unemployed in Kazakhstan.

Despite its ranking higher than other countries in Central Asia and Caucasus, Kazakhstan has some difficulties in narrowing its gender gap further. The ranking (72 out of 153) in the World Economic Forum Gender Gap Index[12] comes from the poor representation of women in the state policy development and decision making (8.4%), women's representation in the country labour force and gender wage differences (on average 66% of the men wages).[13]

Regarding Almaty, the composition of the Maslikhat also points to the low representation of women, as in 2019 they held only 16.3% (7) of the deputy seats compared to the 83.7% seats for men. While in 2019 there were 2008 female public servants in Almaty, none of them held a political public servant position.[14]

# 1.2 Financial overview

The primary legal document which regulates public finances is the Budget Code of the Republic of Kazakhstan. One of the guiding principles of the Budget Code is budget independence – art. 4 (7) –, meaning that all levels of government have the right to independently carry out the budgeting process, and that additional revenues to the local budgets cannot be withdrawn by higher authorities.

[8] Almaty Development Program 2025.
[9] See: https://stat.gov.kz/region/268020.
[10] UNECE (2019). Kazakhstan Environmental Performance Review.
[11] Kazakhstan Country Gender Assessment 2018 https://www.adb.org/sites/default/files/institutional-document/479136/kazakhstan-country-gender-assessment.pdf
[12] Global Gender Gap Report 2020, WEF. http://www3.weforum.org/docs/WEF_GGGR_2020.pdf equality.html#:~:text=In%20addition%2C%20over%20the%20past,Central%20Asia%20Countries%20(0.279)
[13] https://www.oecd-ilibrary.org/governance/gender-policy-delivery-in-kazakhstan_9789264280359-en
[14] Source: https://stat.gov.kz/

The majority of the municipal revenues of Almaty are own revenues, consisting of income taxes (the largest source of funds for the municipality), but also non-tax revenues (lease income and dividends from state-owned property, fines, sale of goods and services etc.) and sale of property. While the absolute value of the own revenues has been increasing over the analysed period, their percentage in the overall municipal revenues has dropped by 10 p.p. However, they remain on an average value of 79% of the overall gathered funds. Almaty does not have rate-setting power over taxes as the central government has full fiscal authority over tax rates.

Transfers from the state budget represent the rest of the revenues in the municipal budget, fluctuating between 13% and 31% of total revenue during 2016-2020. Almaty makes annual compulsory transfers to the central budget, the amount of which is determined by the central government and is historically around 20% of total expenditure.

**On budgeting and capital investments**

Over the 2017-2020 period, the municipal budget of Almaty was subject to year-to-year increases, the sharpest one in 2020, likely due to the Coronavirus situation.

The budget includes very low expenses on debt servicing, and 70.5% of the revenues of Almaty are own revenues, in most part from local taxes, conferring the city of Almaty high creditworthiness. In 2022 Fitch Ratings has affirmed Almaty's Ratings at 'BBB' with Stable Outlook, which reflects a combination of a 'weaker' risk profile and a 'AAA' debt sustainability assessment. Fitch expects the city's payback ratio (net adjusted debt/ operating balance) will not exceed 2x over the rating horizon, 2021-2025, supported by sound operating balance and low pace of debt growth.

One potential weakness that has been evident from GDP growth rate is dependence of the economy on global oil prices and the need for a reform on energy pricing. However, the city's overall financial standing, together with the 3-4% part of the expenses which are used for capital investments, gives the city significant potential for green development, investment and partnerships opportunities.

It is worth pointing out that Almaty implemented an annual Public Participation Budget, where citizens can submit projects and the residents of the municipality will vote on them. Since 2019, there were 796 project proposals, amounting to 23,7 billion KZT/47,4 million EUR. The public authorities of Almaty are also implementing Public-Private Partnerships (PPP). As of 2020, 15 such projects (with 53 PPP contracts signed) are being implemented or are approved for implementation, with a total value of 58,7 billion KZT/117,4 million EUR (private sector contributions consist of 19,2 billion KZT/38,4 million EUR).

# 1.3 Institutional set-up

In Kazakhstan, local state administration is carried out by executive bodies called Akimats (standing for Council Office); the head of a local government is called Akim. The local representative bodies are called Maslikhats.

The Akims of regions, and cities of republican significance (such as Almaty) and of the capital are appointed by the President of the Republic with the consent of Maslikhats of regions, cities of republican significance and the capital, respectively. The President of the Republic has the right to dismiss Akims at his discretion.

The Akim of the Akimat of the city of Almaty is the chief authority in the city. The Akimat of the city of Almaty is the local government responsible for providing management and control, organizational, legal, consultative and logistical support to the activities in the city.

Maslikhats are local representative bodies that express the will of the population and the respective administrative-territorial units and, taking into account national interests, determine the measures necessary for its implementation and control their implementation. The Maslikhats have the following functions:

- approval of plans, economic and social programs for the development of the territory;
- approval of local budget including the budget programs implemented by Akims of the district in the city (separately for each district in the city);
- approval of rules for improvement of the territories of cities and settlements and for maintenance and protection of green spaces.

In practice, only the Akim has administrative functions, and the legislation gives Akim more powers than to the Maslikhat deputies.

The Akim of the Akimat of the city of Almaty is supported by five Deputy Akims with different functions including some areas relevant for GCAP. Two of the Deputy Akims covers most of the urban development sectors, namely housing and communal services, urban economy, ecology and transport.

The Akimat is represented at the level of all 8 districts: Alatau, Almaty, Auezov, Bostandyk, Medeu, Nauryzbay, Turksib and Jetysu. Each district has its own district level Akimat. The head of the district-level Akimat in a city of republican significance is appointed by the Akim of the city with the consent of the Maslikhat of the city.

The Akimat of the city of Almaty has 23 departments as presented below. The departments relevant to GCAP development are highlighted in dark grey.

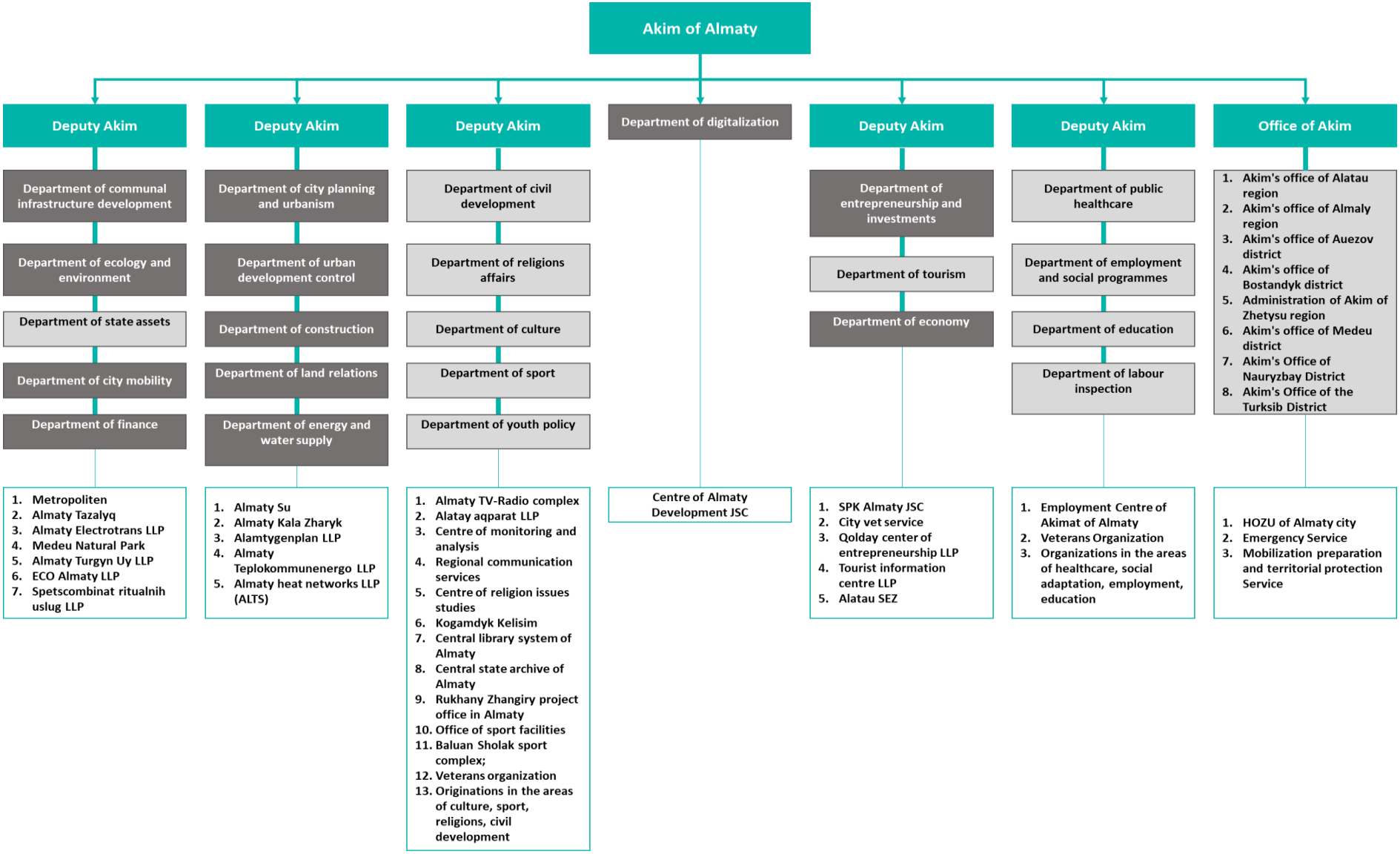



*Figure 3 Departments of the Akimat of the city of Almaty*

The municipal service providers in Almaty cover sectors such as: electricity/heating distribution, water generation/distribution, wastewater and sewage, power plants, waste, transport. Most service providers are state-owned companies. The relationship between the companies and the Akimats has an administrative nature, and this gives the Akimat the possibility of intervention in the administrative activities of the municipal companies.

The water and gas supply in the city is handled by the Department of Energy and Water Supply of Akimat of the city of Almaty. Waste management falls under the attribution of the Department of Communal Infrastructure Development, which operates a rational, environmentally friendly, and efficient municipal waste management system, including separate collection, regular removal, recycling and utilization of municipal waste.

In terms of urban planning in Almaty, the Akimat of the city of Almaty develops a scheme of regional planning of the region, master plans for the city and submits them for consideration to the Maslikhat of the city. The Akimat also acts as a customer for the construction, reconstruction and renovation of the assets of the city, municipal property and social and cultural facilities of the city and gives permission for the construction of utility networks and facilities.

For developing the GCAP, the Akimat has appointed a Working Group led by a Deputy Akim of Almaty, for cooperating with the consultant team and the EBRD. The Working Group engages in GCAP development both by providing input and feedback and by overseeing the implementation of the project. The Working Group includes heads or deputy-heads of the 7 urban development departments deemed most relevant for the GCAP, namely[15]:

- Department of Ecology and Environment
- Department of Energy and Water Supply
- Land Relations Department
- Department of Communal Infrastructure Development
- City Mobility Department
- Department of City Planning and Urbanism
- Entrepreneurship and Investment Department

The departments of the municipality represented in the Working Group of the GCAP have clear roles in conceiving policies and implementing actions. Policies and budgets are sent to the Department of Finance, which collects, reviews and centralizes the sectoral plans and ensures a coherence in terms of strategy and budgeting.

For the GCAP implementation, a dedicated department will be established. The **Akimat Office for Green Project Implementation** will act as the main body responsible for coordinating the GCAP implementation, development and implementation of foreseen actions and ensure high environmental performance of services and investments in the city. This unit will be directly subordinated to Akim, ensuring fast and effective decision-making processes.

[15] Some departments have changed their names in accordance with the latest Akimat institutional structure approved in June 2022: https://www.gov.kz/memleket/entities/almaty/press/article/details/89805?lang=ru

# 2 Methodology

## 2.1 Methodology applied for GCAP development

Throughout the development of the Green City Action Plan, the methodology developed by EBRD has been applied, based on the Pressure-State-Response (PSR) assessment framework (figure below).

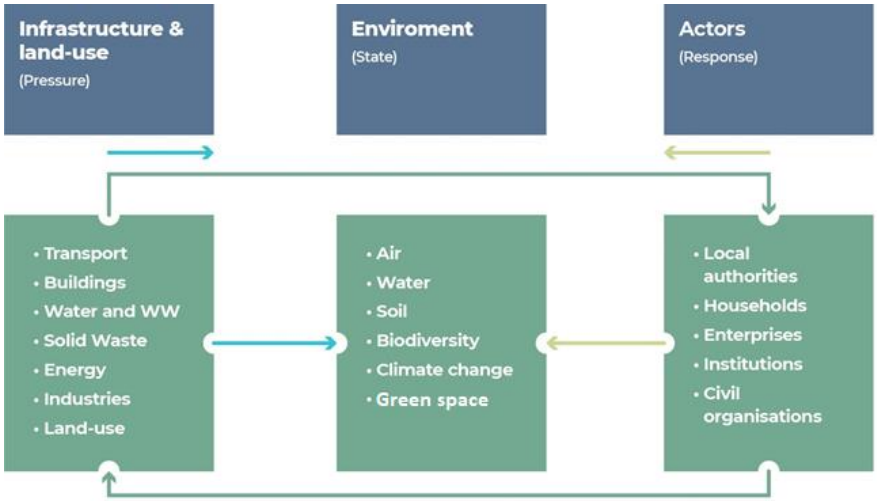



*Figure 4 Pressure-State-Response Framework*

This framework identifies human activities that exert **pressures** on the urban environment in the 7 GCAP sectors (figure below) and change its **state** in terms of environmental performance. It also identifies how the society **responds** to these changes through general environmental, economic, social and sectoral policies, investments, and through changes in behaviour, thus affecting the pressures caused by human activities. The PSR framework therefore builds causal linkages between the environmental performance of a city; the key associated economic activities of different social groups; and investment, services and policy instruments to respond to these challenges.


*Figure 5 Symbols used to indicate GCAP sectors*

In order to outline the environmental performance of the city according to the above-described framework, we have conducted a thorough **data collection** based on a series of specific state and pressure indicators. These have been provided officially, through letters/primary data, or retrieved from official policy documents, strategies, official statistics and responses on official letters to relevant Akimat departments and key entities. In some cases, expert judgment (for qualitative indicators) and suitable proxies were used by experts in case of lack of locally specific information. The response indicators were assessed in order to

evaluate whether the city has sufficient policies and initiatives in place to address its environmental challenges.

The draft database with state, pressure and response indicators has gone through several iterative validation stages, ensuring the highest possible level of confidence in the final data. This process is illustrated in the figure below.

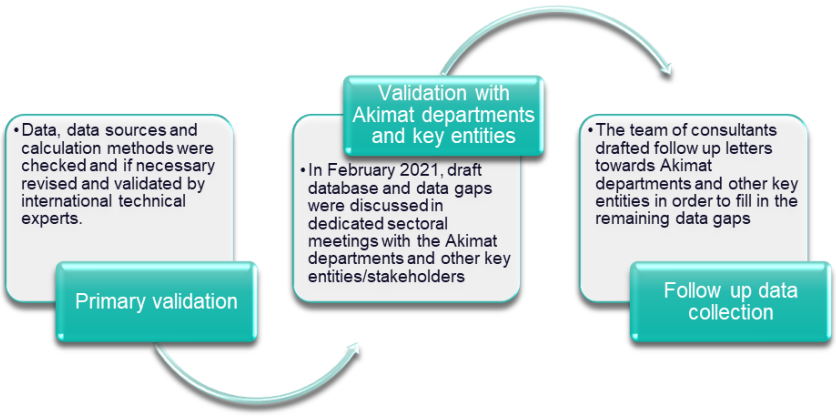



*Figure 6 Data validation steps*

The collected indicators were benchmarked to international standards. This allowed for the traffic light screening of the environmental performance of the city, when indicators are ranked, corresponding to **traffic light thresholds** ("green", "amber", "red"). This method also allows for identifying priority challenges. The linkages between priority state, pressure and response indicators are depicted in **problem trees**. Problem trees are used to assess and select/discard priority challenges in stakeholder consultation. First, a **long list** of ideas or actions is drawn for each priority challenge and discussed with the technical staff of the municipality. The **short list** of ideas emerges from this technical assessment that are further developed and prioritized through stakeholder consultations. The selected and prioritized ideas are then detailed and included in the action plan.

**Additional aspects considered**

Throughout the baseline assessment, **smart solutions** were considered whenever possible in order to adjust the city infrastructure to 21st century needs. Smart solutions can bring benefits for the city (data-driven decision, reducing operation cost), citizens (services to consumers, access to data) and the private sector (further business development, development of the digital economy).

The action plan also embeds the findings of a **social and gender assessment**. Each action included in the GCAP specifies, where relevant, additional measures and specific activities related to the reduction of gender inequalities, social inclusion, maximizing the socio-economic benefits and ensuring equal opportunities for all categories of persons, including the most vulnerable ones.

Given the **COVID-19 pandemic** unfolding during the GCAP development process, several lessons are being learned at a rapid pace by all nations and in particular by municipalities throughout the world. On one hand the COVID-19 pandemic has emphasized gender inequalities regarding access to resources and information in terms of gender, education and income level of citizens, and it had disproportionate impact on women. All these lessons learned are internalised to ensure that engagement methods reach a broad and inclusive audience.

On the other hand, resilience has emerged as a key feature which urban areas need to possess and develop to face future times. The recovery process of cities after the pandemic provides a unique opportunity to 'rebuild' in a more resilient and green way. The development of the GCAP therefore integrates in an optimum

way the recovery process, uses the momentum and harnesses the newly achieved awareness to streamline the green and 'resilient by design' development of future Almaty.

## 2.2 Stakeholder consultations

The stakeholder consultation process during the GCAP development had to consider and to adapt to the challenges related to COVID-19 pandemic and the limitations/restrictions regarding in-person meetings and travelling. In this regard, special attention was given to the communication with the stakeholders' groups and alternative/additional engagement activities have been implemented to achieve the best results for the project and to keep, at the same time, all the parties involved safe and healthy.

These activities are listed below, further detailed in Table 1:

- Regular online team meetings to update and brief each other about the project progress and upcoming tasks;
- Site visit combined with online meetings to allow international team members to participate;
- Regular online meetings with local experts to validate and to obtain information on the development of different sectors;
- Online consultation workshops (baseline, prioritization of challenges, validation of actions, etc.);
- Initial letters and follow-up letters to relevant Akimat departments, Public Utilities Companies and other relevant stakeholders;
- Exchange of letters with NGOs/CSOs;
- Constant communication and information disclosure via Municipality website.

All interested parties have been involved in the engagement process starting at early phases of the process. Stakeholder involvement was done using a step-by-step approach, being involved in each phase of GCAP, to achieve the best results for GCAP development.

The list of key stakeholder engagement activities is presented in the tables below. The names of the Akimat departments were valid at the time the meetings were held. Some departments have changed their names in accordance with the latest Akimat institutional structure approved in June 2022 (Figure 3).

*Table 1 List of key stakeholder engagement activities with the Akimat, Public Utility Companies and other relevant stakeholders*

| Event / Activity | Date | Topics of discussion/Main outcomes |
|---|---|---|
| Launch Event and First Stakeholder Consultation Workshop (online webinar format) | 9th Sept. 2020 | Mobilization<br>Informing public at large on the GCAP methodology and project plan<br>Perceived environmental and sectoral challenges of the city<br>Cooperation methods |
| 4 Working Group meetings (online, via Zoom platform) | During the baseline development phase (1st of Oct. 2020, 11th and 19th of Nov. 2020, 30th of March 2021) | Project progress<br>Deliverables and input needed from the Akimat departments |
| 3 Sectoral meetings with the Akimat departments, Public Utility Companies and other relevant | During the baseline development and challenges | Data/information collection and validation. During these 3 days the following stakeholders were consulted: |

| | | |
|---|---|---|
| stakeholders (online, via Zoom platform) | prioritization phase (1st, 3rd and 9th of Feb. 2021) | • Akimat Energy Efficiency and Infrastructure Development Department;<br>• Akimat City Mobility Department;<br>• Ecology Department of Almaty City;<br>• Department of Emergency Situations of Almaty city;<br>• ALES District Heating Company and Almaty Heating Network;<br>• Almaty SU Water Utility Company;<br>• Almaty Street Lightning Company. |
| Initial letters and Follow-up letters to relevant Akimat departments, Public Utility Companies and other relevant stakeholders | During the baseline development and challenges prioritization phase (Jan. and Feb. 2021) | A number of 9 initial letters were sent in January 2021 and other 8 follow-up letters were sent in February (after the sectoral meetings) in order to verify and/or request data points related to the indicator database. |
| Second Stakeholder Consultation Workshop: Prioritization of challenges (regular online meeting, via Zoom platform) | 21st – 22nd of Apr. 2021 | The environmental and sectoral challenges have been prioritized. |
| Meeting with the Deputy Mayor of Almaty responsible for GCAP (online, via Zoom platform) | June 2021 | A dedicated meeting was organized to present the project, status, and further developments. |
| Third Stakeholder Consultation Workshop (regular online meeting, via Zoom platform) | 7th – 8th of July 2021 | Prioritization of long list of actions |
| Online meetings with the following Akimat Departments and stakeholders for validating priority actions in GCAP sectors (waste, water, energy, buildings, transport and land use):<br>- Two meetings with JSC Tartyp waste company<br>- Almaty SU water company<br>- ALTS Almaty Heating Network<br>- City Mobility Department<br>- Green Economy Department<br>- GenPlan Almaty<br>- Urban Planning and Urbanism Department<br>- Digitalization Department<br>- Etc. | 8th and 24th of September 2021<br>3rd and 4th of November 2021 | Validate the list of actions in each sector to be detailed and included in the final GCAP |
| Mission to Almaty for face-to-face technical meetings with the Akimat Departments, other stakeholders and site visits (Wastewater treatment plant, Almaty Heating network, waste sorting plant, CHP-2) | 8th – 12th of Nov. 2021 | A mission to Almaty was organized and international consultants participated in a series of meetings with key stakeholders (see below) to better understand the local circumstances, to present and discuss the priority actions for each GCAP sector and to collect relevant feedback to improve/adapt the actions to the city context as much as possible.<br>Key stakeholders that attended the technical meetings:<br>- Urban Planning and Urbanism Department<br>- Green Economy Department<br>- City Mobility Department<br>- Digitalization Department<br>- Comfortable Urban Environment Department<br>- Housing Policy Department |

| | | |
|---|---|---|
| | | - Energy Efficiency and Infrastructure Development Department<br>- Almaty SU water company<br>- JSC "Tartyp" waste company<br>- Department of Emergency Situations of Almaty city<br>- Ecology Department of Almaty City<br>- GenPlan Almaty<br>- ALES DH Company<br>- ALTS Almaty Heating Network<br>- Alatau Zharyk (Energy Grid Company)<br>- RES Association<br>- LLP "Almatylectrotrans"<br>- "Public space development" designers |
| Follow-up online meetings after the mission with several key stakeholders (Akimat Digitalization Department, Samruk Energy) | 25th of Nov. and 3rd of Dec. 2021 | Discussion about the Almaty Digital Twin Project, data governance, investments in CHPs |
| Meeting with representatives of Almaty Akimat – feedback on the draft GCAP | 2nd of August 2022 | Discussion about specific feedback on the draft GCAP report |
| Fourth Stakeholder Consultation Workshop (hybrid meeting) | 12th of October 2022 | Presentation of the Green City Actions<br><br>Comments received after the workshop within the consultation period are acknowledged by the Akimat and will be considered for GCAP implementation |

*Table 2 Additional relevant stakeholders' meetings/activities*

| Meeting | Date | Topics of discussion/Main outcomes |
|---|---|---|
| Several sectoral meetings with EBRD experts (online, via Zoom platform) | Through the project implementation | Technical input on baseline and GCAP Actions |
| Online meeting with local water experts | 1st of Jan. 2021 | Current situation in the sector, main challenges, cooperation methods |
| Online meetings with NGOs/CSOs (Green Salvation, Centre for Sustainable Production and Consumption) | 18th of Feb. 2021, 26th of July 2021 | Current developments in the waste, land use, industrial, biodiversity sectors with special focus on operations/management of Karasai landfill |
| Online meeting on energy | 19th of March 2021 | The meeting was scheduled with a small-scale renewable prosumer to understand the enabling conditions, fiscal incentives, legislation in the field of renewable energy/small scale renewables, connection to the grid, the barriers to connect to the grid/distribution network, Akimat support for prosumers' activity, suppliers, service providers for the technology, the metering system for selling and buying energy and the tariff associated with excess of produced energy. |
| Online meetings with transport experts | 27th of Apr., 19th of May and 22nd of Nov. 2021 | Discussion on recent developments in the transport sector (metro, LRT, PT, Almaty Agglomeration Project) and follow up meeting after November mission |
| Exchange of letters with NGOs/CSOs | Through the project implementation | Discussion on project status and stakeholders' consultation workshops |

The consultation process was done based on the stakeholder engagement plan (SEP) prepared at the beginning of the process. SEP was published on the official website of the Akimat, as part of the Inception Report.

***Stakeholder engagement workshops:***

At the **Launch event and 1st Stakeholder Consultation Workshop** (webinar) held on 9th of September**,** more than 50 persons/entities have participated out of a total of over 100 invitees. The participants were mainly representatives from municipal technical departments of the Akimat, public utility companies, NGOs and civil society organizations, financing institutions and environmental and social specialists. Out of the total number of participants, 24 (41%) were women.

The aim of the Launch event and 1st Stakeholder Consultation Workshop was to discuss the overall approach of the Green Cities Programme, GCAP methodology and development process. The webinar was an interactive one. Several topics discussed during the meeting were referring to:

- Synergy of the Plan with other ongoing projects/initiatives in Almaty.
- Stakeholder consultations/ engagement on key steps of the project, the approach taken in formulating the actions, financial aspects regarding the measures to be developed in the GCAP.
- GCAP project implications within the national policy context.
- Aspects about project implementation.
- Project budget, funding sources, planning horizon.

The **2nd Stakeholder Consultation Workshop** for the prioritisation of environmental challenges, organized on April 21st and 22nd, brought together representatives of municipal technical departments, civil society organizations, EBRD and other interested stakeholders to discuss the state of the environment in the city and the environmental challenges identified following the technical analysis and sectoral meetings with the Municipality and other key stakeholders. More than 110 persons/entities were invited to the event and 63 persons attended the two-day workshop. Out of the total number of attendees, 28 (45%) were women.

During the workshop, the following topics were addressed:

- Stakeholder consultations/ engagement on the identified sectorial challenges;
- The importance of implementing targeted and effective measures in all 7 sectors;
- Aspects of waste management, including future plans for construction and demolition waste as well as effective waste recycling and composting measures;
- Recommendations from stakeholders, such as improving the quality of urban transport, measures to reduce water usage and implementing enabling environmental policies.

After each sector session, a voting poll was launched and the participants had the opportunity to vote the challenges they considered to be relevant for each sector. Based on the prioritized challenges, the consultant developed a set of actions addressing the identified challenges on the short term, the rest of the challenges to be addressed within the long-term planning of the Akimat.

The **3rd Stakeholder Consultation Workshop** – its topic being Vision and Strategic Objectives and prioritization of environmental actions – was organized by the Akimat on July 7th and 8th 2021. Various institutions interested in the development of GCAP such as representatives of Akimat together with representatives of municipal technical departments, public utility companies, CSOs and NGOs, academic entities, EBRD representatives and other key stakeholders defined together with the team of consultants the vision and the strategic objectives of the GCAP. They also debated and selected the specific policy and

investment actions the Akimat would undertake in the next 3-to-5-year period (short-term) and 10-to-15-year period (long-term).

Around 140 people were invited to the event. Out of the 64 participants, 29 (45%) were women. The topics addressed by the attendees referred to:

- For the vision and strategic objectives it was suggested to include more clearly the citizens' perspective and include the aspect of safety in objectives;
- Integrated waste management system and implementing Extended Producer Responsibility;
- Urban planning, water retention, blue-green infrastructure, disaster risk resilience and reduction as well as circular economy measures;
- Protection of the river system and fresh water supply of Almaty;
- Sustainable transport infrastructure, including expansion of public and cycle transportation system, reduction of traffic congestion;
- Recommendation from stakeholders, such as the importance of implementing targeted and effective measures in the context of Almaty city.

After each sector session, the consultant team launched a poll in which participants voted for the actions that need to be addressed in the short-term period.

# 3 Environmental and sectoral baseline

This chapter summarises the policy background and the key findings of the baseline assessment of the city against a set of indicators. For further details not included in this document, please consult the full External Framework Report (EFR) and the Technical Assessment Report (TAS), published on the Akimat website.

The first part refers to the policy highlights and environmental condition of the city, followed by the presentation of key challenges on GCAP sectors including an overview of the current situation of each sector.

## 3.1 Policy landscape

In order to incorporate GCAP into the policy landscape of Almaty city and Almaty Agglomeration context and to ensure the linkage with existing strategies and initiatives, we conducted an analysis of policies related to the GCAP sectors at international, national and local levels. Mapping relevant policies and legislation has helped to fill potential gaps, address environmental challenges through local policy interventions and provide a solid basis for further improvement of environmental governance.

The findings of this assessment are detailed in the External Framework Report prepared by the consultant team in the first phase of GCAP development and published on the website of the Akimat. In this document, we provide highlights on the most relevant policies, with a special focus on the local policy landscape. In what follows, we provide a brief overview of the main findings of the report.

**National and local level**

The reviewed documents reveal political commitment to urban development. The policy framework in Kazakhstan has been characterized by a trend of reducing the number of strategic documents by integrating issues into overarching documents. Planning in the environmental area has clearly been influenced by this trend. In the absence of a strategic document on environmental protection, the **Concept on Transition to Green Economy 2050** has become a rescue vessel for the environmental sector. Green economy is a policy priority in Kazakhstan. Developing appropriate regulatory frameworks and incentives on sustainable and renewable energy is set as a priority, while adapting to climate change and addressing the challenges associated with reducing carbon dependency are other major areas of concern. **The Voluntary National Report on the UN Sustainable Development Agenda 2030 implementation (2019)** covers renewable energy development, water resources saving and quality improvement and sustainable development of the cities.

Kazakhstan has no national policy on air protection, nor does it have specific air quality programmes. Some air quality policy directions are based on other strategic documents, such as air protection requirements integrated into the new **Environmental Code**, approved on January 2nd, 2021. The new Environmental Code proposes solutions to air pollution issues, such as modernization of technological processes, introduction of the Best Available Technologies (BAT) and strengthening Emission Trading Scheme (ETS), as well as fines for environmental pollution.

Kazakhstan has a number of key strategies, concepts and accompanying action plans that outline the strategic directions for mitigation and adaptation to climate change in the country. Under the **Kyoto protocol**,

the country pledged to reduce emissions to levels close to the 1990 baseline. Kazakhstan pledged to reach carbon neutrality by 2060 and is currently working on a long-term **Strategy for Low-emission Development until 2050** (**LEDS**) based on NDCs. LEDS describes what measures the country will take to achieve climate targets that include coal phase out, renewable energy share increase, etc. At city level, the Green City Action Plan can support Almaty contribute to achieving sector-specific climate targets. Moreover, GCAP actions implemented in the city of Almaty can serve as best practice examples or be considered pilots to be learned from and replicated/upscaled on the territory of the Almaty Agglomeration.

The key documents at Agglomeration and local level are the **Interregional Action Plan for the Development of the Almaty Agglomeration until 2030**, the **Almaty Development Strategy 2050** and the **Almaty 2030 Development Strategy**. These documents indicate actions towards a sustainable development of the city. The development program integrates all relevant aspects, including environmental ones. For instance, it includes sections such as "green city"; "good roads and transport", "clean environment" and "reliable housing and utilities infrastructure", which reflect tasks and measures to improve the environmental situation through increasing energy efficiency, greening the transport system, increasing green areas, and improving solid waste management and recycling.

The Interregional Action Plan for the Almaty Agglomeration development until 2030. The Almaty Agglomeration should be developed as a multifunctional region with a competitive economy, high quality standards of life and environment, good interaction between city and regional akimats in terms of urban planning. This vision forms the basis of the document, providing 108 measures to be implemented until 2030. These measures are linked to 7 strategic directions, including: improving the environment "Green Almaty", developing a unified transport system, creating a digital map, developing an integrated system for monitoring and preventing emergencies.

The implementation actions of the objectives in the policy documents are often not sufficiently concrete or worked out. For instance, the Almaty Development strategy 2050 lists the existing issues of the city. It describes how the city will develop but there are no specific measures/benchmarks on how to achieve these goals. However, the **Almaty Sustainable Transport Strategy 2013-2030** is considered an efficient planning document with clear activities and associated estimated budget. Most of the measures have been implemented. Although no information was found on the implementation status of the **Municipal Energy Efficiency Plan 2017-2030**, this plan is also efficient in that it includes feasible energy saving measures and details of its implementation. The plan's authors have estimated the investment costs per sector (total 10 sectors) and expected results.

**On the specific challenges of Almaty city**

The urban development of the city has a number of challenges associated with insufficiently effective planning solutions. The city is experiencing a rapid population growth caused by both the adding of settlements from the periphery and their territories in the last decade and the migration inflow. Therefore, Almaty faces the challenges of uneven development and a gap in living standards between the centre and the outskirts, migration pressure and uncontrolled urbanization with overloaded infrastructure. The gap in the level of development between the centre and the outskirts is a key cause of commuting and traffic congestion.

***On air quality***

Almaty is one of the cities in Kazakhstan experiencing a high level of air pollution for many years. Pollution is particularly problematic for Almaty because of its topography, as there are limited airflows and pollution does not disperse efficiently. The main sources of air pollution in the city are due to the coal-based energy sector, but also to polluting and energy intensive industries and to some extent the transport sector. During the long heating season, CHPs and emissions from private households have a considerable impact on the

air pollution levels in the city. Transition of Almaty Energy Complex from coal to gas and improvement of energy efficiency in the residential sector would have a strong influence on air quality.

Policy directions for air quality improvement are identified in local policy documents. Multi-sector approach is proposed for curbing emissions from key polluting sectors and measures to protect health. GCAP focuses on this issue as the main environmental challenge and a top priority on the political agenda.

***On GCAP sectors***

- The main policy documents focus on improving the quality and coverage of **urban infrastructure** and basic services and implementing a sustainable and inclusive process of urban development. The main aim stated in the city's policy is to develop a polycentric city without outskirts, with high living standards in all districts. Optimized infrastructure development for productive use and cost recovery is being emphasized in the present GCAP.

- **Land use** and **green spaces** play a crucial role in improving the state of the urban environment and the living standards of the city's population. One of the priorities of Almaty is to increase the green space area, highlighted in the Almaty 2025 Development Program and through the more specific actions foreseen in the Green Space Development Strategy 2030 to be approved soon. Ideas are developed further in the GCAP on how to enhance the potential for nature-based solutions.

- There are many robust **transport** related measures set out in several local policy documents. Moreover, there is a dedicated strategy for a sustainable transport sector in the city of Almaty. Transit oriented development is at the heart of the strategy. There is also a dedicated plan for promoting cycling. Evidence is clear of numerous measures implemented in the city to improve the quality of public transport services such as BRT lines, development of cycling-friendly infrastructure, moving towards ecologically cleaner fuels and introducing electric cars. However, traffic congestion and increasing number of private cars due to low cost of fuel remain one of the main challenges in the transport sector. In the context of the pollution in the city and intense traffic during rush hours, one of the measures GCAP will focus on is to encourage citizens to give up personal cars in favour of alternative means of transport.

- The country is one of the most carbon-intensive economies in the world, with the **energy sector** being the major $CO_2$ emitter. However, Kazakhstan has high potential to decrease its footprint as a global GHG emitter. A shift from coal and oil to gas and renewable energy sources would decrease GHG emissions. The Government is already taking steps to reduce energy intensity. Almaty city, albeit has some potential influence, depends heavily on government decisions and governmental energy policies for greening the energy sector. District heating is one of the main sectors in which the city needs significant improvements, and further investment projects on production, transmission and demand side are being planned. GHG emission trading system exists but for now emission quotas are too high to trigger investments into shifting to low carbon economy.

- The **building sector** is covered in the Development Program and Strategy and is a focus area in the Municipal Energy Efficiency Plan with strategic goals and investment pipeline set out for this sector. There is high potential of energy efficiency improvements in the public, residential and commercial buildings, as well as for improvements in the public lighting sector. A review and prioritization of these projects was carried out within the GCAP as evidence so far suggests that few of these investment measures have been implemented so far. The low tariffs in energy and a lack of a clear institutional responsibility in the Municipality for these investments keeps these investments lagging.

- The **industry sector** ambitions in the city's policy focus on diversifying away from trade as the main commercial activity and focusing on high tech, innovation, services and modernizing the existing industrial activities, making them more environmentally friendly. The city takes an active role in pushing for the environmental modernization of industry, focusing on urban regeneration of former industrial sites and

implementing initiative for green economy through the involvement of the Ecology and Environment Department.

- The policy framework has clear targets in the **water sector** regarding increasing water efficiency and water reuse and treatment (biogas from wastewater sludge) and expanding coverage of the population by water supply and sanitation systems. GCAP prioritizes and complements the existing measures and focuses on the outskirts of the city, as there is no central water supply and sewerage system in many micro-districts.

- Currently there is no dedicated policy on **waste management sector** set at local level. A draft document is currently being developed. The newly enacted Environmental Code introduces waste management related requirements and targets that will drive the sector forward. However, waste related provisions are foreseen in the Almaty Development Program 2025, but also in the Almaty Municipal Energy Efficiency Plan 2030 in terms of saving potential in the sector. The city struggles with inadequate quality of waste collection services in the outskirts and does not have adequate waste sorting arrangements. The current arrangements in operator models, such as the long-term PPP for part of the system and the landfill being operated by regional authorities makes planning feasible and efficient investments difficult in the sector. Thus, GCAP focuses on prioritization of actions and will consider the city's plans to reduce the amount of waste sent to the landfill and increase the share of recycling.

***On gender aspects***

Although Kazakhstan is one of the few countries in the world that have a well-established database of normative documents detailing the country's strategic steps towards gender equality, there is a huge gap at local level in this regard. Almaty does not have a gender strategy, nor gender provisions included in other cross sectoral policy documents.

The Almaty 2050 Development Strategy is the main city development strategy financed from the state budget. However, the allocation of funds does not consider gender budgeting instruments. This approach leads to the fact that needs and requirements of citizens are not sufficiently considered in the context of gender equality.

GCAP takes a comprehensive approach to integrating gender equality and economic inclusion. Therefore, the GCAP actions support Almaty in addressing its identified challenges, while ensuring co-benefits in areas including gender equality and economic inclusion.

***On smart maturity***

Almaty successfully developed the Smart Strategy 2020-2025 in order to ensure a more comprehensive development of the digital culture and to create the most optimal environment for development. The Akimat of the city of Almaty has a dedicated department which is responsible for the implementation of the strategy. There are many initiatives related to smart/digital development in Almaty which are initiated by the Akimat and clearly show a strategic approach in which several departments are actively involved. GCAP enhances the existing smart initiatives and is further considering the potential for actions to exclusively call for smart solutions or integrate smart solutions to achieve green outcomes. The Smart Strategy is supporting further data integration and data governance, providing a basis for a citywide digital twin.

# 3.2 Environmental quality

This section presents an overview of the current state of the environment in Almaty as it results from benchmarking the latest available values for indicators in the database (process described in the previous chapter). This overview is schematically presented in the figure below. Indicators were aggregated per topic to provide a simpler snapshot of the city's environmental performance.

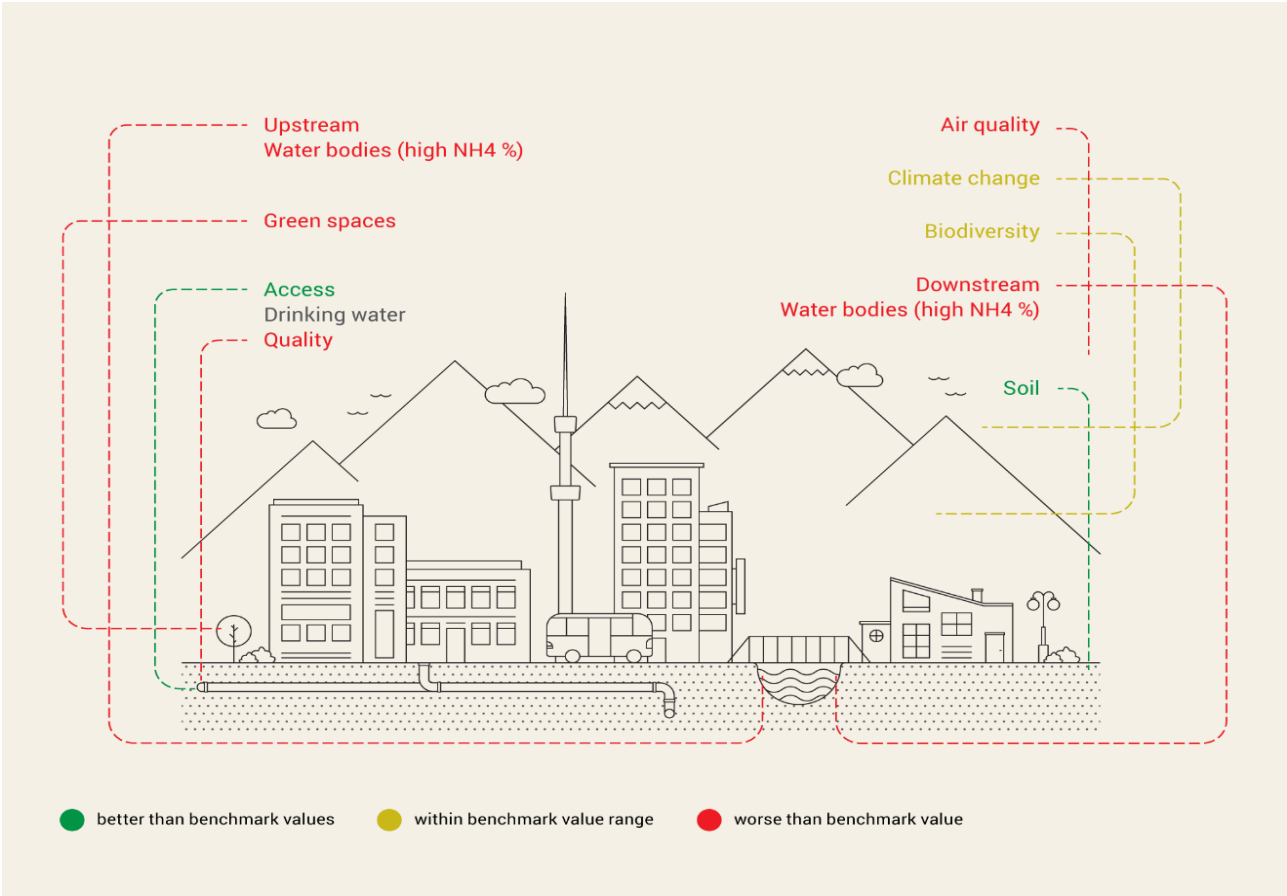



*Figure 7 Snapshot of the environmental performance of Almaty*

As per the data analysed, coupled with expert knowledge of the local context and the discussions held with key stakeholders, the main environmental challenges of the city refer to:

- **Air quality:** high levels of PM2.5, PM10 and $SO_2$ which exceed the international limits, mostly due to fossil fuel-based energy and lack of energy efficiency measures.
- **Water**: Poor surface water quality upstream and downstream of Almaty, high level of ammonium ($NH_4$) likely due to obsolete sewage network, use of pit latrines in suburbs, lack of pre-treatment of industrial wastewater and due to the poor condition of the existing wastewater treatment plant.
- **Green Spaces:** low share of green spaces in the urban area and worsening trends compared to benchmarks due to increase in population, increase in constructions and difficulties with maintenance and irrigation.
- **Greenhouse gas emissions:** Though there is no data for the emissions, however, reliance on fossil fuels for energy use and energy intense buildings and industry indicate high greenhouse gas emissions.
- **Climate change resilience**: Global warming led to rapid decrease of glaciers, that in turn leads to mudflows in the short run and water scarcity issues in the long run. Though Water Exploitation Index indicates a moderate water consumption, it shows an increasing trend.

# 3.3 Sector-based key challenges

The sector challenges have been formulated based on the collected GCAP indicators, sectoral discussions with key stakeholders and the technical analysis performed in this regard (see the Technical Assessment Report). The list was prepared together with the representatives of the technical departments of the Akimat, for each GCAP sector. The list has been discussed during the 2nd Stakeholder Engagement Workshop in order to conclude up to 5 priority challenges per sector. The full description of the prioritization process can be found in the Prioritization Report, published on the Akimat website.

During the development of the GCAP, we sought to embed, whenever possible, smart technologies in the proposed actions. Therefore, this sub-chapter also summarizes gaps in terms of smart/digital solutions.

The city's priority challenges have been the basis for formulating the vision, specific objectives and actions for GCAP (Chapter 4 and 5).

## EN ENERGY

**Current situation:**

| | |
|---|---|
| Connection to electricity: | Most of the population has an authorized connection to electricity, as connections are strictly monitored by private suppliers and metered. |
| Connection to the DH network: | Based on the split between individual housing and high-rise buildings and considering the level of connection of each of these categories, only 72% of Almaty population has access to centralized district heating. The rest of the population is using individual heating systems. |
| RES: | The price of coal and energy generated from coal is very low, which disincentivizes the use of renewable energy sources (RES). Also, even considering the existence of a specific legal framework on RES and according to the interviews, there is a lack of technical regulation regarding the connection of small-scale RES with the grid/substations. Therefore, RES represents a small fraction of total energy consumption at city level. |
| Heat consumers: | The number of heat consumers as of 01.03.2021 is 402,627, including: Individuals: 386,919 units<br><br>Legal persons: 14,708 pcs. |
| Heat losses: | Standard losses in the district heating distribution network are around 17%.<br><br>61% of the district heating network is depreciated and needs investments (45% is more than 25 years old).<br><br>The repair fund included in the tariff does not cover the whole list of necessary measures for modernization and reconstruction of the assets of Almaty Heating Network. |

| | |
|---|---|
| Climate risk resilience: | The city is located in a mountain area and the energy distribution network is exposed to climate change risks such as earthquakes, mudflows and floods. Even though the city has an alert system that runs 24/7, the resilience of the electricity network to climatic extremes still needs upgrades. |

**Key sector challenges:**

- ✓ Insufficient penetration of renewable energy sources (RES).
- ✓ Insufficient investments in the quality and coverage of electricity grid.
- ✓ Significant depreciation of the District Heating (DH) distribution system.
- ✓ Insufficient financing or incentive schemes to unlock the investment in RES.
- ✓ Climate-risk resilience of electricity grid is insufficiently tested and needs upgrades.

**Other points of discussion related to ENERGY sector:**

- Subsidies existing for coal and not for renewables - coal lobby is strong in Almaty.
- Use of localized, decentralized, and manageable energy sources insufficiently promoted.
- The price for DH is higher than in other places. Connecting to district heating is expensive especially for new districts.
- There are legal and administrative barriers to the use of small-scale renewables. Connecting to the grid is possible in theory but very expensive in practice, the prosumer is left with the responsibility to bear most of the connection costs.
- Resilience of the electricity network is weak. The grid in the city centre was not designed for such high consumption rates.
- Reducing grid losses in electricity network and heat network are just as important for GHG emission reductions as are renewable energy sources.
- High consumption peeks, e.g., from crypto mining (due to heavy coal subsidies) has led to blackouts in city districts.

**Sector gaps in terms of green / smart solutions:**

- Smart grids powered by Demand Response (DR) models, which enable a real-time analysis of customer demand trends.
- Microgrids / locally produced energy systems.

## BL BUILDINGS

**Current situation:**

| | |
|---|---|
| Building stock: | The city has 27,158 multi-storey buildings with 675,006 apartments and 133,868 individual houses.<br><br>Housing stock – total 47.4 mln. $m^2$ including: 0.8 mil $m^2$ municipal and 46.6 mln. $m^2$ private.<br><br>Provision of housing per resident is 28.3 $m^2$. |

| | |
|---|---|
| | High coal-based heating and electricity consumption (sourced from fossil fuel) in residential buildings is caused by an old and obsolete building stock for which insufficient renovation interventions are a major concern.<br><br>The city has 948 dilapidated houses with a total area of 325,200 $m^2$, in which 8,910 families live. Most of the dilapidated houses are in Turksib district, there are 461 houses with an area of 135.5 $m^2$, and Bostandyk district, where there are more than 150 houses. Almaty's dilapidated housing demolition program will be extended until 2030. Apartments are provided as compensation based on the principle that each resident should receive 10 $m^2$ more living space than what they previously owned. If a resident wants an even larger apartment, then they must purchase additional space at their own expense. |
| Energy consumption: | The public sector is a major energy user, with schools as the largest energy consumer among public buildings in Almaty (274,405 MWh per year), followed by healthcare units (124,497 MWh per year) and kindergartens (around 100,000 MWh per year). Average energy consumption per square meter for different categories of buildings: 180 kWh/$m^2$ for a big school (300-400 students); 40 kWh/$m^2$ for offices/commercial buildings; 250 kWh/$m^2$ for big hospitals; 160-170 kWh/$m^2$ for small clinics.<br><br>Heating consumption in residential buildings - data collected for several years shows a decreasing trend (140 kWh/$m^2$ as of 2020). Many buildings are overheated, with temperature exceeding the normative of 20°C since there is a lack of temperature control or thermostat at apartment level. |
| Metering system: | According to the Almaty Heating Network, 94% of the buildings are provided with heat meters but only at building level. For this reason, there is very limited potential to control heat consumption at apartment level. Metering at apartment level and control of heating in apartment is possible only in new buildings that have special devices to control temperature in the room. According to the Almaty Heating Network, it is not mandatory that buildings (including the new ones) connect to the grid. |
| Building certification: | Each building in Almaty has a unique building passport which contains relevant information about the building, the material used for construction, year of construction, etc. All these data are available at Akimat level.<br><br>There is a classification of EE residential buildings but there is no certification system as green building certification is not a current practice in Kazakhstan. However, there are a few private buildings certified as green buildings, using the international certification system BREEAM and LEED. Even though new buildings need to comply with more stringent energy efficiency norms, these are not as strict as a dedicated standard for Green Buildings. |
| Public lighting: | By September 2019, the level of energy-saving LED lighting of Almaty streets has reached 28% (out of more than 97 thousand lamps illuminating the city, more than 27 thousand are LED lamps). |

**Key sector challenges:**

- ✓ Insufficient investment and lack of dedicated financing schemes for Energy Efficiency (EE).
- ✓ Given the low rate of renewable energy there is a high consumption of coal-based heat and hot water, and fossil fuel-based electricity in residential buildings.
- ✓ No metering of heat consumption and limited potential to control heat consumption at apartment level.
- ✓ The low price of coal and coal generated energy disincentivizes EE and RES investments.

**Other points of discussion related to BUILDINGS sector:**

- Renovation Program for obsolete buildings is needed.
- Buildings' certification system is not in place.
- Building stock is mainly energy inefficient.
- Insufficient data on energy efficiency and energy/heat losses of buildings and city infrastructure.
- There is a simplified energy assessment tool for buildings for Nur-Sultan already implemented and has an online tool that could be followed as a model.
- Budget funds allocated by the Akimat for the renovation of old buildings are limited.
- Making RES an obligation for new buildings would be a good idea.
- Availability of incentives for renewables, that is changing the policy towards the proportion of renewables and minimum targets for the implementation of renewables in new investments is needed.
- Incentives should be in place for people to generate renewable energy and become prosumers.

**Sector gaps in terms of green / smart solutions:**

- Individual metering & control of heating at apartment level.
- Smart control applications for lighting systems in buildings.
- BMS in public buildings.

## TR TRANSPORT

**Current situation:**

| | |
|---|---|
| Public Transport System: | The public transport in Almaty includes buses, trolleybuses, and metro.<br><br>75% of the public transport fleet runs on diesel.<br><br>The total route network length is 6,568 km. The length of the dedicated lanes for public transit is 151 km. The length of the trolleybus network is 236 km.<br><br>The metro system has become functional in 2012, and is operated by Almaty Metropolitan, an entity under the Akimat. E-ticketing was introduced in Almaty in 2014. There are two types of e-cards - one for regular passengers and one for special/vulnerable groups. The e-ticketing system allows the analysis of data on the distribution of passengers in the public transport system. The system has also proven its effectiveness by increasing transparency and financial revenues 2-3 times. |

| | |
|---|---|
| Private vehicles: | In average private cars are of 8 years old.<br><br>Low percentage of diesel cars 4%. |
| Fuel standards: | Legal requirements are missing. All major distributors sell EURO 4 standard fuel, even downgraded to EURO 2. |
| Electric vehicles: | 4% (2020 data) of cars run by electric hybrid fuel.<br><br>52 charging stations for electric vehicles (EVs). |
| Modal share: | Public transport trips represent 40% of the total trips. In 2016 the number of passengers using private transport went down to 40% as compared to 50% in 2012. The reasons behind this modal shift are mindset change, poor parking infrastructure, new comfortable bus fleet with further investments planned to increase the bus fleet with 10-20%. Also, the trend of bikes/e-bikes usage is increasing. |
| Traffic: | Traffic congestion is aggravated by the lack of an adequate parking policy. Planning and budgeting for parking infrastructure is insufficient. |
| Parking: | The City Mobility Department pointed out that the number of parking lots in the city centre has increased over the years, starting with a thousand in 2016, reaching 6 thousand in 2020, with a 100% occupancy. |

**Key sector challenges:**

- ✓ Lack of a comprehensive network of safe and comfortable bicycle routes, connecting major attraction points.
- ✓ Interruptions in public and emergency transport in case of disasters.
- ✓ High transport demand and limited alternatives for car use causes traffic congestion.
- ✓ Old vehicle fleet has a negative impact on air pollution.
- ✓ Low frequency of PT-connections between suburbs & city centre.

**Other points of discussion related to TRANSPORT sector:**

- Lack of a detailed transport strategy, including specific and efficient incentives for the transition to electric vehicles and, in general, the sustainable development of the transport sector.
- Underdeveloped micro mobility regulation.
- The market for electric vehicles is not supported/ incentivized.
- Energy efficiency indicators for transport are not monitored.
- Public space is dominated by cars, while priority to other transport modes is lacking.
- Transport service quality is still not sufficient.
- Outdated fleet has a negative impact on air quality.
- Lack of budget needed to implement the actions.

**Sector gaps in terms of green / smart solutions:**

- A further optimization of (public transport) traffic flows by ITS (Intelligent Transport Systems) based on the existing transport information systems in Almaty and the monitoring system for intersections and traffic lights that is currently being implemented.
- A further optimization and roll out of the parking management system, based on the AParking initiative.

- The promotion of electric vehicles and further enhancement of charging station network.
- Further improvement of road safety (also behavioural changes) within the Vision Zero Almaty (VZA) initiative.

## LU LAND USE

**Current situation:**

| | |
|---|---|
| Green space: | Currently, there are 894 hectares of green space in the urban parts of the city, or 7.7 $m^2$ per person. The plan of the city is to reach 10 $m^2$ per person by 2030. Within the larger city area further green areas are located that are not included in these calculations such as the *Ile-Alatau national natural park.* |
| Population density: | Population density is low: 2,810.5 residents/$km^2$ (2020). A reason for the low-density rate might be that Almaty annexed new districts and currently covers a lot of mountainous area with scarce or no population in some parts of the districts. |
| Average commuting distance and time: | Average distance is high (10 km or more) and average time spent commuting is about 45 minutes – up to 1 hour to reach city centre from suburbs. |
| Population living within 20 min to everyday services: | A relevant pressure is the underdeveloped social infrastructure/lack of daily services in the new districts that used to be of Almaty region and, moreover, the inclusion within the city boundary of new districts with less strict urban planning brings about the most acute pressure in land use. |
| Urban sprawl indicators: | The average annual growth rate of built-up areas is high. |
| Climate change: | Climate change is not fully taken into consideration in the city's planning process. There is no future scenario analysis for the risks of mudflows. |

**Key sector challenges:**

- ✓ Low percentage of green space per capita compared to international standards.
- ✓ Insufficient link between green infrastructure and blue (water) network.
- ✓ Climate change is not fully taken into consideration in the city's planning process.
- ✓ Risk of social infrastructure development not keeping up with housing development.
- ✓ Lacking future scenario analysis for the risks of mudflows, leading to lack of control over the prevention of land allocation with construction risks (considering the new districts).

**Other points of discussion related to LAND USE sector:**

- Density is different in the various areas/districts of Almaty and in general it is not considered an issue for the city.
- Green space coverage and quality varies in the different districts.
- Green zones and green belt should be considered due to their role in cleaning the air.
- Creeks and rivers of Almaty are highly regulated, decreasing the permeability of the city.

**Sector gaps in terms of green / smart solutions:**

- Digital monitoring of people movement pathways allows to collect data on mobility dynamics and to justify need for improvement of city layout and transport routes. Use of the Almaty Situation Centre and the experience gained during the pandemic to visualize people movement as a basis.
- Stimulating initiatives around citizen participation and co-creation, based on the Q-Lab initiative.

## WS WASTE

**Current situation:**

| | |
|---|---|
| Waste generation: | 270 kg/cap/year in 2020. Between 2016-2019 the waste generation rate was above 300 kg/cap/year. |
| Waste collection service: | Provided to 100% of the city's population. Apart from Tartyp Company, which is the largest waste collection operator, there are another 82 waste collection operators (predominantly private) in the city. Although the Akimat of the city of Almaty has already initiated steps for source separation, an established system for separate collection of recyclables is not in place yet.<br><br>There are some local private initiatives for separate waste collection such as: Kazakhstani production company ZETA – focusing on collection of plastic materials for recycling; the Lemonadoff Food company produces drinks and accepts plastic bottles for recycling; Technodom company has installed 131 eco-boxes throughout Kazakhstan. Most of them are located on the territory of Almaty; the company "GlassTrade" is engaged in the collection and processing of glass containers; V-Recycling recycles office equipment, medical waste, batteries, industrial waste, wood materials (furniture), etc. |
| Waste treatment: | A sorting plant was established at the city's main landfill in 2018. The capacity of the plant is 550,000 tonnes of waste per year and is operated by Green Recycle Company, which is part of Tartyp Waste Management Company. In 2020, 332,416 tonnes of mixed municipal waste were treated at the facility.<br><br>Information from the Department of Communal Infrastructure Development indicates that about 42 thousand tonnes were segregated as recyclables. The official information available at the portal of the Electronic Government shows that the recycling rate in Almaty ranges between 5.8% and 10% in the last three years.<br><br>According to the data provided by the Almaty Department of Ecology, the percentage of recycled waste from the total volume of generated production waste was 10.9% in 2018, and 26.7% in 2019.<br><br>At present, green waste is not collected separately and is not composted. |

| | |
|---|---|
| | The bulk of collected construction and demolition waste is used for backfilling in a quarry near Aksay. |
| Waste disposal: | Karasai landfill, a licensed disposal site, near Aytey, some 30 km west of Almaty. The landfill was constructed in 1989 and began operation in 1990. The total area of the landfill is 63 ha.<br><br>75% of the landfill is still available which indicates that the remaining life of the landfill is about 20-23 years.<br><br>The disposal site is not an engineered facility; there is no baseline sealing, leachate, or gas collection.<br><br>The lack of a management system for construction and demolition waste leads to illegal dumping of co-mingled municipal and construction waste. |

**Key sector challenges:**

- ✓ Lack of a C&D waste management system.
- ✓ Source separation is insufficiently promoted or incentivized.
- ✓ The Karasai landfill does not meet sanitary landfill criteria.
- ✓ Lack of awareness and public involvement in source separation.
- ✓ Recycling and composting rates are low.

**Other points of discussion related to WASTE sector:**

- Lack of incentives for development of waste disposal, recycling, treatment, etc.
- Recommended level of waste recycling/treatment was not available in national legislation or local plan.
- Waste to energy technologies/costs/waste incineration (including waste incineration plant for Almaty) was debated, there were pro and con opinions regarding these technologies.
- There is no solution or plans to recycle the C&D waste, this should be a priority. In general, it is of high importance to increase the efficiency of C&D waste management.

**Sector gaps in terms of green / smart solutions:**

- Smart data collection on collected, recycled, and disposed of waste.
- Online reporting system for industrial and commercial waste generators to report on type, quantities of waste, contracted operators and waste management/disposal methods employed.

## WA WATER

**Current situation:**

| | |
|---|---|
| Water distribution network: | Primary distribution 124 km, 3,400 km of secondary distribution – close to 97.7% network coverage according to statistics. However, this data needs to be verified as it may not reflect the fact that the network does not cover some of the suburbs of the city, such as the upper part of the city and the western part of the Nauryzbai district. |

| | |
|---|---|
| Water consumption: | Approx. 130 litres of water per capita per day. Almost 87% of the city residents have individual water meters. |
| Water losses: | 30% for 2020. Water losses are not metered at end-users. The losses are mainly because of the poor condition of the water pipes and illegal connections in the summertime. Some pipes have already reached their end of useful life, they are worn out and leak. According to the Almaty SU Water Company, 59% of the 3,400 km of water pipes are deteriorated. |
| Water tariffs: | Differentiated by types of consumers. Water is billed based on a flat rate and includes the water losses. The residential sector pays the lowest tariff. |
| Sewerage network: | Connection rate of 82% (as of 2020)<br>The coverage in suburbs is only 50% and districts that recently became part of the city are not connected to sewage system.<br>Most of the sewage network is more than 50 years old and, 60% of the 1,750 km of sewage network is obsolete. |
| WWTP: | One public WWTP located downstream of the city. The plant covers 4 cities, Almaty with some nearby mountain resorts and three neighbouring cities. The capacity seems to be sufficient, around 640,000 $m^3$ daily; and the city of Almaty uses 360,000 $m^3$ during the summertime.<br><br>The WWTP is equipped with mechanical and biological treatment (MBT) and it needs renovation and improvements.<br><br>Inflow of industrial and communal wastewater is combined. 35% of the wastewater inflow is from the commercial users, the rest 65% is from residential users.<br><br>Some of the industrial plants are causing problems with the sewerage system due to low percentage of plants with wastewater pre-treatment (grease and sand catchers). |
| Sludge management: | The sludge is currently stored on the territory of the WWTP (dried in lagoons) and then landfilled leading to pollution. |
| Resilience to floods: | A mudflow happened along the Kargaly river (Nauryzbay district) in 2015, resulting in economic damage of 2 billion tenge (4 million EUR) and 6 people being affected. In the last 6 years, this was the only natural disaster that took place in the city. |

**Key sector challenges:**

- ✓ Enterprises that lack pre-treatment plants lead to illegal wastewater discharge into the municipal sewerage system or rivers.
- ✓ Insufficient regulations on mandatory pre-treatment of industrial wastewater.
- ✓ Poor condition of the only existing WWTP. Inflow to WWTP of industrial and communal wastewater is combined and some of the industrial wastewater is not pre-treated which leads to high levels of pollution.
- ✓ High losses in the water supply networks due to deterioration of the network and illegal connections in the summertime. High losses in the sewerage networks due to deterioration of the network.
- ✓ Lack of future projections on water scarcity, having a water saving plan or measures.

**Other points of discussion related to WATER sector:**

- Water availability and water scarcity need to be viewed from a wider perspective given the future climate impacts.
- Considering the water scarcity perspective, Almaty needs a water saving plan.
- Drinking water has poor quality at taps, partially due to problems with the obsolete water supply network.
- Investments in the water sector are scarce.
- Production of biogas from sludge is not in place and should be a priority.

**Sector gaps in terms of green / smart solutions:**

- Digitalization of the water supply and sanitation systems including:
    - Smart metering and remote data readings along the network and for every customer.
    - Continuous water quality monitoring sensors for both drinking water supply and wastewater treatment.

## IN INDUSTRY

**Current situation:**

| | |
|---|---|
| Emissions and main polluters: | 35% of emission of pollutants comes from the industrial sector, out of which 29% are CHP plants and 6% are other industrial facilities in Almaty.<br><br>The main polluters in the city: CHP-1, CHP-2 and CHP-3. CHP-1 and CHP-3 operate mostly on natural gas (more than 90%), while CHP-2 uses coal (99.5%).<br><br>Other polluters: small boiler houses located on the territory of CHP-2; food enterprises; concrete/cement/coal/ceramic plants; technical maintenance enterprises. |
| Electricity and heat consumption: | Data for consumption of electric and thermal energy relative to GDP show high consumption compared to the methodology benchmarks.<br><br>The energy consumption is mostly coal-based, aggravating the climate change impact of the energy intensive industry. According to the Almaty Heating Network (heat distribution and transmission), all industrial facilities are connected to the central district heating system and are charged based on the data provided by meters. |
| Industrial wastewater: | The public WWTP collects all wastewater in the city including industrial wastewater. CHP-1 and CHP-2 have their own WWTP that treats the bottom ash.<br><br>There is a low percentage of industrial plants with wastewater pre-treatment (grease and sand traps). Some tanneries, oil depots, dairy, car washing, and car parks pre-treat wastewater, but there are other smaller facilities in the manufacturing sector that do not pre-treat wastewater at all. |

| | |
|---|---|
| Industrial waste: | There are large volumes of industrial waste and a very low level of recycling activities (waste sufficiently recycled only at a few plants). The total volume of industrial waste is more than 2.5 mil tonnes/year (as of 2020), mostly bottom ash from CHP-2. Bottom ash is disposed at the regional Karasai landfill with little pre-treatment.<br><br>Steel mills are a source of industrial waste, disposing over 600 thousand tonnes of waste per year. |

**Key sector challenges:**

- ✓ Limited recycling of industrial waste.
- ✓ Low level of environmental compliance of industry related to wastewater pre-treatment (grease and sand traps) and possibly also air and soil pollution standards.
- ✓ Lack of proper treatment of industrial waste (mainly bottom ash, waste from steel mills). Industry is generating large quantities of waste.
- ✓ Pollution generated by poor management practices regarding hazardous industrial waste.
- ✓ Insufficient implementation of energy efficiency measures and renewable energy investments.

**Other points of discussion related to INDUSTRY sector:**

- Data monitoring and KPIs and data availability for the industry sector is weak.
- Annual energy audits are needed and demand side management.
- Emission Trading Schemes should exist for the industry to incentivize energy efficiency and RES, but in fact the emission caps are very generous and are unable to create a viable market, the instrument is not efficient.
- A Guide on Best Available Technologies (BAT) is currently being developed. Enterprises that will implement BAT will consequently be exempted from air pollution tax. Accordingly, if the company does not use BAT, the air pollution tax rate of payment will significantly increase.
- Necessity of industrial symbiosis. Material flow analysis is needed to uncover potential for industrial symbiosis.
- Small rivers are regulated too extensively (concrete riverbeds) and used by the industry sector.
- Different GDP of Kazakhstan than other countries due to an oil-based economy limits the meaning of GDP based indicators for the country.
- Future changes in industrial sector must include smart development and capitalize on digital opportunities.

**Sector gaps in terms of green / smart solutions:**

- Online registration and reporting system for industrial facilities connected to the environmental management authorities, to report on emissions to air and water, generated & managed waste quantities by type and operation.
- Online platform for industrial symbiosis, facilitating industrial waste exchange for reprocessing/recycling purposes.
- Smart sensors for monitoring energy performance and equipment wear and tear.

Almaty
Green City Action Plan

# Section 2
# Green City Action Plan

2

# 4 Green City vision and strategic objectives

Almaty is a city with a total population of over 2 million persons. It is the most important metropolitan city in Kazakhstan, with an advantageous geographical position in the South-Eastern part of the country, that offers the city a unique opportunity for development. Therefore, the Government of Kazakhstan decided to develop the Almaty Agglomeration which will be a multifunctional region with a competitive economy and high standards for quality of life and environment. Almaty city is the driving force of the Agglomeration and is very attractive for Kazakhs and even internationals due to its job opportunities and services provided.

The pressure on the urbanization process has constantly increased in the last years but the city administration is determined to make all the necessary efforts to steer the development process towards a sustainable and future-proof city where the standards of living are constantly increasing without jeopardizing the environmental conditions in the city. Furthermore, the ambition is to have a city connected and organically tied with the nearby settlements, forming a modern and functional urban Agglomeration. All the investments envisaged in the GCAP aim at transforming our city into a model for new, innovative and smart city for all other urban areas in the country and the region. Our aim is to become a **Green Innovation Hub of Central Asia.**

Based on our vision we have defined 4 strategic objectives presented in what follows.

Almaty
The Green Innovation Hub of Central Asia

Almaty
Green City Action Plan

# SO

SO1

STRATEGIC OBJECTIVE 1

## Improve air quality

SO2

STRATEGIC OBJECTIVE 2

## Achieve future proof city

SO3

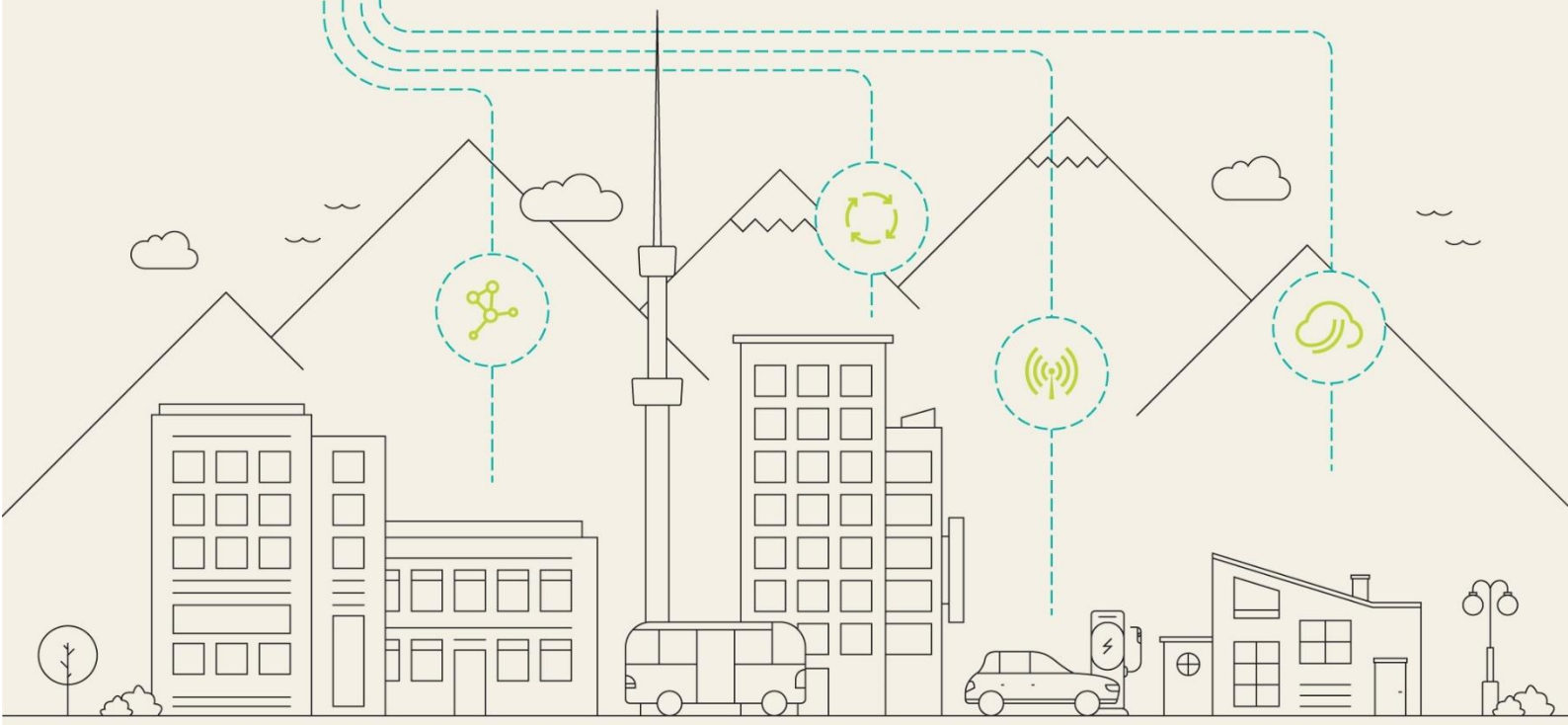
STRATEGIC OBJECTIVE 3

## Become a green and smart city

SO4

STRATEGIC OBJECTIVE 4

## Accomplish a city without outskirts



STRATEGIC OBJECTIVE 1

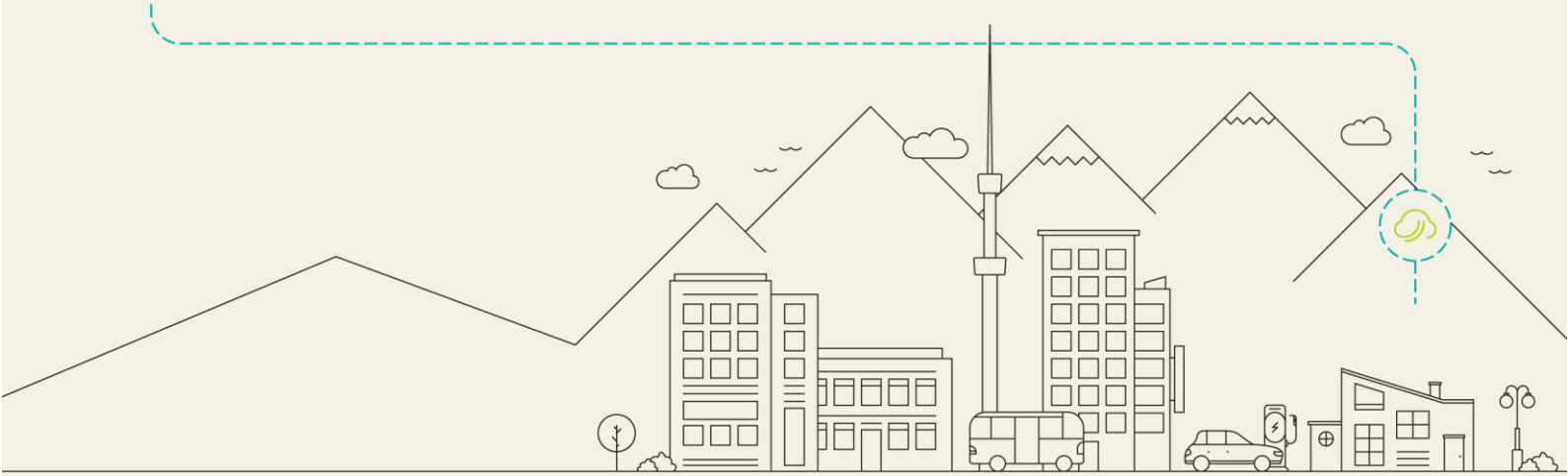
# Improve air quality

S01

Air quality is the number one environmental concern of Almaty city and the Almaty Agglomeration, with major health and life quality impacts. The high pollution, with particulate matters and sulphur dioxide, is attributed mostly to the coal-based energy sector, but also to polluting and energy intensive industries and to some extent the transport sector. Accelerating green energy transition by improving energy efficiency, boosting renewable energy and promoting clean transport will improve air quality and therefore citizens health.

Almaty is already planning modernization of the CHPs and is embracing technical innovation in transport. These actions will be enhanced and widened to include energy efficiency, mainstream renewable energy and empower consumers in the energy transition and at the same time to continue developing alternative means of transport. The municipality will take action to promote and increase uptake of cleaner production solutions and renewable energy across all sectors.

The ambition of the vision for Almaty is reflected in this objective through developing and testing a set of smart city integrated solutions for carbon neutrality.



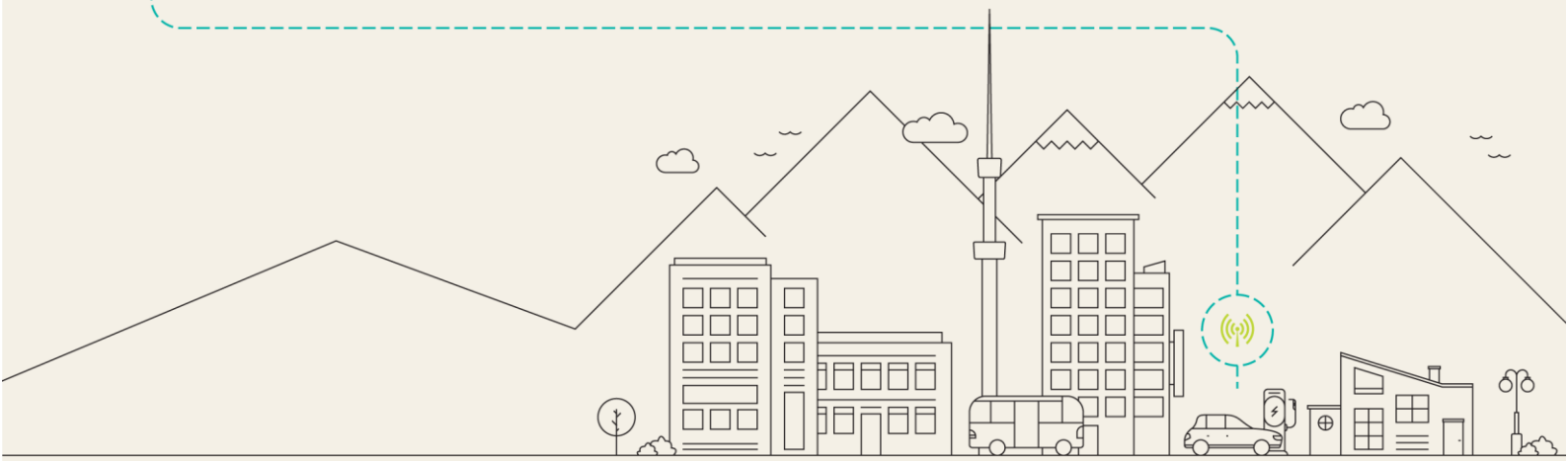
STRATEGIC OBJECTIVE 2

# Achieve future proof city

SO2

Almaty needs to look outward and into the future more to be able to develop in a resilient way, enhancing safety and happiness of the citizens of Almaty. This is in line with the vision of the Almaty Agglomeration. The potential for futureproofing is determined by factors such as capability for innovation, high levels of technology start-ups and scale-ups, the quality of the urban environment, from liveability to public transport infrastructure. Outward vision for Almaty means first, continue cooperation with the settlements located within the Almaty Agglomeration, to solve circular economy and wastewater challenges, look at water issues in the entire river basin, tackle transport ensuring a smooth connection to long distance commuters, people visiting the city and freight. The existing infrastructure should be improved and optimized as currently the city is carrying a heavy burden of outdated public utility infrastructure.

Looking into the future is needed to see the dynamics of the developments and prepare for these. In terms of climate change vulnerability, water scarcity, but also technical advancement, digitalization, trends in migration of people the changes are quick and their impacts on urban development are vast. Almaty develops capacity and projects to increase climate resilience and future proof plans and actions.



STRATEGIC OBJECTIVE 3

# Become a green and smart city

SO3

Almaty, as many other cities around the world, is facing population growth. This put increasing pressure on the city environment, affecting the quality of life and well-being of citizens as well as the efficiency of urban operations and functions.

Digital connectivity, automation and robotization are growing at an exponential pace and Almaty is already pioneering their adoption. ICT systems – as an enabling, integrative, and constitutive technology of the twenty-first century – will be instrumental in addressing many of the challenges presented by urbanization. Creating opportunities for research and business to connect to solve challenges will pave the road to move away from a trade-based to a knowledge based green economy.

It is therefore of strategic value to make best use of digital & smart technology to understand and if possible, mitigate the potential effects of urbanization, with the primary aim of tackling the many intractable and wicked problems involved in urban operational functioning, management, planning, and development, especially in the context of sustainability.

Several initiatives show that Almaty can be considered a frontrunner in this regard, and that these systems can be used as a technological basis to connect initiatives and people, to increase environmental performance and to evolve towards a smart and sustainable city.

STRATEGIC OBJECTIVE 4

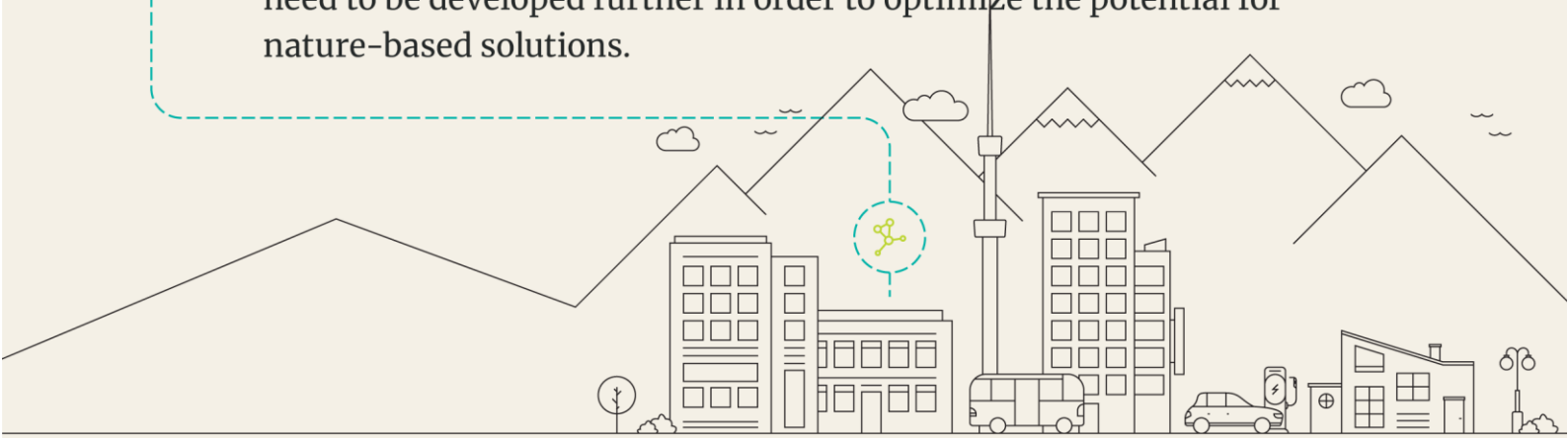
# Accomplish a city without outskirts

SO4

The city highlighted many times the challenges of uneven development and a gap in living standards between the centre and the outskirts. The development of a polycentric Almaty without outskirts remains one of the main aims in the city's policy. However, the success of a strategic plan is measured by how fast and well its implemented. Reducing the difference between the city centre and the suburbs requires defining and implementing priority actions. It is of utmost importance to improve the quality and coverage of urban infrastructure and basic services everywhere in Almaty to achieve sustainable and inclusive urban development. GCAP is enhancing the Master Plan's provisions in this regard, as well as identifying specific actions for reconstruction of former industrial sites.

Further on, the GCAP aims to support the city in its efforts towards development of the Almaty Agglomeration. The goal and objectives of the Almaty Agglomeration focus on well-being, creating job opportunities, establishing a functional urban area that gravitates around the Almaty city. Thus, the GCAP aims at bridging the ambitions of the city with the ones of the agglomeration and determine the steps to be taken by the city in order to strengthen the ties between the city centre and the outskirts and to eliminate any disparities.

Green space plays a crucial role in improving the state of the urban environment and the living standards of the city's population. Although the city is increasing the green space area through specific measures, actions need to be developed further in order to optimize the potential for nature-based solutions.



# 5 GCAP actions

The Green City Action Plan for the City of Almaty includes **30 detailed actions** to be implemented on the short term, in the first 5 years of GCAP implementation. In addition, we have defined long-term actions as well for the following 10 to 15 years which, if implemented, will contribute to the sustainable, green development of the city, and will boost the achievements of GCAP implementation.

The scope of the actions included in this GCAP is limited to Almaty city. Still, the actions have been defined considering the vision and objectives of Almaty Agglomeration and serve as a first step towards implementation of the projects foreseen for development of the Agglomeration.

The actions are presented as follows:

- First, an overview of both the short-term (implemented in the first 5 years) and long-term actions (implemented after 5 years up to year 15) is presented.
- This is followed by a Roadmap of GCAP implementation; then
- The 30 short-term actions are presented in detail.

The implementation of the actions leads to attaining our vision of Almaty becoming the **Green Innovation Hub of Central Asia**.

# 5.1 Overview of GCAP actions

| Sector | Short term actions to be implemented in the first 5 years (2023–2027) | Long term actions to be implemented starting with year 6 up to 15 (2028–2037) |
|---|---|---|
| **Cross sectoral actions** | **Action 1**<br>Akimat Office for Green Project Implementation<br>**Action 2**<br>Almaty Green Innovation Incubator<br>**Action 3**<br>Citywide Digital Twin | Performance-based contracting for all public services<br>Green Public Procurement implemented for all public tenders and own activities<br>Tariff reform for urban services<br>Full digitalization of public services<br>Fully functional Digital Twin tool available for urban planning |
| EN<br>BL | **Action 4**<br>Energy Efficiency Programme for public buildings and facilities<br>**Action 5**<br>Residential buildings retrofit programme<br>**Action 6**<br>Almaty CHP-2 modernisation<br>**Action 7**<br>Rehabilitation and modernization of the District Heating (DH) infrastructure<br>**Action 8**<br>Heat pumps and solar heating programme for residential buildings which are in areas not connected to DH<br>**Action 9**<br>Development of the Almaty Smart Grid Programme and pilot project implementation | CHP 1 and CHP 3 modernization<br>Implementation of the public buildings retrofit Programme – second phase<br>Implementation of the residential buildings retrofit Programme– second phase<br>Promotion of nZEB and green building standards for building design<br>Energy efficient behaviour Programme<br>Promotion of large-scale RES<br>Promotion of small-scale hydropower as part of the decarbonization strategy of the city |
| TR | **Action 10**<br>Transit Oriented Development (TOD) – Applying TOD in satellite city development<br>**Action 11**<br>Connecting different transport modes: multimodal hubs<br>**Action 12**<br>Increase the visibility of school areas in the city<br>**Action 13**<br>Creating enjoyable cycling and walking routes<br>**Action 14**<br>Developing a high-performance public transport network<br>**Action 15**<br>Establishment of Low Emission Zones | TOD implementation, including the existing agglomerations on the west and the east of Almaty<br>MRT: extension of metro line<br>Promote the use of low carbon private cars<br>Gender neutral legislation for public transport drivers<br>Regulate car parking policy in the centre (limited in time)<br>Increase safety conditions for road workers<br>Extend cycling and pedestrian infrastructure<br>Roll-out of traffic safety measures in other school areas |

| | | |
|---|---|---|
| LU | **Action 16**<br>Reaching a city-wide Blue and Green Strategy and Implementation Plan<br>**Action 17**<br>Implementing priority blue green infrastructure projects at the district level<br>**Action 18**<br>Increasing the water permeability of the city of Almaty<br>**Action 19**<br>Preventing and curing landslide-prone situations<br>**Action 20**<br>Awareness raising and education centre for landslide prevention | Further development of blue green infrastructure projects at city level<br>Prevention and curing of landslide-prone situations<br>Urban regeneration through circular economy |
| WS | **Action 21**<br>Development of an Integrated Waste Management Strategy (IWMS)<br>**Action 22**<br>Establishment of a construction and demolition waste (CDW) recycling facility<br>**Action 23**<br>Feasibility Study for establishment of a biowaste management system and pilot project for green waste composting<br>**Action 24**<br>Feasibility Study for upgrading the existing waste sorting plant<br>**Action 25**<br>Implementation of separate waste collection system for dry recyclables | Implementation of the IWMS<br>Urban gardening projects<br>Policy actions and pilot projects for prevention of single use plastic<br>Improved collection service through route optimization and digitalization<br>Management of hazardous waste<br>Development of a digital platform “wastebox” for construction site disposal |
| WA | **Action 26**<br>Developing a leakage reduction programme for drinking water supply<br>**Action 27**<br>Development of a water saving plan<br>**Action 28**<br>Wastewater collector retrofit<br>**Action 29**<br>Feasibility study on WWTP modernization and industrial wastewater treatment options | Construction of a modern Water Resource Recovery Plant<br>Rehabilitation of entire wastewater collection system<br>Rehabilitation and extension of water supply and distribution network in Almaty |
| IN | **Action 30**<br>Feasibility Study for establishment of a Green Industrial Innovation Park (GIIP) | Construction of the GIIP<br>Promotion and support for green and smart economic activities via fiscal incentives<br>Support for attracting investors for circular economy activities / production from secondary materials |

# 5.2 Roadmap of GCAP implementation

In Almaty it is important to start with setting up the institutional framework to strengthen project-based implementation of green development and link them to key performance indicators. This will allow creating the mandates for the currently missing competencies and a more integrated planning and governance. It will be done in parallel with setting up the citywide digital twin initiative as a tool used for better planning and management (Actions 1 and 3). Actions start in the first three years of the planning period and are defined to be implemented and completed in the 5-year planning period.

As it can be seen from the roadmap below, several actions will start in parallel in the different urban sectors, starting with the most stringent issues, those that are at reach and give fast results while making sure strategic issues that will define in a major way the face of the city 30 years from now are in the forefront. This includes making sure that micro-mobility works, and alternative modes of transport are accessible; that the city makes a start with modernizing CHP-2, the major source of energy and the DH distribution system linked to residential buildings retrofit programmes; that waste sector gets an integrated approach and there is a focus on managing the bio-waste that is a growing fraction; the wastewater collection pipeline rehabilitation starts and that land-slide risks are better managed. At the same time, it is of strategic importance to start work right away on a water saving plan and on transit-oriented development, acting now to shape the city's longer-term future.

Actions that follow in the second year of implementation continue efforts in the sectors above. In the sector of energy and buildings actions continue in EE in public buildings and turn to look at RES solutions to areas not connected to DH. In the transport sector investments continue in cycling and walking infrastructure, multi-modal hubs, public transport network (Actions 11, 13, 14). As for the land use sector, a city-wide blue and green strategy development will start with a focus on increasing the water permeability of the city (Actions 16 and 18). In the waste sector, actions towards upgrading the existing waste sorting plant will begin and establishment of a C&D recycling facility (Actions 22 and 24). In water sector, investment will continue on wastewater collector retrofit and, at the same time, development of a feasibility study on WWTP modernization and a leakage reduction program for drinking water will start (Actions 26, 28, 29). Blue-green infrastructure actions start during this year. Also, in this year the actions that are dedicated for stepping up the co-creation, networking and innovation in the city are started for the start-ups and industry (Actions 2 and 30).

In the third year, Smart Grid programme implementation will start, the blue-green infrastructure will reach in all areas of the city and establishment of low emission zones start. In the last two years of the GCAP short-term actions implementation emphasis will be placed on investment projects related to blue green infrastructure at district level, public transport network and other sectors. Furthermore, the implementation of the short-term actions will serve as a good basis for long term actions to be implemented starting with year 6 up to 15.


2023
2024
2025
2026
2027
... 2037
Action 1
Action 3
Action 5
Action 6
Action 7
Action 13
Action 14
Action 19
Action 20
Action 21
Action 25
Action 27
Action 10
Action 11
Action 12
Action 23
Action 28
Action 16
Action 24
Action 29
Action 30
Action 22
Action 26
Action 2
Action 8
Action 4
Action 18
Action 9
Action 15
Action 17
LONG TERM ACTIONS
EN
BL
TR
LU
WA
WS
IN
SO1
SO2
SO3
SO4

# 5.3 Detailed description of short-term actions

In the following, the 30 detailed short-term actions are presented according to a template, which includes sections such as:

- First page: definition of targets and benefits; estimated CAPEX; potential source of finance and timeframe of implementation; scale and location; key stakeholders.
  Also, on the right side of the first page of each action, the correlation of the action with the strategic objectives and the related GCAP sectors is emphasized.

- Second and third page include: a brief description of the context and how the action fits in the overall development programme of the city; legal and policy framework; the implementation steps; the costs estimates both for CAPEX and OPEX; considerations related to inclusion of smart components in the action, and how the action is linked to other actions detailed in the GCAP.

# Action 1
# Akimat Office for Green Project Implementation

SO1 SO2 SO3 SO4

EN BL TR LU WS WA IN

| Estimated CAPEX (thousands) | Potential source of financing |
|---|---|
| 165 EUR<br>80,520 KZT | Municipal budget, IFIs, bilateral development agencies |

| Timeframe | Scale and location |
|---|---|
| 2023–2027 | This action is to be implemented at the Akimat level of Almaty. |

## Targets

- Institutional structure for GCAP coordination and implementation established
- 5 financed projects in the first 3 years

## Benefits

- Efficient use of available resources; enhanced management practices for city development; promoting the uptake of green products; costs savings; tools developed for criteria for screening green projects defined; key performance indicators for each project defined.
- New job opportunities will be created; training on gender equality and economic inclusion to be provided to all employees engaged in GCAP implementation
- Facilitate policy dialog to improve women's access to employment
- Integrate in the evaluation process of projects socio-economic and gender criteria and provide incentives for projects which are addressing these aspects

## Key stakeholders

Akimat Departments: Ecology and Environment, Finance, Economy, Digitalization; Maslikhat

### Context and description

The GCAP is developed by the Akimat for the city of Almaty together with a wide range of stakeholders, including both internal stakeholders such as departments and municipal service providers as well as external ones such as NGOs, independent experts and other interested persons. In the planning phase, it was found that many green initiatives are interdepartmental or are not yet in the mandate of the existing departments. This creates barriers for several green initiatives, such as the digital twin, electric vehicles and charging stations, retrofitting and energy efficiency, water saving, taxi regulation, transit-oriented development. Therefore, a new institutional structure "Akimat Office for Green Project Implementation" (OGPI) will be established within the Akimat to close any institutional gap in this regard. It will have the following roles:

- Coordinating GCAP implementation
- Coordinate with other institutions which are responsible for implementing the Almaty Agglomeration programme in order to jointly work towards attracting funds, implementing projects and monitoring and evaluate the development process.
- Ensuring that OGPI staff covers all competencies and is mandated together with relevant departments to initiate and implement projects in GCAP relevant sectors, including those currently poorly governed, such as energy efficiency, energy management of the city, sustainable and electric mobility, water saving, taxi services, transit-oriented development, etc.
- Development and implementation of GCAP actions. Each action in the GCAP should be upgraded to a level of maturity which will be transformed into a feasible project ready to be implemented.
- Ensure high environmental performance of services and investments in the city.
- Ensure awareness raising and information campaigns regarding the OGPI's activities and tasks.

The OGPI should be directly subordinated to the Akim. The main tasks to be performed within the OGPI will focus on: ensuring that sectoral policies and plans developed hereto will include GCAP actions; supervise the GCAP implementation in terms of effectiveness and efficiency (time, allocated resources, progress and impact); lobby and advocacy for GCAP at all levels; fund raising and coordination of efforts for ensuring that sufficient resources are allocated for GCAP implementation; communication, transparency and accountability; monitoring and coordination of data collection and management of information (digitalization) related to all GCAP projects; monitoring and results, dissemination of information, reporting to internal and external stakeholders and initiating and overseeing the periodical update of the plan.

Due to the limited financial capacity of the Akimat for sustaining operational costs and investments, priority will be given to those sectors and practices that may attract financing for capital investment projects or may increase financial sustainability in operation of public services.

Additionally, the following long-term measures will be considered:

- Introducing environmental requirements in the public procurement system.
- Purchasing Power Agreements (PPAs). The Akimat will seek out opportunities to buy energy at fixed price or cheaper price by entering PPA type contracts with private sector for longer term procurement contracts. Renewable energy investors will be favoured.
- Tariff reform for urban services. Tariffs for water and wastewater, heat & power distribution, waste and public transport services do not fully cover their costs. Insufficiency of investments puts at risk the sustainability of the city's municipal infrastructure. For this reason, an in-depth tariff reform study is proposed. Back in 2017 a RAB (Regulatory asset base) based tariff methodology was proposed for tariff reform by an EBRD technical consulting project, eliminating subsidies from the tariff. However, the reform was not implemented, and the study needs update.

### Legal and policy framework

Law on Local Government and Self-Government in the Republic of Kazakhstan (Article 27, p. 22) stipulates that the Akimat can establish state institutions and enterprises.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Institutional analysis to develop the most suitable institutional structure and functions for the dedicated OGPI | 4 months, starting in 2023 |
| 2. Create and mandate the dedicated OGPI. Include OGPI in the organizational chart of the Akimat. | 3 months |
| 3. Allocate resources for setting up the institutional structure and provide qualified staff. | |
| 4. Define objective criteria for screening green projects. | 2 months |
| 5. Define and monitor key performance indicators for each project – system for monitoring the environmental performance. | 2 months |
| 6. OGPI – operational period | Ongoing starting with end of step 2 |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Establish the OGPI, including investments in equipment and preparation of job description for all members of OGPI team | 50 | 24,400 |
| System for environmental monitoring | 15 | 7,320 |
| Capacity building program for OGPI employees (*learning by doing*) | 100 | 48,800 |

**Estimated yearly OPEX (thousands):** 20 EUR / 9,760 KZT
The budget of the OGPI will be reviewed as needed during the approval of the mandate and capacity of the office.

### Smart and digital solutions

New high-tech equipment and up to date software will be procured for daily operation of the newly created office, training of employees on usage of new equipment and software.

### Correlation with other actions

| Action | Explanation |
|---|---|
| All actions | The OGPI will coordinate the overall implementation of GCAP |
| Action 3 | The unified digital platform (Citywide Digital Twin) will be a strategic tool for the OGPI - for implementation of actions, synergies between them and monitoring of results. |

# Action 2
# Almaty Green Innovation Incubator

SO1
SO2
SO3
SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 100 EUR | Not Applicable |
| 48,800 KZT | |

| Timeframe | Scale and location |
|---|---|
| 2024–2027 | IT Park Almaty |

Potential source of financing

Municipal Budget, Private sector

EN
BL
TR
LU
WS
WA
IN

Targets

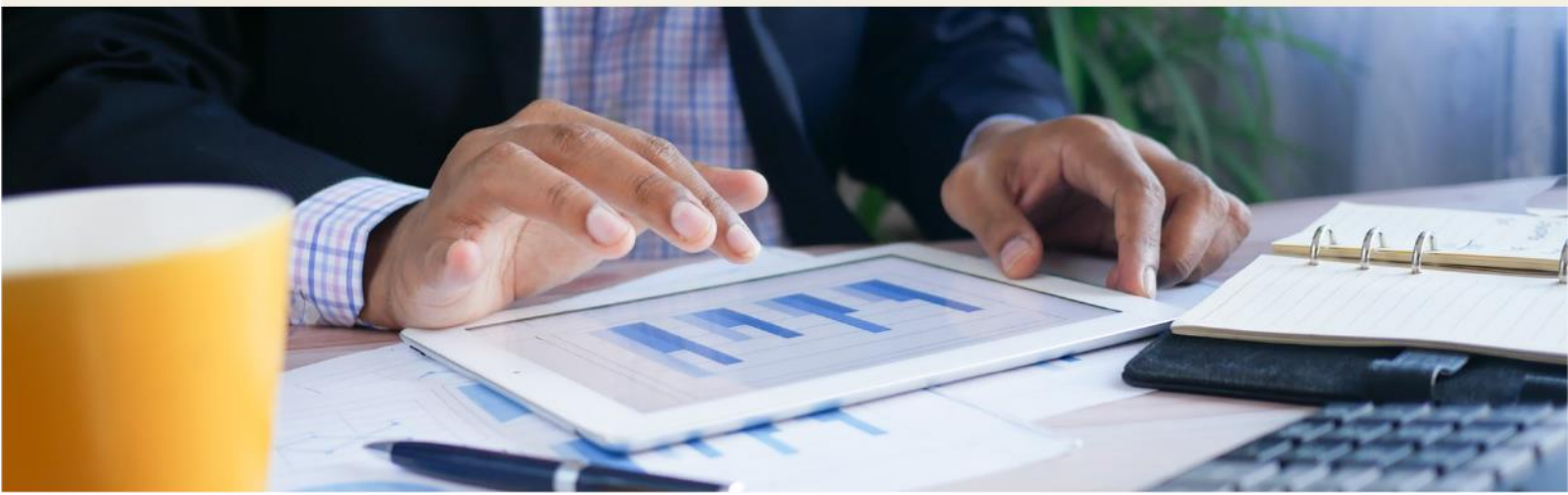
- Launching at least 20 start-up companies in areas related to green innovation businesses in 5 years

Benefits

- Creating sustainable business opportunities
- Reducing the ecological footprint of Almaty's economic development
- Green job creation, estimated at 300 to 500 jobs in the first 5 years

Key stakeholders

Akimat Departments: Ecology and Environment, Finance, Digitalization, Entrepreneurship and Investments, Economy Private investors and investor funds, Innovative Companies, Universities, such as Al-Farabi Kazakh National University (KazNU)



## Context and description

Almaty's GDP heavily relies on trade, representing 35.7% of the city's GDP. Trade and services are driving the economy. In order to fulfil its vision of shifting to a green city, Almaty needs to move towards a green and knowledge-based economy.

Responding to this need, the municipality has already established an Ecology and Environment Department, which is a valuable step in this direction. There are a number of enabling conditions in place that make establishing the "Green Innovation Incubator" timely for Almaty.

Almaty is a Centre for universities, home to five well-established universities. The city's population is young, as 65% of residents are under the age of 40 which is a fertile ground for start-ups. Also, the city has developed a thorough database on many aspects of urban development and is ready to continue with digitalization. The construction of an IT Park has been initiated through a cooperation between KazNU and Turkish investors and developers with the aim to create a Silicon Valley type development in the city.

This action proposes to bring together universities, the local government, businesses and citizens in order to generate innovative solutions for the green development of Almaty. The action will use the lessons learned and build on the EXPO-2017 experience, when Almaty initiated the creation of the Almaty Innovation Center. Such Incubator is a space for co-creation grounded in the local community, which entails the following advantages: it is a structured platform for harnessing capabilities, focusing investment and stimulating entrepreneurial skills; it brings added value for local initiatives; and it is an effective vehicle for shaping the dynamics of go-to-market solutions.

IMPACT HUB – AMSTERDAM


The Hub focuses on identification of startup business ideas and transforming them into reality. It has an ecosystem approach, because complex issues our society is facing cannot be solved alone. They ask for collaboration. Our ecosystems are focussed on the food sector, circular economy, inclusive society and fashion sector. Through our ecosystems startups, SMEs and organisations can **activate** their first steps in sustainability, get **matched** with innovative solutions to make a positive impact with their business and **accelerate** their impact through capacity building programs

*More information available here: https://amsterdam.impacthub.net/*

Thus, the Green Innovation Incubator (GII) would be responsible for facilitating communication and cooperation between these stakeholders with the aim of picking up ideas from the stage of research to developing these into feasible business opportunities and incubating start-ups. The seed money for the activity would come from the municipality but gradually investments and private sector participation should take over and the Incubator should become self-sustaining.

The type of research the Incubator could take up and foster could include among others:

- Renewable energy
- Digitalization and high-tech
- Circular economy start-ups
- Recycling the ash from coal fired power plants of the city as construction material or activated carbon, based on the existing local research[16]
- Industrial symbiosis
- Urban gardening

## Legal and policy framework

[16] Solutions developed by Kazakhstani experts with regard to the CHP waste disposal

Smart Strategy 2020-2025 for Almaty

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Establish the organization set-up and mandate; members and boards should include the Akimat and Universities | 2 months starting with 2024 |
| 2. Develop a work programme and business plan for 1-3 years | 4 months |
| 3. Allocate financing and establish an office for the Green Innovation Incubator. | 1 month |
| 4. Carry out Incubator activities as per the work programme, focusing on networking, networking events, matchmaking research, business development and green urban development | Ongoing, starting with end of 2024 |
| 5. Help mature ideas turn into start-ups by helping with company set-up, business plan development and facilitating access to finance. | |
| 6. Monitor and evaluate the Green Innovation Incubator activities at the end of each year and update the 3-year work programme. | |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Establishing the Green Innovation Incubator Office (including office equipment) | 100 | 48,800 |

**Estimated yearly OPEX (thousands)**: 100 EUR / 48,800 KZT (for staffing, costs of networking events, market research studies, business plan development, overhead, etc.)

### Smart and digital solutions

The action will support smart and digital solutions, research oriented to digital development, use of big data and modelling in green business development.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The Office will channel ideas and business opportunities towards GII and will be actively engaged in the coordination of the GII. |
| Action 3. Citywide Digital Twin | A partnership between the Green Innovation Incubator and the development of the CDT could be considered. More broadly, the Incubator could benefit from open data (available or to become available). |

| | |
|---|---|
| All actions | The GII will provide innovative solutions in each sector and for each action with a strong focus on smart and digital components. |
| Action 30. Green Innovation Industrial Park | Potentially the matured businesses developed in the GII will move their operation to GIIP. |

# Action 3
# Citywide Digital Twin

SO1
SO2
SO3
SO4

EN
BL
TR
LU
WS
WA
IN

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 5,000 EUR<br>2,440,000 KZT | Cost savings by increasing operating efficiency, water, resource and energy efficiency & reducing maintenance cost |

| Timeframe | Scale and location |
|---|---|
| 2023–2027 | Citywide |

Potential source of financing

IFIs, Municipal and State budget

Targets

- Have an operational CDT by 2025, including a number of features, which have been tested and optimized in a pilot case

Benefits

- Improved air quality by optimized traffic and air flows
- Reduced congestion by optimized mobility management and planning
- Improved overall quality of urban living by a combination of benefits
- Offer equal opportunities for all categories of stakeholders, including vulnerable persons to get actively engaged in decision making processes and to monitor the city development

Key stakeholders

Digitalization Department of the City of Almaty, sectoral departments, IT companies

## Context and description

A unified city digital platform (Citywide Digital Twin – CDT) for the Akimat of the city of Almaty will provide an up-to-date view of the situation in the city so that any measures planned can be simulated and tested. It builds a bridge between the digital and physical urban world and is designed to enable policymakers to take data-driven decisions based on real time data monitoring and scenario modelling, enhancing a holistic approach to urban planning.

Almaty has already addressed a number of decision-support domains by specific individual information systems in the urban context. These information systems now build on 'data silos' per disciplinary domain, although the data lake initiative[17] is already putting the city on the right track to break down data silos.

Cross-domain urban decision support is the main added value of the CDT. The CDT allows interconnecting urban data sources and modelling algorithms in a gradual way for potentially all sectors. This means that the CDT can be constantly enriched to better reflect the complex reality of its physical urban counterpart.

Looking at the challenges for Almaty, these priorities have been defined for the CDT:

- Identify key investments to reduce air pollution in Almaty, by integrating modelling algorithms on air flow, air quality and traffic in the urban data model (Pilot). The wind pattern will be considered as well and link this information to future development and construction plans
- Modern and efficient district heating system including a pilot on low temperature DH
- Optimize intelligent traffic management and mobility planning
- Enhanced water distribution network and water saving interventions
- Building heat loss and energy efficiency modelling for targeted energy efficiency measures

The CDT will be developed in a modular fashion over time. The priorities listed above will be the initial modules developed. Subsequently, the following modules can be implemented:

- Environmental conditions remote sensing & display
- Digital land-use and building permitting
- Real-time public transit & multimodal passenger information
- Smart parking & smart charging
- Water quality monitoring & consumption tracking
- Digital flood monitoring & pollution control

In addition, the actions being taken in several other sectors can benefit from the rollout of the CDT. The CDT can support the definition, implementation and monitoring of several actions and, reversely, several actions can provide data that would feed the CDT. The CDT also creates a potential for private sector development (further business development, development of the digital economy).

The CDT represents the first step towards achieving a digital mapping and creation of a unified database system for the entire Almaty Agglomeration. This could help forecast the city development for the next 5 -15 years. This is one of the objectives of the newly development programme of the entire Almaty Agglomeration and the CDT will serve as a best practice example on how digitalization can be enabled in the urban and regional development context.

## Legal and policy framework

There are two relevant policy documents for this action: the "Digital Kazakhstan" Program approved in 2017 and the Smart Almaty Strategy 2020-2025. The Akimat of the city of Almaty has a dedicated department which is responsible for the implementation of the Smart Strategy.

[17] Data Lake Initiative in Almaty is a project where data is collected and structured, thus similar to the concept of 'data warehouse'.

## Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Set up the CDT rollout programme<br>- Set up project implementation unit<br>- Define scope of digital twin<br>- Continue work on data governance, data management, data processing and data integration, based on ongoing initiatives (e.g., Digital Almaty: https://digital-almaty.kz/ru )<br>- Explore possibilities to integrate community-led and private sector-led initiatives (open data-based)<br>- Include lessons learnt from Nur-Sultan digital twin setup, and consider the interoperability of different digital twins in Kazakhstan<br>- Build up stepwise approach: define pilot process and additional priorities<br>- Set clear goals and rollout timeline | 10 months, starting with 2023 |
| 2. Develop a 3D model as representation of the city<br>- Link to existing geo-based platform (Digital Almaty) which includes static and dynamic urban data<br>- Enable visualization and representation on different spatial and temporal scales | Ongoing activity, starting with 2024 |
| 3. Set up a pilot to test the CDT<br>- Pilot on air pollution monitoring & air movement<br>- Interconnect static urban data sources (geo based, linked to 3D-model), dynamic urban data sources (based on IoT: traffic, air quality) and modelling algorithms (air flows simulation, urban mobility simulation, air quality simulation)<br>- Use the pilot to assess the results of impact modelling of future scenarios, and to see how this could impact investment decisions and potential policy changes.<br>- Include lessons learnt from pilot in further process | 16 months |

## Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Set up the CDT rollout programme | 250 | 122,000 |
| Develop a 3D model as representation of the city | 2,000 | 976,000 |
| Set up a pilot to test the CDT | 2,750 | 1,342,000 |

**Estimated yearly OPEX (thousands)**: 500 EUR / 244,000 KZT

### Smart and digital solutions

The action has a strong emphasis on smart and intelligent systems, with innovative urban planning solutions.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will make all the necessary efforts to support the implementation of this action |
| All sectoral actions | The CDT extensively supports actions in the water, building and transport sectors. |

# Action 4
# Energy Efficiency Programme for public buildings and facilities

SO1 SO2 SO3 SO4

| Estimated CAPEX (thousands) | |
|---|---|
| 37,650 | EUR |
| 18,373,200 | KZT |

**Estimated annual savings**

Annual energy savings: 40.8 million kWh/year
Reduction in $CO_2$ emissions: 14,400 tonnes $CO_2$/year

**Timeframe**

2024–2027

**Scale and location**

100 public buildings in the city covering approximately 415,000 $m^2$.

**Potential source of financing**

IFIs, Municipal budget

**Targets**

- Minimum of 40% energy saving of heat energy for all retrofitted buildings with an overall impact of 30 to 50% energy savings.
- Consumers change to more energy efficient behaviours.

BL

**Benefits**

- Improved city air quality
- Achieving required standards for indoor thermal comfort, i.e. temperature and humidity in work and living spaces
- Additional benefits: extend the expected building lifetime, increase asset values or public health.
- Increased quality of life and comfort of citizens
- Implement measures which are targeting vulnerable persons, increasing their accessibility to public buildings.

**Key stakeholders**

Akimat Departments: Energy and Water Supply, Ecology and Environment, Construction, Communal Infrastructure Development, Green Project Office of the Akimat

### Context and description

The public sector is a major energy user in Almaty. According to the Almaty Municipal Energy Efficiency Plan for 2030, among public buildings, schools are the largest energy consumer, followed by healthcare units and kindergartens. Education facilities and public offices are often overheated, since thermostat valves to regulate the temperature are not available.

Many public buildings were built several decades ago, when no energy standards existed, having limited insulation and a high consumption. The annual energy bill for municipal buildings in Almaty represents 2% of the municipal budget and there is a lack of public buildings energy audits, i. e. a clear identification of the refurbishment needs.

To promote deep retrofit of public buildings aiming at energy efficiency, thermal refurbishment, and smart technologies, a guide for energy efficiency retrofit in public buildings will be drafted. An energy efficient behaviour programme will be implemented including information campaigns and capacity building.It is expected that the results of this action targeting public buildings will have a demonstration effect and be used as showcase in information and awareness campaigns to promote energy efficiency in private offices and commercial buildings. This action will take into account the necessary repair works for the public buildings damaged as a result of the events that occurred in January 2022.

Among public buildings, schools should be prioritized for demonstrating green building practices using this as for educational purposes. The programme will also prioritise kindergartens, and medical facilities having the highest impact in the community and will include the retrofit of building envelop, the modernization of heating and hot water systems, improvement of lighting, adoption of Building Management Systems (BMS) and small-scale renewable energy.

All existing public buildings and facilities belonging to the Akimat within the city boundaries are virtually eligible for this action. A feasibility study, based on a building inventory followed by energy audits, must be carried out in order to determinate the selection of the buildings. The action is aligned with the Municipal Energy Efficiency Plan for 2030 and proposed a target of 20 public buildings retrofit on average per year.

The implementation of this action results in financial savings, ultimately in the improvement of air quality in Almaty.

The selection of the buildings and the results of the audits and retrofit improvements must be based and integrated in Almaty “Citywide Digital Twin” to measure the impact and leverage from the experience.

### Legal and policy framework

Law on energy Savings and Energy Efficiency (2012); Almaty Development Strategy 2050 (2019); Municipal Energy Efficiency Plan 2030.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Develop a feasibility study based on building inventory, energy audits, building technical expertise and a comprehensive thermal imaging programme. | 12 months, starting with 2024 |
| 2. Develop an energy efficiency and comfort design guide for future buildings retrofits. This guide will be part of the terms of reference in the renovation projects and identify and assess funding and financing opportunities | 8 months (2024) |

| | |
|---|---|
| 3. Develop the terms of reference for the retrofits (minimum requirements, etc.) and lunch the tenders. | 4 months (2025) |
| 4. Monitor implementation and evaluate performances via performance indicators and information on the digital twin. | Ongoing, starting with 2025 |
| 5. Developing an energy efficient users' guide for all occupants of public buildings and deliver an energy efficient behaviour programme. | 4 months (2025) |
| 6. Organize site visits to promote implemented measures and results. | Ongoing, starting with 2026 |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Feasibility study and ToR development | 250 | 122,000 |
| Development of materials for the energy efficient behaviour programme | 50 | 24,400 |
| Measures implementation (considering an average investment of 90 EUR/$m^2$ – 43,920 KZT/$m^2$) | 37,350 | 18,226,800 |

**Estimated yearly OPEX**: savings

### Smart and digital solutions

Building retrofit includes active measures such as smart metering, smart heating control systems and BMS, providing real-time data collection, such as heating demand and energy consumption that can be integrated in the digital twin.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 3. Citywide Digital Twin | Building heat loss & energy efficiency modelling is one of the priorities of the CDT. |
| Action 6. Almaty CHP-2 modernisation | CHP-2 modernisation will consider the thermal refurbishment of public buildings. |
| Action 7. Rehabilitation and modernisation of District Heating infrastructure | Thermal refurbishment of public buildings |

# Action 5
# Residential buildings retrofit programme

SO1

SO2

SO3

SO4

BL

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 22,665 EUR<br>11,060,520 KZT | Minimum 35% energy saving representing over 14.8 million kWh/year.<br>Reduction in $CO_2$ emissions: 5,200 tonnes $CO_2$/year |

| Timeframe | Scale and location |
|---|---|
| 2023–2027 | Private multi-storied buildings focusing mainly on panel buildings from Soviet era, covering 5,000 apartments |

Potential source of financing

Private sector, IFIs and bilateral development agencies, Municipal budget

Targets

- 35% energy saving in 5,000 dwellings located in residential buildings

Benefits

- Improved air quality.
- Better indoor thermal and air quality.
- Staffing requirements will take full consideration of gender equality and equal rights for job opportunities.
- Contribute to enhancing the quality of life and comfort of residents of Almaty

Key stakeholders

Akimat Departments: Construction, Energy and Water Supply, Communal Infrastructure Development, Green Project Implementation Office, Kazakhstan Centre for housing and communal services modernization and development (Kazcenter ZhKH)

### Context and description

According to the official statistics, the city has 27,158 multi-storey buildings with 675,006 apartments and 133,868 individual houses. Housing stock totals 47.4 million $m^2$ floor area in mostly privately owned buildings. The majority of these are old and obsolete and were built without any energy efficiency standards, having very limited insulation. Although the adoption of EE and RES in private buildings is on the political agenda, currently residential blocks are insufficiently maintained, and no major investments in rehabilitation are being undertaken especially in low-income areas. This results in a highly deteriorated housing stock with a low energy efficiency performance. For instance, in 2019 the heating consumption in residential buildings reached 106 kWh/$m^2$ and the electrical consumption was of 38 kWh/$m^2$.

According to the State program of housing and communal development "Nurly Zher" for 2020–2025 that was issued in December 2019 No 1054, improving building energy efficiency is one of the priority actions. Due to a lack of individual apartment heat consumption-based metering households are not paying their bills based on consumption leading to an inefficient use of energy. However, in order to switch to individual apartment consumption-based billing, buildings need to undergo energy efficiency works and a tariff reform must be considered.

This action proposes deep retrofitting of residential panel buildings from Soviet era, encompassing 5,000 apartments, namely via the insulation of the building envelope, replacing of windows and doors, heating improvements such as individual controllers and apartment level heat metering, replacement of elevator equipment, efficient lighting, and green solutions such as green roofs. The action will also support the adoption of small-scale renewable energy sources such as photovoltaic, solar water heaters or heat pumps.

The Akimat will promote the rehabilitation works by providing support to homeowners and homeowners associations via a one-stop-shop to be implemented by the Akimat. The one-stop-shop will support the development of investment-grade energy audits and thermal imaging, technical expertise to assess the building structure, showcase technologies, materials, and evidence of successful rehabilitations, as well as promote existing local and national incentives and the adoption of financing schemes.

Homeowners will have access to the programme via the one-stop-shop and, in case they comply with the requirements, an invest grade audit will be performed in order to identify the measures to be adopted. These audits are supported by the Akimat with bilateral development agencies' support.

Buildings that undergo the retrofit programme will access grants and loans based on a preliminary study on grants scheme and loan programme to be developed.

The selection of the buildings and the results of the audits and retrofit improvements must be based and integrated in Almaty "Citywide Digital Twin" to measure the impact and leverage from the experience.

### Legal and policy framework

Almaty Development Strategy 2050 (2019) and Municipal Energy Efficiency Plan 2030 (2018).

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Develop the municipal one-stop-shop supporting homeowners and homeowner associations with investment-grade audits and thermal imaging, technical information, funding and providing incentives available and develop the implementation plan. | 10 months, starting with 2023 |

| | |
|---|---|
| 2. Develop a study on the grants scheme and loan programme. | 3 months (2024) |
| 3. Support the outsource of the renovation works according to the implementation plan. | Ongoing activity starting with 2024 |
| 4. Monitor implementation, evaluate performances and incorporate the results in the on-stop-shop. | |
| 5. Conduct information and awareness campaigns to promote energy efficiency in residential buildings. | |

## Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Develop the One-Stop-Shop | 15 | 7,320 |
| Study on the grants and loan scheme | 50 | 24,400 |
| Deliver the investment-grade audits | 100 | 48,800 |
| Building retrofit (4,500 €/dwelling) | 22,500 | 10,980,000 |

**Estimated yearly OPEX**: savings

## Smart and digital solutions

The building retrofit allows the opportunity to install equipment such as smart heating controls and smart meeting systems providing real-time data collection regarding heating demand and energy consumption. This data will allow the validation of the effectiveness of the different measures and the adoption of demand response approaches.

## Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions |
| Action 3. Citywide Digital Twin | Building heat loss & energy efficiency modelling is one of the priorities of the CDT. |
| Action 6. Almaty CHP-2 modernisation | Building heat loss & energy efficiency modelling CHP-2 modernisation will consider the thermal refurbishment of residential buildings |
| Action 7. Rehabilitation and modernisation of District Heating infrastructure | Thermal refurbishment of residential buildings |
| Action 8. Heat pumps and solar heating programme for residential buildings which are in areas not connected to DH | Small-scale renewable energy sources such as photovoltaic, solar water heaters or heat pumps will be included in the programme. |

# Action 6
# Almaty CHP-2 modernisation

SO1 SO2 SO3 SO4

**Estimated CAPEX (thousands)**

630,000 EUR

307,440,000 KZT

**Estimated annual savings**

CHP with electrical efficiency of more than 60%, and a fuel utilization rate of about 80%

Reduction in $CO_2$ emissions of 35% (1.35 million tonnes/y)

Reduction in $NO_x$ of 75% (5,625 tonnes/y)

Elimination of PM and $SO_x$ emissions

**Timeframe**

2023–2027

**Scale and location**

Three units with a total installed capacity up to 620 MW of electrical power and 957 Gcal / h of heat capacity

Likely the same location as current CHP-2 plant

**Potential source of financing**

State budget and IFIs

EN

**Targets**

- Modernisation of CHP-2 by 2027 including the full phase-out of coal, replaced by natural gas, as the primary fuel (first turbine unit operation by the end of 2023; all three turbine units installed and commissioned in 2027).

**Benefits**

- Improved air quality due to the 35% reduction of $CO_2$, 75% reduction of $NO_x$, elimination of $SO_x$ and PM of the city's major power plant, CHP-2
- Full elimination of ash waste generation

**Key stakeholders**

Ministry of Energy, Akimat Departments: Energy and Water Supply, Ecology and Environment, "Samruk-Energy" JSC, "Almaty Power Stations" JSC ("AIES" JSC), KazTransGas JSC.

IN

## Context and description

Air quality is one of the major concerns in Almaty due to high values of $PM_{2.5}$, $PM_{10}$ and $SO_2$. According to the hydrometeorological service Kazhydromet, the atmospheric air in Almaty is generally characterized by a high level of pollution. An independent $PM_{2.5}$ measurement network (Airkaz) also monitors Almaty's air pollution levels in real time and displays at the airkaz.org portal. The Airkaz data also indicates severe air pollution, where the annual average and daily average $PM_{2.5}$ concentrations exceeded WHO limit values.

One of the major sources of pollution is the energy and heating sector, namely from CHP-2 and CHP-3, located not far of the border of Almaty. Both CHP-2 and CHP-3 are coal-fired plants increasing the amount of air pollution and ash disposal.

CHP-2, the focus of this action, has an electric power capacity of 510 MW, in addition to 1,176 Gcal/hour of heat capacity. The plant generates the largest share of Almaty's heat however is one of the less efficient (~60%) facilities.

This action considers the modernisation of the Almaty CHP-2 with full replacement of coal by natural gas as the primary fuel. Among others, given the fact that the existing facility is developed below ground level the conversion of the existing turbines for gas is unviable. The modernisation of Almaty CHP-2 encompasses the construction of a new power plant of three turbine units with a total installed capacity up to 620 MW of electrical power and 957 Gcal / h of heat capacity.

Considering the dimension and relevance of Almaty CHP-2 (in 2020 it produced 2601,4 million kWh and 3,2 million Gcal representing a utilization factor of installed capacity of 58,1% and 27,6% respectively) the modernisation is estimated to be developed in three phases, based on the three turbine units to be installed, to ensure uninterrupted supply of heat to the city of Almaty. According to the feasibility study, the first turbine unit is expected to be operational by the end of 2023 with all three turbine units installed and commissioned in 2026.

Also, according to the feasibility study the considered solutions are the installation of combined-cycle gas turbine units (CCGT) and open cycle gas turbines (OGTs) with heat recovery boilers (HRB) for the generation of hot water for the district heating network. The envisaged producers of the turbines are Tier-1.

It is recommended that the project considers the adoption of Best Available Technologies (BAT) according to EU requirements, including turbines which can work on gas/hydrogen mix and having sufficient level of energy efficiency. Also, the approval of bankable regulatory framework for payback mechanism, that would be applicable to the project, is considered relevant.

Considering that the viability of the transition from coal to gas is dependent of the necessary gas infrastructure, the Akimat of the city of Almaty in coordination with KazTransGas shall ensure the construction of the gas infrastructure before the completion of the first phase (2023) to connect CHP-2 with gas pipelines in Almaty Agglomeration.

The current infrastructure will be transferred to the emergency reserve system. It is expected that this modernization also triggers the subsequent transition from coal to gas on CHP-3 and the efficiency improvement on CHP-1. These modernisations and the coal phase-off will have a major impact in the reduction of the $CO_2$ emissions and improvement of the city air quality.

## Legal and policy framework

Almaty Development Programme 2025 (2019), Air Quality Improvement for the City of Almaty 2025 (2019).

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Develop a long-term Low-carbon climate-resilient Roadmap for the district heating system of Almaty for 2020 – 2060. Subject to technical/economic feasibility. | 6 months, starting with 2023 |
| 2. Prepare detailed terms of reference for the modernization of CHP-2 and launch the tender process. | 8 months (2023) |
| 3. Develop the works of the Almaty CHP-2 modernization in three phases. | 48 months (2024–2027) |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Modernisation of CHP-2 | 630,000 | 307,440,000 |

**Estimated yearly OPEX (thousands)**: 15,000 EUR / 7,320,000 KZT

### Smart and digital solutions

The modernisation of the CHP-2 plant can be coupled with relevant monitor and control systems and demand-side energy efficiency measures.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will make all the necessary efforts to support the implementation of this action via lobby and advocacy as well as with permitting process, when required. |
| Action 3. Citywide Digital Twin | Links can be made with the CDT for implementation and monitoring of targeted measures. |
| Action 5. Residential buildings retrofit programme | CHP-2 modernization was designed based on current needs and estimations considering the retrofit programme for residential buildings. |
| Action 7. Rehabilitation and modernisation of the District Heating (DH) infrastructure | The modernization of District Heating system will consider the newly features of CHP-2. |
| Action 9. Development of the Almaty Smart Grid Programme | CHP-2 new capacities for electricity production |
| Action 30. Green Industrial Innovation Park | CHP-2 could be the service provider for the park. |

# Action 7
# Rehabilitation and modernisation of the District Heating (DH) infrastructure

SO1
SO2
SO3
SO4

**Estimated CAPEX (thousands)**

220,100 EUR

107,408,800 KZT

**Estimated annual savings**

Reduction of 205,000 Gcal/year in energy losses
Reduction in $CO_2$ emissions: 84,300 tonnes $CO_2$/y

**Timeframe**

2023–2027

**Scale and location**

The district energy network covering the rehabilitation and modernization of 200 km of network.
A selected district for low temperature network.

**Potential source of financing**

IFIs, State budget,
Municipal budget

EN
BL

**Targets**

- Rehabilitation of 16% of the existing DH infrastructure as part of a rehabilitation programme.
- Accomplish a pilot project for low-temperature networks enabling the use of renewable and waste energy sources for heating and cooling.

**Benefits**

- Reduction in air pollution
- Improvement of grid and infrastructure resilience and better user comfort with positive health impacts

**Key stakeholders**

Akimat Departments: Energy and Water Supply, Ecology and Environment; ; District Heating Companies (Almaty District Heating Networks LLP); Institute of Heat Power Engineering and Control Systems.

### Context and description

Almaty District Heating network and facilities, supplying heat and hot water, are fossil fuels based and are mainly obsolete with relatively large heat losses given their age and insufficient maintenance. As of end of 2020 the share of heating networks with over 25 years is 62.4% or 801.95 km (distribution heat networks: 69.5% or 691.15 km; main heating networks: 38.3% or 110.80 km). In addition, according to the district heating company (ALTS), under a business-as-usual scenario the share of heat losses in 2022 will be 15.58%, in 2023 of 15.23%, in 2024 of 14.88%, in 2025 of 14.52% and in 2026 of 14.15%.

The district heating company estimated that, in order to operate the system without major problems, it is necessary to reconstruct about 40 km of heating networks per year. However, considering the recent years, the best achievement was the rehabilitation of 25 km in one year. Since the system is outdated, there is a large energy-saving potential in the district heating network and facilities. Also, the Network and facilities need to be modernised and working temperatures reduced as much as possible to facilitate future integration of heat pumps, waste heat and other renewables. For this reason, and to achieve a good level of efficiency, the infrastructure needs a comprehensive rehabilitation and modernisation programme based on the replacement of obsolete pipelines, pumping stations and storage tanks, as well as the installation of individual heating substations and the modernisation and automation of the system. According to the investment plan, in 2021, ALTS LLP carried out a set of measures in 17 facilities to reconstruct heating networks. These works covered 7.518 km leading to a reduction in average annual from 10,134.46 Gcal / year to 2,604.79 Gcal / year, i. e., a reduction of 74,3% (7,529.67 Gcal / year).

Also, according to the ALTS LLP investment program for 2020–2026, the company plans to spend almost 34 billion tenge (69 million EUR) on the equipment purchase, reconstruction of heating networks and other repairs. Out of these 34 billion tenge, 8 billion tenge (16 million EUR) is their own funds and 26 billion tenge (53 million EUR) is budget investments.

These actions must be combined, where and when feasible, with the development of low temperature networks. Low-temperature district heating reduces the amount of energy loss attributable to converting and transporting energy to buildings (losses in the distribution network can go below 10%) and are able to use low temperature renewable energy such as solar thermal collectors or large heat pumps and excess heat sources combined with thermal storages for heating and cooling.

The massive use of heat pumps can also play a significant role in the achievements of a heating and cooling strategy and the overall modernization of the system, as they can create the ideal balance and integration across energy systems by providing a solution that combine energy efficiency, use of renewable sources and engagement of consumers in the energy system.

A pilot project for this will be selected and implemented in the next 5 years. In the medium to long term, the adoption of low temperature networks should be considered for new areas of the city.

Smart metering systems are in place at most of the users, however only hot water is paid based on the consumption, since heat bill is based on the dwelling gross floor area (given the fact that heat is measured at building level). The pilot project will test measures to encourage the adoption of apartment consumption-based billing and the inclusion of building level heat sub-stations and smart heat cost allocators.

The system is clearly in deficit as the tariffs do not cover investment and operating costs. This deficit can significantly undermine the financial sustainability of the system hindering mainly investments in the retrofit and modernization of the system. Nevertheless, changes in heating tariffs are always sensitive. For this reason, an in-depth tariff reform study is proposed. Back in 2017 a RAB based tariff methodology (Regulatory Asset Base) was proposed for tariff reform by an EBRD technical consulting project, eliminating subsidies from the tariff. However, the reform was not implemented, and the study needs update. The study

will also analyse the impact and specific measures to encourage the switch to apartment consumption-based metering.

### Legal and policy framework

Almaty Development Strategy 2050 (2019); Municipal Energy Efficiency Plan 2030 (2018); Air Quality Improvement for the City of Almaty 2025 (2019).

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Develop an investment programme, including the definition of the most priority rehabilitation investments. | 4 months, starting with 2023 |
| 2. Perform renovation and modernization works according to the investment programme. | Ongoing, starting with 2024 |
| 3. Monitor implementation and evaluate performances through performance indicators. | |
| 4. Developing a feasibility study regarding the adoption low temperature networks using renewable and waste energy sources for heating and cooling. | 10 months (2025) |
| 5. Implement a pilot project based on the feasibility study to test solutions. | 12 months (2027) |

In parallel with the previous steps: update the existing tariff reform study.

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Network rehabilitation and modernisation (200 km) | 215,000 | 104,920,000 |
| Feasibility study and pilot project implementation for low temperature DH network | 5,000 | 2,440,000 |
| Updating the existing in-depth tariff reform study | 100 | 48,800 |

**Estimated yearly OPEX (thousands)**: 6,500 EUR / 3,172,000 KZT

### Smart and digital solutions

The use of low temperature and heat pump-based systems together with the ability to shift demand allows cost optimisation and brings economic benefits however this strategy relies on the level of digitalisation and use of artificial intelligence and self-learning algorithms to integrate data from consumers with production and substations enabling real system efficiency.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 3. Citywide Digital Twin | Links can be made with the CDT for implementation and monitoring of targeted measures. |
| Action 4. Energy Efficiency Programme for public buildings and facilities | District Heating will be also included in the EE Programme for public buildings. |
| Action 5. Residential buildings retrofit programme | District Heating will be considered for residential building retrofit Programme. |
| Action 6. Almaty CHP-2 modernisation | The modernization of District Heating system will consider the newly features of CHP-2. |

# Action 8
# Heat pumps and solar heating programme for residential buildings which are in areas not connected to DH

SO1 SO2 SO3 SO4

| Estimated CAPEX (thousands) | |
|---|---|
| 3,800 | EUR |
| 1,854,400 | KZT |

**Estimated annual savings**

The proposed systems will provide savings of more than 40% on heating energy consumption representing over 3.7 million kWh.
Reduction in $CO_2$ emissions: 1,300 tonnes $CO_2$/y

**Timeframe**

2024–2027

**Scale and location**

The action will cover 1,500 residential buildings (both individual homes and apartments) located in areas not connected to DH.

**Potential source of financing**

IFIs, Private sector

**Targets**

- Uptake of small-scale renewable energy, namely via the introduction of 1,500 heat pumps and solar heating systems in apartments or individual houses.

BL

**Benefits**

- Improved city air quality and better indoor thermal comfort
- The use of heat pumps can be combined in the future with measures on low temperature district heating.
- Financing incentives will be promoted to support low-income households supporting social inclusion and promoting the fight against energy poverty.

**Key stakeholders**

Akimat Departments: Energy and Water Supply, Communal Infrastructure Development, Ecology and Environment, Construction, Urban Development Control; ALTS Almaty Heating Network, Housing associations, Technology providers, Kazakhstan Centre for housing and communal services modernization and development (Kazcenter ZhKH)

### Context and description

According to the official statistics, the city has 27,158 multi-storey buildings comprising 675,006 apartments and 133,868 individual houses. Most of these are old and obsolete, this fact coupled with the low rate of renovations leading to a high heating consumption in residential buildings.

The share of population with a District Heating (DH) system connection is of 72% and it is not mandatory that buildings, including the new ones, connect to the DH system. There still are coal-burning heating appliances in some of the individual houses, emitting hazardous pollutants and greenhouse gases (GHG).

The prevalent coal-based heating and electricity consumption (sourced from fossil fuel) in residential buildings causes a major concern for the environment and the safety and comfort of building users.

The action proposes a solar heating and heat pumps programme for residential buildings located in selected areas not connected to DH. By promoting the use of renewable energy in these areas it can promote future integration of low temperature DH networks. The measure will involve the financial support of 1,500 equipment (heat pumps or hot water solar heating systems).

This measure will be supported by mechanisms to promote investments, namely:

- Fiscal incentives and/or access to grants for the adoption of individual heat pumps and/or solar heating;
- Financing incentives to support low-income households, primarily in the transition from coal to heat pumps or solar heating.

The terms of the incentive and selected areas for intervention will be developed in a feasibility study. Investment can include the necessary complementary works for the installation of the heat pumps and solar heating.

This measure will be managed and implemented by the Akimat.

### Legal and policy framework

Almaty Development Strategy 2050 (2019) and Municipal Energy Efficiency Plan 2030 (2018). These plans already consider a set of energy efficiency retrofit and renewable energy, namely solar measures.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Prepare detailed terms of reference for selection of consultant for developing a feasibility study. | 4 months, starting with 2024 |
| 2. Tender process for the selection of consultant. | 6 months (2024) |
| 3. Feasibility study for the selection of the areas and impact of the heat pumps and solar heating. | 10 months (2024–2025) |
| 4. Develop the terms of reference for the incentive mechanisms (funding rates, performance indicators, eligibility criteria, etc.). | 4 months |
| 5. Promote the incentive mechanisms via awareness campaigns. | Ongoing, starting with approval of feasibility study (2025–2027) |
| 6. Support the implementation via the opening the call for projects, managing the applications. | |

| | |
|---|---|
| 7. Monitor implementation and evaluate performances through performance indicators. | |
| 8. Promote results through information and awareness campaigns, organize a site visit and press releases | |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Feasibility studies and terms of reference development | 50 | 24,400 |
| Programme implementation (supply and installation of equipment) - (2,250 / equipment) | 3,375 | 1,647,000 |
| Programme monitoring and evaluation | 375 | 183,000 |

**Estimated yearly OPEX (thousands)**: 10 EUR / 4,880 KZT (Regarding ongoing coordination and administration by the Akimat)

### Smart and digital solutions

New equipment can integrate smart monitoring system providing real-time data collection, such as heating demand and energy consumption. The use of local renewable energy can help to promote low temperature district heating systems and monitor heat losses.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions |
| Action 3. Citywide Digital Twin | The CDT could be used to visualize the potential for solar energy heating and target investments |

# Action 9
# Development of the Almaty Smart Grid Programme and pilot project implementation

SO1
SO2
SO3
SO4

EN

**Estimated CAPEX (thousands)**

1,000 EUR

488,000 KZT

**Estimated annual savings**

Smart grid and digitally enabled measures can allow 5% reduction in O&M costs and enable smart demand response, integration of renewable energy sources and charging points for EVs.

**Timeframe**

2025–2027

**Scale and location**

The strategy will cover the entire city and the pilot project will focus on a specific district.

**Potential source of financing**

IFIs, Municipal budget, Alatau Zharyk Company

**Targets**

- Promoting the flexibility of the electrical grid via the digitalization, renewable energy and storage integration and the development of new services.
- Improve the level of system reliability, quality, and security of supply.

**Benefits**

- New business development and test bed for companies
- Reduced operational cost of grid management
- Improved grid resilience and reduced power cuts
- Call requirements will take full consideration of gender equality and equal rights for applicants.

**Key stakeholders**

Akimat Departments: Energy and Water Supply, Communal Infrastructure Development, Ecology and Environment; Alatau Zharyk Company, Almaty Power Stations (AIES)

## Context and description

The electrical grid in Almaty is in some areas very old and working very closely the maximum capacity. This problem is exponentiated by the rapid growth of the city together with the intensification of transport electrification, share of renewable energy sources, storage, or demand response systems. These changes are driving an increasing need to improve and reconfigure the grids. Massive infrastructure upgrades to accommodate these changes, and ensure system reliability, quality, and security of supply are expensive and slow to implement.

Digital or interconnected energy management systems, converting analogue information such as energy bills into digital information, improved utilities operations, together with smart meters allow homes to alter when and how much they draw electricity from the grid, i. e. to adopt prosumer and demand-side responses strategies. This flexibility can avoid investment in new electricity infrastructure.

Also, the rapid progress in artificial intelligence and machine learning is enabling new applications and business models across the energy system and helps to integrate higher shares of variable renewables into the grid by better matching energy demand to solar or wind supplies.

The Reference Standard of Smart Cities of the Republic of Kazakhstan was approved in 2019 to standardize the approach to building smart cities. Considering this standard, by the end of the year 2020 Almaty ranks first in the Internal rating of the Republic of Kazakhstan for “Smart cities” with a total scoring of 70.4%.

Smart Strategy 2020-2025 for Almaty includes, among others, one initiative under task 2 on “smart energy” “aiming the introduction of energy-efficient housing and utilities systems that can automatically adjust to consumers (various tariffs), electronic technologies for collecting electricity consumption readings by the population, remote control technologies for electricity consumption in the urban economy, electricity distribution and management systems (Smart and Micro Grid, AMR)”.

This action aims to develop an electrical smart grid programme of investments. The programme will be based on an analysis of existing barriers and definition of investment needs for the electrical infrastructure to enable the incorporation of small-scale renewables, storage of electricity and electric vehicles charging points. At the same time investments will support grid flexibility, demand response via the digitalization of the energy. Digital data and analytics can reduce power system costs in at least four ways: by reducing operations and maintenance costs; improving network efficiency; reducing unplanned outages and downtime; and extending the operational lifetime of assets. Studies show that smart grid management (including smart metering and invoicing) can reduce operation costs in a range of 5 to 10%.

In parallel with the development of the investment plan, a specific district must be selected by the Akimat and Alatau Zharyk Company to serve as testbed for companies, research centres, students and other stakeholders to test and promote bold solutions and services on digitalization, renewable energy, storage and demand response. The scale of the pilot depends on the technology to be tested; however, it should at least conduct to an integration of 30% of variable renewables with building smart demand response. This approach is aligned with the task 6 of the Smart Strategy 2020–2025 for Almaty by supporting the creation of an innovative ecosystem.

The pilot project will be co-financed by the Akimat and the Alatau Zharyk Company with the support of involved companies. Once the pilot project proves its efficiency and effectiveness, the programme can be upscaled to Almaty city and Agglomeration level.

## Legal and policy framework

Almaty Development Strategy 2050 (2019), Almaty Smart Strategy 2025

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Prepare detailed terms of reference for a consultant to develop the electrical smart grid programme and investment plan. | 4 months (2025) |
| 2. Consultant to develop the smart grid programme and investment plan. | 10 month (2025) |
| 3. Develop the terms of reference and support the implementation of a pilot project. | 27 months (2025 - 2027) |
| 4. Develop and deliver an awareness raising campaign about the benefits of the smart grid, using the pilot project as demonstration platform for technologies. | 3 months (2027) |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Development of the strategic programme and investment plan | 200 | 97,600 |
| Pilot project implementation | 800 | 390,400 |

**Estimated yearly OPEX (thousands)**: 35 EUR / 17,080 KZT (related with the pilot and the awareness raising campaign)

### Smart and digital solutions

The whole action aims at introducing smart and digital solutions, please refer to the main description.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 3. Citywide Digital Twin | The action can be linked to the rollout of the CDT. |
| Action 6. Almaty CHP-2 modernisation | The grid will be designed to incorporate the new capacity for electricity production. |
| Action 8. Heat pumps and solar heating programme for residential buildings which are in areas not connected to DH | The grid will be designed to allow for feeding with electricity produced from renewable sources. |

# Action 10
# Transit Oriented Development (TOD) – Applying TOD in satellite city development

SO1
SO2
SO3
SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 500 EUR | Not Applicable |
| 244,000 KZT | |

| Timeframe | Scale and location |
|---|---|
| 2023–2024 | Satellite cities to be identified in the territory of Almaty Agglomeration (details provided in the context section) |

Potential source of financing

IFIs, State budget, Municipal budget, added land value created by TOD

Targets

- Achieve satellite cities development is based on Transit Oriented Development principles

TR
LU

Benefits

- High modal share for public transport (> 50%) for commuters from the G4 satellite cities
- TOD as a critical component to achieve climate-neutral satellite cities
- Reduced pressure on air quality from commuting
- Improved access to city and enhanced conditions for transportation for all categories of persons, including vulnerable persons.

Key stakeholders

Akimat Departments: City Mobility, Land Relations, Ecology and Environment, City Planning and Urbanism, Construction, Urban Development Control, Digitalization, Research Institute "AlmatyGenplan" LLP

## Context and description

As a rapidly growing metropolis, Almaty is facing increasing pressure on land use, especially in its suburbs and in the territory of the Almaty Agglomeration. In turn, the rather monofunctional development of 'commuter districts' increases the pressure on the transport system, resulting in traffic jams for commuters.

In the Almaty Development Strategy 2050 and the Interregional Action Plan for the Almaty Agglomeration development until 2030, the vision and strategic guidelines are set out to deal with these pressures. For example, the 2050 Strategy mentions a 'city without outskirts' and guarantees high living standards in all districts. The long-term goal is the realization of a polycentric city: a city where each district offers a healthy and diverse mix of activities, infrastructure, and services to the inhabitants, with good connections within the district and between each district. The revised Master Plan for Almaty sets the stage for this polycentric development and aims for the establishment of satellite cities. G4 satellite cities is an example of a potential satellite cities project, still at the concept level, for the creation of four new cities between Almaty and Konayev Lake – Gate City (business and financial hub), Golden City (knowledge and medical hub), Growing City (industrial and logistics hub) and Green City (tourism and entertainment). G4 city is expected to become a new economic hub in Central Asia and speed up foreign investment into Kazakhstan. By 2050, 2.2 million

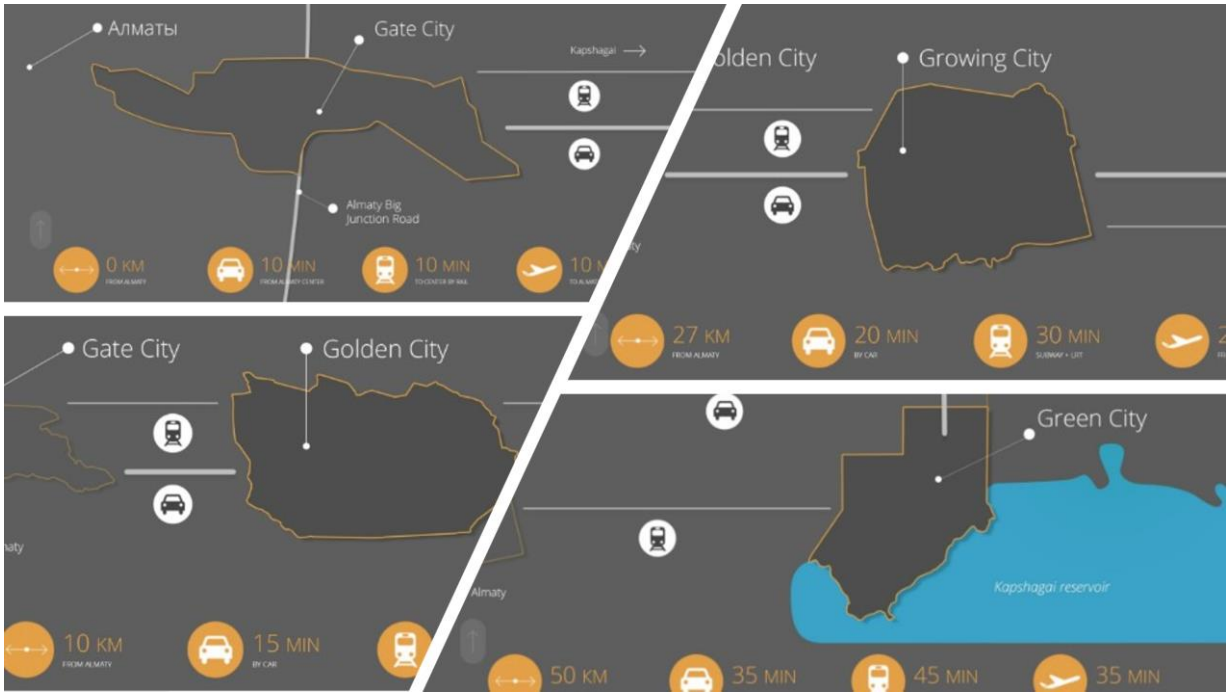



*Figure 8. Location of G4 cities (source: http://www.g4city.kz)*

people will live in the satellite cities, and over a million jobs will be available.[18]

The Interregional Action Plan for Almaty Agglomeration sets as one of its objectives to develop a unified transport system throughout the entire territory of the newly established Agglomeration.

The connection between satellite cities and the unified transport system for the Almaty Agglomeration are best realized according to a transit-oriented development (TOD) approach. In a TOD, rapid transit stations are the centres of lively districts, providing high-quality and fast connections to the city and other districts. TOD will enhance public transit ridership and create additional economic value by concentrating residential, retail and commercial development around the stations. It will also reduce the need for vehicle trips and

[18] Official website of the project: http://www.g4city.kz/o_proekte

increase proximity by developing PT networks, bringing energy savings, air quality and congestion benefits compared with a dispersed approach to new development.

Transit-oriented development depends on conditions that determine its success. One of these conditions is that the networks and facilities (rapid transit, hubs, cycling infrastructure) must already be in place for TOD to work. To make this work, the added land value created by planning multimodal stations can be used for investments in these networks and facilities. This added value can be captured by the government in various ways: by issuing concessions, by levying specific taxes, and so on. Another determining condition is seamless cooperation between the city departments on urban planning & transport (e.g., to capture the created land value).

### Legal and policy framework

Almaty Development Strategy 2050; Interregional Action Plan for the Almaty Agglomeration development until 2030, Almaty Master Plan (to be implemented) as a guiding plan for urban development.

Almaty Sustainable Transport Strategy 2023, as a guide for transit development and multimodal hub design, supporting the development strategy in Master Plan.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Prepare detailed Terms of Reference for selection of consultant for developing a feasibility and implementation study. | 4 months, starting with 2023 |
| 2. Tender process for selection of consultant. | 6 months (2023) |
| 3. Feasibility study on TOD implementation strategy, based on selection & planning of satellite cities. The study will focus on how to apply TOD in satellite city development. This includes, but is not limited to:<br>- Feasibility study on costs & benefits of TOD, planning of works, links with rapid transport development & urban development including infrastructure and utilities and pedestrian and non-motorised transport<br>- Stakeholder engagement & communication<br>- Financing scheme based on added land value<br>- Research on implementation of 15-minute city principle<br>- Defining implementation strategy for TOD | 14 months (2023–2024) |

A detailed master plan for the satellite cities is not included in this study.

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Feasibility and implementation study | 500 | 244,000 |

**Estimated yearly OPEX**: N/A

### Smart and digital solutions

Link with city digital twin on smart management of public transport, link with passenger information system, link with (e-)micro-mobility and smart charging system for public transport.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 3. Citywide Digital Twin | Data integration<br>Real-time traffic information & management<br>Real-time public transit & multimodal passenger information |
| Action 11. Connecting different transport modes: multimodal hubs | Infrastructure elements included in the feasibility study will also refer to multi-modal hubs. |
| Action 14. Developing a high-performance public transport | Public transport infrastructure to be defined in the feasibility study |

# Action 11
# Connecting different transport modes: multimodal hubs

SO1

SO2

SO3

SO4

**Estimated CAPEX (thousands)**

445 EUR

217,160 KZT

**Estimated annual savings**

Lower costs of health care (more active transport users and less pollution)
Reduction of 2,380 tonnes CO2/year

**Timeframe**

2023–2025

**Scale and location**

Support the roll out of new transport modes that cater for varying transport needs and preferences

**Potential source of financing**

Municipal budget, State budget, IFIs

**Targets**

- Creation of 3 multimodal hubs
- Reduction of private cars in the city centre
- Support the roll out of new types of micro mobility
- Speed up the number of charging stations
- Increase the share of shared mobility and increase the share of electric mobility

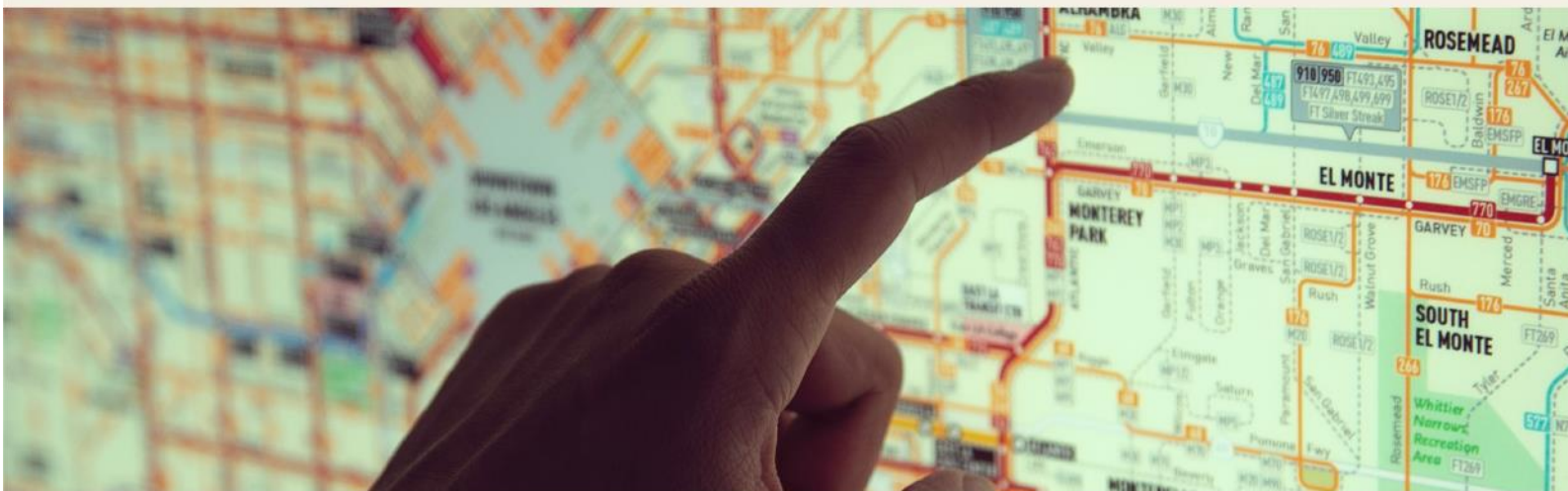
TR

**Benefits**

- Reduced number of cars in the centre
- Informational displays providing time schedules, tariffs, weather, etc.
- Different types of transport modes are available for every type of user (children, elderly, women, disabled)

**Key stakeholders**

Akimat Departments: City Mobility; Almaty Metropolitan;Construction, Land Relation, Private operators, such as: Green Bus Company AvtoAlma-Trans, Almaty Electro Trans, etc.; partnerships with external providers for the mobility solutions.



## Context and description

Parking shortage and highly congested roads are the main mobility problems in Almaty. The dominance of the car in the urban transport network is the culprit. By using multimodal hubs, it is possible to provide a mobility service infrastructure to switch seamlessly between transport modes.

The action refers to creating multimodal hubs at public transport stops accessible to everyone. These hubs should include: access to PT, e-bikes, e-scooters, charging stations for EVs and parking area for private cars. Pooling different types of shared electric micro mobility can speed up the process of electrification and charging infrastructure. Sharing mobility has become more and more widespread and can reduce the number of private cars in the city by disrupting the private vehicle ownership model. A multimodal hub is an ideal location to start implementing **new types of modern mobility** and do some **pilots**.

When outlining the plan for a multimodal hub, a municipality has the power to control and decide of the providers. In this way it is possible to choose which shared mobility is needed. In Almaty, the main focus should be on keeping large share of the cars out of the city centre. A well-developed multimodal hub could be located at the periphery of the city centre, where there is still public space available to park the car so the switch can be made easily.

**Focusing on the last mile** (or first) of the journey of the commuter is a challenge. Providing a variety of stations and drop-off zones (for e-scooters, steps, e-bikes, etc.) across the city is highly recommended in order to facilitate the use of shared mobility.



Besides offering mobility alternatives it is also desirable to offer other additional services such as deliveries (food, groceries, clothes, etc.), lockers, laundry salons, bike repair tools and informational displays. In this way the **multimodal hub can increase its attractiveness in the neighbourhood,** which can result in spill over effects.

To create support and commitment, involving citizens in the early stage of the process is crucial. For example: campaigns, information events, participation evenings, etc. are good instruments to achieve this goal.

Regulation on micro-mobility is also a key factor for a successive roll-out of shared mobility. In the short-term pilots and time-limited permits can provide a framework to explore the possible options for shared mobility. Cities must clearly define and regulate their expectations (fleet size, equipment, maintenance, fleet distribution, etc.) in order to maximize public benefit as most systems are operated by private companies. Through agreements, promotion and regulation, the Akimat would be supporting private operators to organise micro-mobility to best suit the city's needs and complement other modes in a seamless way. This would be beneficial to both parties to ensure successful roll-out and operations. The same principles and guidance is

applicable for the Almaty Agglomeration. This action will serve as an example and baseline for understanding how multi-modal hubs can work in the wider context of the new Almaty Agglomeration setup.

### Legal and policy framework

Almaty Master Plan, as a guiding plan for urban development.

Almaty Sustainable Transport Strategy 2023, as a guide for transit development and multimodal hub design, supporting the development strategy in Master Plan.

Almaty Development Strategy 2050, on expansion of the public transport network to reduce the dependence on private transport and Interregional Action Plan for the Almaty Agglomeration development until 2030 for establishment of a unified transport system at regional level.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Feasibility study<br>a. Inventory of areas for the implementation of multimodal hubs<br>b. Selection of areas for multimodal hubs<br>c. Land acquisition procedure, if the case. | 10 months, starting with 2023 |
| 2. Creating design plan (citizen participation) | 8 months (2024) |
| 3. Development of micro-mobility regulation and defining an operating framework | 4 months (2024) |
| 4. Selection process of partnerships for shared mobility, charging stations, services, etc. | 4 months (2024) |
| 5. Construction and implementation of multimodal hubs, including land acquisition if the case. | 14 months (2024–2025) |
| 6. Evaluating and monitoring the multimodal hubs | Ongoing, starting with 2024 |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Charging station and parking space for 6 e-cars | 65 | 31,720 |
| Installation of 10 parking spaces including 1 parking for people with reduced mobility (excl. parking spaces e-cars) | 200 | 97,600 |
| Lockers for minimum 40 boxes | 10 | 4,880 |
| Station of 6 shared bikes/e-scooters | 25 | 12,200 |
| Digital displays & data infrastructure, Wi-Fi hot spots | 40 | 19,520 |

| | | |
|---|---|---|
| Theft-proof and covered bike park | 25 | 12,200 |
| Waiting infrastructure including seats & garbage bin | 80 | 39,040 |

**Estimated yearly OPEX (thousands)**: 80 EUR / 39,040 KZT.

### Smart and digital solutions

At the multimodal hubs displays can provide general information for the users, such as time schedules of PT, availability of shared mobility/parking places, weather, etc. Additionally, the development of a multimodal payment system can facilitate the usage. In a further stage, an online application can be developed for the use of the different types of transport modes (e.g., payment system, current tariffs, supply, time schedules, etc.).

From the provider's perspective, monitoring and analysing the current situation of the multimodal hub can provide interesting insights in how to improve and develop. The use of displays can influence users' travel behaviour, which is a useful tool for local governments.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 3. Citywide Digital Twin | Data integration<br>Real-time traffic information & management<br>Real-time public transit & multimodal passenger information<br>Smart parking & smart charging |
| Action 10. Transit Oriented Development (TOD) – applying TOD in satellite city development | Considerations on land use planning as well as connection to transport corridors |
| Action 13. Creating enjoyable cycling and walking routes | Design infrastructure elements suitable for cycling and walking |
| Action 14. Developing a high-performance public transport network | Align the development of the multimodal hubs with the public transport development strategy and action plan |
| Action 25. Implementation of separate waste collection system for dry recyclables | Multimodal hub will include also waste collection infrastructure |

# Action 12
# Increase the visibility of school areas in the city

SO1
SO2
SO3
SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 1,000 EUR<br>488,000 KZT | N/A, focus on road safety |

| Timeframe | Scale and location |
|---|---|
| 2023–2025 | 10 school areas in Almaty |

Potential source of financing

Municipal budget, State budget, IFIs

TR

Targets

- Implement 30 km/h regimes in selected school areas
- Reduce with 50% the number of accidents in the selected school areas of the city

Benefits

- Walking is a healthy, environmentally friendly, cheap, and flexible mode of transport.
- Walkable areas increase the liveability and accessibility of districts.
- Decreased air pollution around schools
- Increased traffic safety, resulting in less collisions and less incidents with pedestrians.

Key stakeholders

Akimat Departments: City Mobility, City Planning and Urbanism, Energy and Water Supply, Construction; NGOs, citizens, etc.

## Context and description

According to the 'Children in the city' report of the UNICEF, Almaty leads among all cities in Kazakhstan in terms of number of road accidents per 100 thousand people and by the number of injured, as a result of road accidents. Problematic and notable is the large share of children aged between 0 to 17 years in the figures.

Walking is the only transportation mode which is always part of any journey whether they are car-based trips or otherwise. The absence of proper pedestrian infrastructure can cause stress and can be dangerous for life and health. Providing attractive pedestrian routes and areas can increase the share of non-motorised transport and the liveability of an area.

School areas are characterized by a high number of children and a lot of traffic. Redesigning these areas is required to enhance traffic safety. The most obvious measure is tackling speeding of motorized traffic through limitation and control. A good way of achieving this goal is installing **traffic calming areas**, narrowing streets in front of schools, cutting of streets, speed bumps, etc. In this way motorized traffic becomes obligated to adjust their speed (preferably 30 km/h) in school zones.

Another measure is improving pedestrian infrastructure, protecting pedestrians from collisions. **Well-developed school routes and school areas** can enhance the number of people walking and cycling to and from school. Instruments include the provision of a network of connected sidewalks, improvement of the crossability of (main) roads (pedestrian crossings, traffic lights), priority of pedestrians, clear signage, and road markings in school areas. **Pedestrians and cyclists are the main users of the school areas** and motorists (as guests) should adjust their behaviour to suit.

Throughout the world, the "play streets" movement is gaining popularity – temporary blocking of streets and turning them into a space for playing. The closure of the road traffic serves as a small but catalytic step to ensure that children have more freedom to move around their area. The initiative was supported by the UN as one of the solutions to reduce air pollution around schools. By focusing strongly on the pleasant and comfortable design of the public space, citizens will be encouraged to make use of it. Parking facilities should be redesigned in such a way that the main entrances are safeguarded from motorized traffic and ensure easy accessibility for pedestrians and cyclists.


This action also includes **traffic education** measures. Some examples of teaching methods that can be used are: traffic parks, provision of textbooks, interactive learning through simulations, including traffic knowledge in the curriculum, training of crossing guards, etc.

The action includes measures that will be piloted in 10 school areas in the coming 5 years. On long term, all the pilot projects will be replicable in other school areas.

## Legal and policy framework

**Almaty Sustainable Transport Strategy 2023.** It envisages a more integrated approach, combining various modes of transport in a single system, and coordinating transport system with urban development plans.

**Program of Measures to Improve Mobility in the city of Almaty 2030.** This program displays measures (with exact locations) that will be carried out in the city in order to improve transport infrastructure. For example: streets that will be converted to one-way traffic and areas of calm traffic, where new cycle lanes (with bicycle rental stations) and pedestrian streets will be laid.

**Strategy on cycling and pedestrian infrastructure of Almaty.** The purpose of the strategy is to increase the share of movement on alternative means of transport and to create conditions to attract their usage by increasing the competitiveness, accessibility and safety.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Make a traffic calming plan for the school areas in the city. | 4 months (2023) |
| 2. Set-up and implement pilot projects in 10 school areas. | 16 months (2024–2025) |
| 3. Develop educational programmes (including school curricula) for traffic safety. | 3 months (2023) |
| 4. Evaluate the projects. | Ongoing, starting with completion of first pilot project |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Construction of pedestrian routes (20 km at 10,000 EUR/km) | 200 | 97,600 |
| Pilot project in school areas (10 schools at 40,000 EUR/ school) | 400 | 195,200 |
| Bicycle parking (10 schools at 20,000 EUR/school | 200 | 97,600 |
| Development of an educational programme for traffic safety | 200 | 97,600 |

**Estimated yearly OPEX (thousands)**: 40 EUR / 19,520 KZT (including implementation of educational programme)

### Smart and digital solutions

In order to increase the visibility of school areas some digital tools can be implemented. The installation of dynamic traffic signs is a convenient method to raise the awareness of these areas. In turn, digital information panels can inform citizens about the used transport modes, weather, parking occupancy, etc.

Monitoring the redesign of school areas can be done by traffic counting sensors. In this way, up-to-date data can be gathered and analysed.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 3. Citywide Digital Twin | Data integration |

| | |
|---|---|
| Action 13. Creating enjoyable cycling and walking routes | Design infrastructure elements suitable for cycling and walking. |

# Action 13
# Creating enjoyable cycling and walking routes

SO1
SO2
SO3
SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 21,750 EUR<br>10,614,000 KZT | Lower costs of health care (more active transport users and less pollution)<br>Reduction of 610 tonnes of CO2/year |

| Timeframe | Scale and location |
|---|---|
| 2023–2027 | 4 routes (details provided in the "Context and description" section) |

Potential source of financing

Municipal budget, State budget, IFIs

TR

Targets

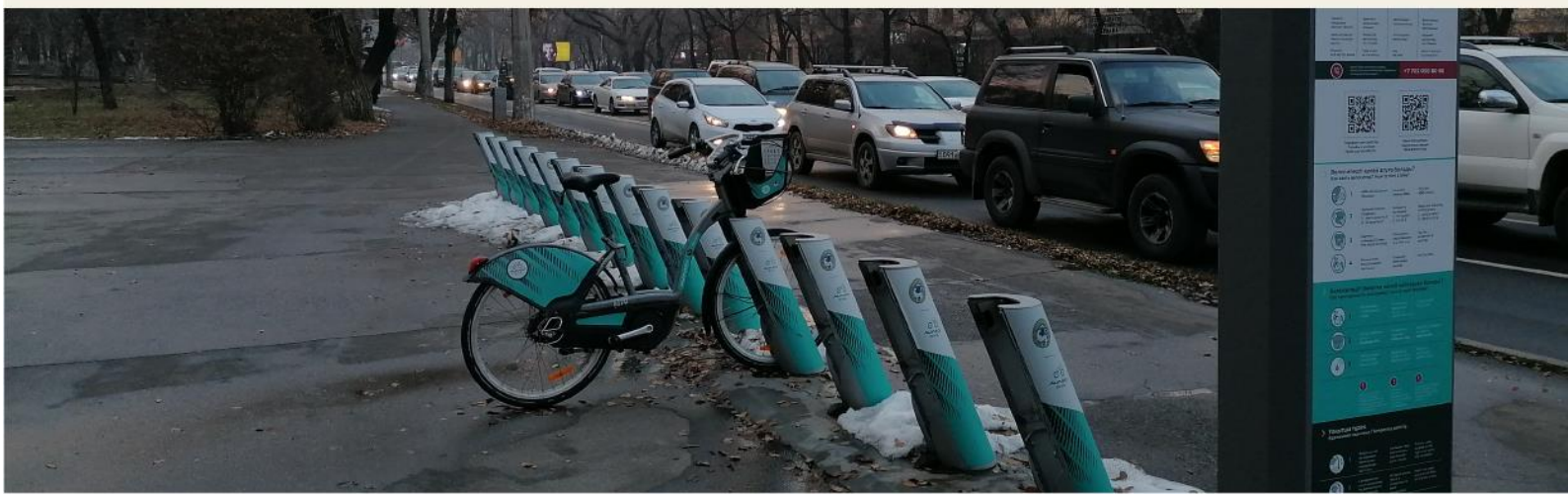
- Eliminate the missing links in the network
- Increase of the number of bike commuters to 10–15%
- Improve traffic safety for cyclists and pedestrians, decrease of collisions
- Improve accessibility for disabled persons

Benefits

- Modal shift towards sustainable transport modes
- Increased physical activity of citizens, enjoyable and safe routes.
- The project has a high potential to positively impact tourism

Key stakeholders

Akimat Departments: City Mobility, City Planning and Urbanism, Construction, Land Relations, Ecology and Environment; Almaty Regional Branch of the "KazAvtoZhol" National Company; NGOs (Almaty bike, Environment and Urban Mobility), citizens etc.



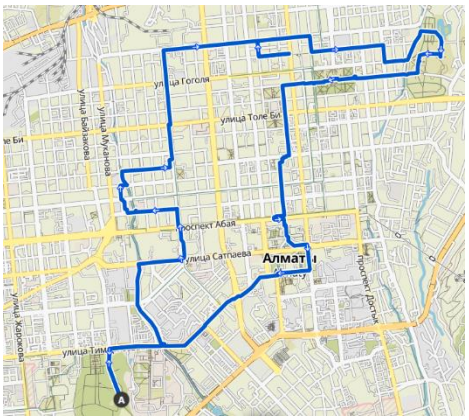
## Context and description

Almaty aims to reduce the use of cars in the centre. Therefore, the focus is on improving micro-mobility by extending the cycling and walking network. Since the construction of the first cycling lane in 2011, the trend of bikes/e-bikes usage is increasing, as Almaty provides evidence of the numerous measures implemented to develop/improve cycling-friendly infrastructure and public transport services in general. Still, the widespread use of bicycles as urban vehicles is hampered by the lack of bike paths and bike parking near buildings.

The aim of this action is to encourage more commuters to use a bicycle for their functional trips (with or without electrical assistance). This can be done by realizing direct, comfortable, safe, and **smooth cycling connections** between living and work areas.

Also, **bicycle parking** will be enhanced/installed throughout the bicycle network, near the entrances of the frequently visited public and commercial institutions: public buildings, universities, shopping centres, schools, business centres, banks, parks, cinemas, etc.

The goal of this action is also to **increase the visibility of the pedestrian infrastructure** in the car-dominated public space of Almaty. The city already has some major attractions (such as green areas, schools, PT-stops, bike-stations, sports facilities, cultural & tourist attractions, and markets) to make a great public place. Instead of segments of great promenades (with their own public space resting banks, fountains, playgrounds, sports facilities), it is crucial to connect them with each other. Important in designing the routes are uniform and tailormade signalization and safe pedestrian crossings (with traffic lights).




The creation of signalized **principle recreational routes** can increase the attractiveness of walking and cycling in the city. Four feasible routes can be distinguished:

- Route 1 (see image): Linking green areas (cyclist/pedestrian): 25 km
- Route 2: Historical city walk (pedestrian): 10 km
- Route 3: Linking shopping centres (cyclist): 35 km
- Route 4: Linking university buildings/areas (cyclist): 30 km

To create support and commitment, **involving citizens in the early stage of the process** is crucial. For example, campaigns, information events, participation evenings, etc. are good instruments to achieve this goal. The opening of the velodrome in Central Park in 2021 could be an enabler to stimulate cycling initiatives.

Marketing actions (such as creation of an app, website, social network) can increase the visibility of the undertaken actions.

Evaluation and maintenance are also two important aspects that need specific attention after the construction of the network ensuring the ongoing development. For example, priority can be given to bicycle and pedestrian infrastructure when removing snow during winter or leaves during autumn.

Further on, the development of cycling routes will have to consider the wider plan of integrated transport system which is envisaged for the Almaty Agglomeration. The connectivity between the cycling routes foreseen for the city of Almaty and the ones designed at regional level is one of the goals and strategic objectives mentioned in the local and regional policy documents.

## Legal and policy framework

**Program of Measures to Improve Mobility in the city of Almaty 2030.** This program displays streets that will be converted to one-way traffic and areas of calm traffic, where new cycle lanes (with bicycle rental stations) and pedestrian streets will be laid.

**Strategy on cycling and pedestrian infrastructure of Almaty.** The purpose of the strategy is to increase the share of movement on alternative means of transport and to create conditions to make their use more appealing by increasing the competitiveness, accessibility and safety.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Enhance the existing Cycling and Pedestrian Strategy by including the missing links and intersections with traffic lights. | 3 months (2023) |
| 2. Tender process for the selection of entrepreneur and consultant for construction works and traffic light optimisation | 8 months (2023) |
| 3. Supervision of the construction works | 48 months (2024–2027) |
| 4. Organise campaigns to promote the use of the network by showing the results and advantages (communication & sensibilization: modal shift, reduce impact during working phase, create awareness). | Ongoing during and post-construction works |
| 5. Monitor, maintain and evaluate the existing network and keep looking for shortcomings and innovation. | |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Construction of bike lanes (10 km/year) | 15,000 | 7,320,000 |
| Construction of pedestrian routes (5 km/year) | 5,000 | 2,440,000 |
| Installation of smart traffic lights (5 intersections/year) | 750 | 366,000 |
| Tunnel/bridge for pedestrian/cyclist (1 x year) | 1,000 | 488,000 |

**Estimated yearly OPEX (thousands)**: 200 EUR / 97,600 KZT

### Smart and digital solutions

Analysing already existing cycling and sport applications can be useful to understand cycling and walking behaviour and routes of people. Furthermore, data-based services can be provided to support decision-making related to this action.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 3. Citywide Digital Twin | Data integration |

| | |
|---|---|
| Action 11. Connecting different transport modes: multimodal hubs | Infrastructure elements included in the feasibility study will also refer to multi-modal hubs. |

# Action 14
# Developing a high-performance public transport network

SO1
SO2
SO3
SO4

| Estimated CAPEX (thousands) | | Estimated annual savings |
|---|---|---|
| 277,800 | EUR | At least 5% reduction of air pollution and GHG emissions from public transport due to renewal of fleet<br>Reduction of 26,900 tonnes of CO2/year |
| 135,566,400 | KZT | |

**Timeframe**

2023–2027

**Potential source of financing**

Municipal budget, State budget, IFIs, PPP

**Scale and location**

Priority lanes on 2x2 roads
Expansion of LRT lines to the East will increase the city's coverage area.
Transport service quality: focus on the main arteries (North-South and East-West)

**Targets**

- 50% of bus fleet containing Euro 4 or higher
- Increased number of public transport users
- Increased average travel speed for buses on the major thoroughfares by 10% (installing priority bus lanes on 2x2 roads)
- Developing of charging infrastructure in bus depots

TR

**Benefits**

- Increased number of PT passengers, lowering the private car ownership (decreased air pollution)
- Coverage of the transport needs in the suburbs; decreased congestion of bus traffic, leading to an increase of punctuality and reliability
- Stimulate career path for drivers of (e-) vehicles, facilitate policy dialogue to improve women's access to employment as public transport drivers; develop a new, replicable and internally accredited training programme for trolleybus drivers.

**Key stakeholders**

Akimat Departments: City Mobility, Municipal Enterprise (Almaty ElectroTrans, Almaty Metropolitan), private operators

## Context and description

### Priority lanes

Due to (car) congestion problems in the city, public transport is facing serious issues concerning their service. The daily average speed is very low because it is limited on major thoroughfares. Because of this, the bus service is not able to provide an efficient way of travelling using PT. Due to limited space available for improving the network, priority must be given to buses on highly congested lanes. Priority lanes, a commonly applied method, allows to tackle the problems of low speed at bottleneck. Designating priority lanes on 2x2 roads is crucial. In this way busses can complete their trip without the disturbances of other traffic and a smooth flow is guaranteed on most of the streets.

### Renewal of the bus fleet

A large part of the bus fleet is outdated and has a negative impact on the air quality in the city. Although there is a low percentage of diesel cars (4%), according to the City Mobility Department, 75% of public transport fleet runs on diesel, of which the majority has a low EURO fuel standard (EURO 4 and lower). To obtain a sustainable bus fleet, a major reduction of diesel consuming busses is needed. A renewal of the fleet by more sustainable sources is highly recommended, which can lead to a reduction of emissions. A transformation to charging infrastructure (e.g., battery swapping, (fast)charging station, etc.) in the bus depots is required. Particular attention will be paid to the range of the battery and acted accordingly. In addition to new infrastructure, education and (re)training of skilled (electric) bus drivers will be crucial.

As of today, a dedicated project for trolleybus renewal is under implementation by Akimat. This project focuses on acquisition of up to 200 modern trolleybuses, procurement of trolleybus maintenance equipment, the rehabilitation of up to 10 power sub-stations, rehabilitation of the depot facilities and modernisation of the trolleybus overhead lines in Almaty.

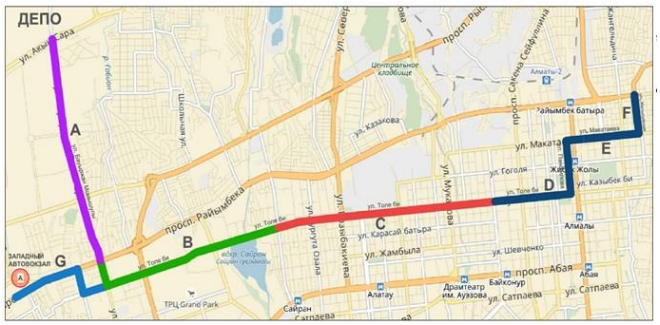
### Transport service quality

The transport service quality is not sufficient. Especially in the suburbs the service underperforms due to low frequency and long waiting lines. Additionally, several different bus lines need to be taken to arrive in the centre. Alignment and increased frequency (by purchasing or redistributing busses) can lead to a better coverage ratio of the suburbs. The public transport system of the city of Almaty is to be developed considering also the wider territory covered by the Almaty Agglomeration where a unified public transport system is foreseen. Thus, this action serves as the first step in implementing the actions foreseen for the entire Almaty Agglomeration.

An interconnected network between BRT, LRT and metro must be accomplished, keeping the focus on the main arteries (North–South and East–West). Optimizing the public transport route (feeder) network includes new terminals, time scheduled interchanges, simplification of bus routes, reduced overlapping of routes, splitting long routes to several shorter ones, extension of metro-line and ensuring priority for public transport (e. g. priority lanes).

## Almaty LRT

The project Almaty LRT is a light rail transit system characterized by a combination of tram and metro features. A total length of 22.72 km, 36 stations and a depot in Alatau district (see www.almaty-lrt.kz) are included in the plan. Almaty's principal avenues (Momyshuly, Töle Bi Street, Panfilov, Makatayev and Zhetysuskaya) will be linked through the line. The implementation of the LRT will be executed in a public private partnership.




LRT ALMATY

## Legal and policy framework

Legal amendments are suggested in terms of:

- gender legislation for public transport drivers (long-term measure) risks drivers' shortage;
- legislation regarding subsidies for infrastructure exploitation;
- special taxes on new vehicles.

**Almaty Sustainable Transport Strategy 2023:** access to a transport system that provides high-quality, integrated, safe and sustainable services to the entire population.

**State Program for Development and Integration of Transport Infrastructure (national level, Kazakhstan):** convert local public transport to cleaner fuels, optimize public transport routes in cities, allocate lanes for public transport in major traffic corridors, promote the widespread adoption of energy-saving technologies in public transport sector and the use of sustainable modes of transport for everyday travel and leisure.

**Municipal Energy Efficiency Plan for the City of Almaty 2030.** The plan highlights the following provisions: conversion of bus fleet to CNG; replacement of obsolete trolleybuses; conversion of public and private taxis to LPG; traffic flow optimization, dispatching system, bus lanes (10 routes); construction of light rails system (12 km, 8 trains); metro network extension (3 lines, 20 kms); etc.

**Interregional Action Plan for the Almaty Agglomeration development until 2030**. The plan emphasises the need for establishment of a unified public transport system for the entire territory of the Almaty Agglomeration.

## Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Procurement plans for acquiring low-emission public transport vehicles (including procurement guideline for e-buses) and other services, including the tender process | 12 months (2023) |
| 2. Implementation of Almaty Electric Public Transport project, which includes:<br>- acquisition of up to 200 modern trolleybuses and in this 1st phase 40 trolleybuses, | 18 months (2023–2024) |

| | |
|---|---|
| - procurement of trolleybus maintenance equipment,<br>- the rehabilitation of up to 10 power sub-stations,<br>- rehabilitation of the depot facilities<br>- modernisation of the trolleybus overhead lines in Almaty<br>- development of PT strategic and operational documents, which will include but not limit to the Strategic Public Transport Master Plan for the next 10 years and Public Service Contracts (review the current PSC, recommend KPI approach to PSC, and propose amendments in line with international best practices). | |
| 3. Implementing the other foreseen investments:<br>- 20 buses /year<br>- bus stop<br>- LRT | 48 months (2024–2027) |
| 4. Invest in capacity building throughout the entire lifecycle of the bus (personnel for procurement, planning, exploitation and bus drivers, maintenance staff, technical workshop). | Ongoing, starting with 2024 |
| 5. Monitor the state of the trolleybuses and set up a renovation plan. | |

## Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Replacing rolling stock of fleet: gas and electric busses – 300,000 EUR/bus (40 buses) (1st phase) | 12,000 | 5,856,000 |
| Almaty Electric Public Transport project | 81,800 | 39,918,400 |
| Bus stop infrastructure – 100,000 EUR/bus stop (40 bus stops) (1st phase) | 4,000 | 1,952,000 |
| Construction of new LRT line - (LRT 1) | 90,000 | 43,920,000 |
| Construction of new LRT line - (LRT 2) | 90,000 | 43,920,000 |

**Estimated yearly OPEX (thousands)**: 5,556 EUR / 2,711,328 KZT

## Smart and digital solutions

The provision of dynamic digital passenger information (such as real-time time schedule, occupancy rate, travel time) via panels and applications can facilitate the use of public transport. Furthermore, this data can be used also to monitor the public transport systems.

A mobile payment system is highly recommended.

Link with city digital twin on smart management of public transport, link with passenger information system, link with (e-)micro-mobility and smart charging system for public transport

## Correlation with other actions

| Action | Explanation |
|---|---|

| | |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 3. Citywide Digital Twin | Data integration<br>Digital land use<br>Smart traffic management |
| Action 10. Transit Oriented Development (TOD) – Applying TOD in satellite city development | Correlation with strategic objectives of TOD.<br>Link LRT with TOD for land value capture. |
| Action 11. Connecting different transport modes: multimodal hubs | Infrastructure elements included in the feasibility study will also refer to multi-modal hubs. |
| Action 13. Creating enjoyable cycling and walking routes | Design infrastructure elements suitable for cycling and walking |

# Action 15
# Establishment of Low Emission Zones

SO1 SO2 SO3 SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 10,600 EUR<br>5,172,800 KZT | GHG and fuel savings depending on the covered LEZ-area and restrictions |

| Timeframe | Scale and location |
|---|---|
| 2025–2027 | Selected central area of the city that is prone to high traffic and air pollution. Map provided below |

Potential source of financing

Municipal budget, State budget, IFIs

Targets

TR

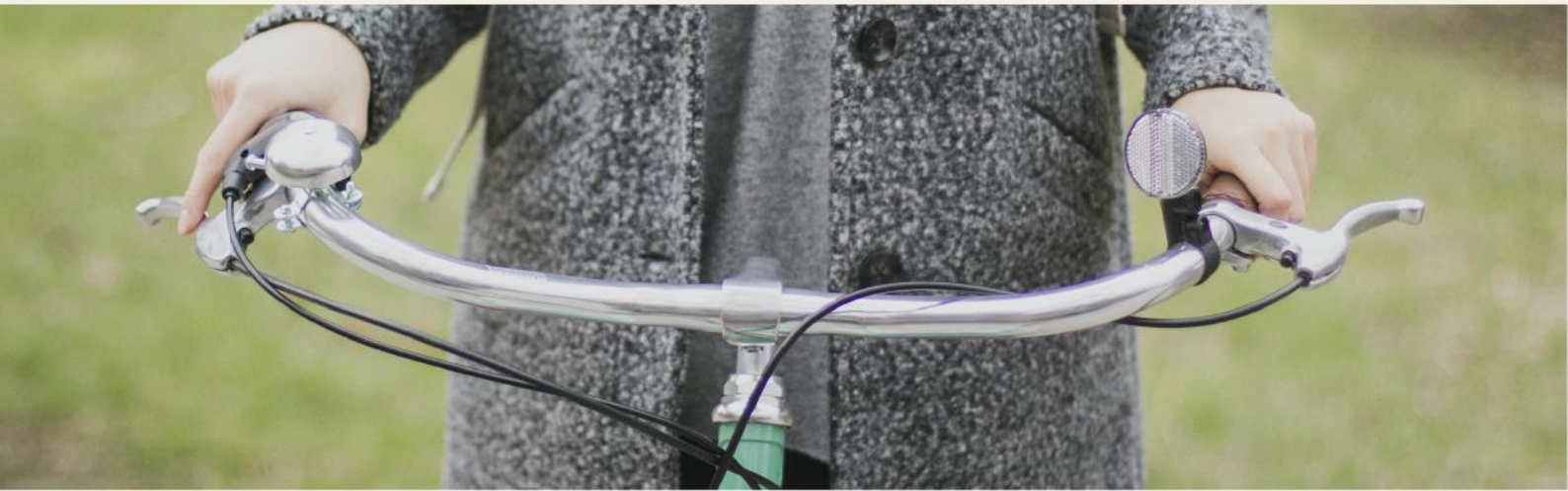
- Reduce the number of cars in the city centre by 30%
- City centre only accessible by Euro 5 standard or higher (diesel) and Euro 3 or higher (gasoline, LPG) (phase out of combustion engines)
- Restriction of heavy good lorries (>3.5 ton)
- Prohibition of motorcycle traffic at night (11 pm – 06 am), except for e-vehicles

Benefits

- Improved air quality in the city centre
- Improved fuel efficiency and renewable energy solutions in mobility
- Direct health effect derived from improved air quality

Key stakeholders

Akimat Departments: City Mobility, City Planning and Urbanism, Ecology and Environment; Municipal Enterprise, Private operators: Almaty Public Council – Commission on Comfortable Urban Environment



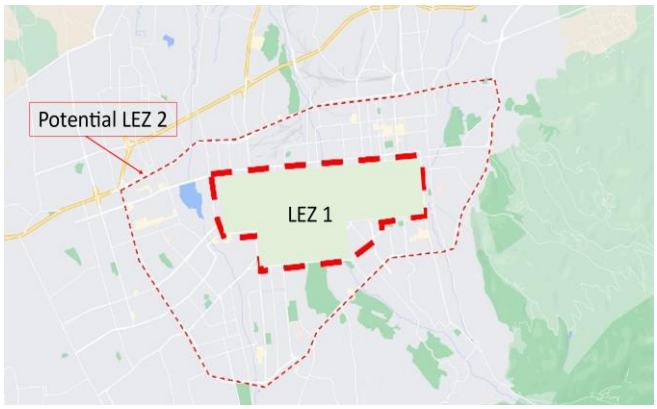
## Context and description

The $CO_2$ emissions in Almaty are expected to increase from an estimated 2.65 million tonnes in 2012 to 4.99 million tonnes by 2023. Almaty has a lot of large roads populated with many cars, many of which are obsolete. The major share of the vehicle fleet consists of very polluting combustions engines (Euro 4 and lower). This results in a city centre with poor air quality and noise pollution, decreasing the liveability for all citizens.

In shifting to more sustainable transport, governments can use push and pull factors to motivate citizens to travel by public transport, cycling and walking. This action will be based on push factors, aimed at increasing the cost of owning and maintaining a car and promoting the use of low-carbon cars.

Many urban centres around the world practice city-entry restrictions for cars. The two most widespread systems are **congestion charging zones** (e. g. London) or **low-emission zones** (e. g. Paris). Both systems aim at increasing the cost of car ownership. The system of Low Emission Zone (LEZ) has the advantage of regulating the most polluting vehicles and different types of vehicles. In this way cities can control and restrict the cars entering the city based on the emissions. By doing so, it is possible to ban different types of vehicles according to the applied criteria: combustion engine (e. g. EURO 4 standards and lower), construction year, tonnage (e. g. >3.5 ton), time of the day (e. g. motorcycles at night) etc. The LEZ system provides a wide range of applications, which can be used to target highly polluted and densely populated areas. Clear and recognisable boundaries (e. g. ring road) are highly recommended.

In the figure below, both red lines represent possible LEZs. It serves as an example of how a zone can be defined.


An important condition of moving towards ecologically cleaner fuels are **supporting measures**. There is a need for stimulating the ownership of electric vehicles, new and extensive charging infrastructure and alternative transport modes.

Involving and informing citizens in the process can increase the support. After LEZ implementation, monitoring, enforcement and follow-up are required in achieving effectiveness.

## Legal and policy framework

**National legislation of special taxes on new vehicles:** A review of the national legislation of special taxes (amounting to one third of initial cost) for the purchase of all new vehicles needs to be considered. The legislation can hold back the transition to more sustainable vehicles (e. g. e-cars, high EURO standard).

**State Program for Development and Integration of Transport Infrastructure (national level, Kazakhstan):** promote the use of sustainable modes of transport for everyday travel and leisure.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Feasibility study including the inventory of the area and checking the applicability of LEZ | 10 months (2025) |
| 2. Develop a LEZ plan for the city centre, selecting priority area based on well-defined criteria. | 6 months (2025) |
| 3. Tender process for the selection of the provider of detecting/tracking equipment | 6 months (2026) |
| 4. Implement the LEZ by installing detecting system, enforcement, administration fines and signalization | 12 months (2026–2027) |
| 5. Carry out communication campaign about LEZ zones | Ongoing, starting with step 4 |
| 6. Evaluate and monitor the LEZ system and enhance restrictions over the years | |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Feasibility study | 500 | 244,000 |
| Installing LEZ (detecting system, cameras, signalisation) | 10,000 | 4,880,000 |
| Development of communication/information materials (flyers, leaflets, etc.) | 100 | 48,800 |

**Estimated yearly OPEX (thousands)**: Revenues are based on the infringements of the LEZ through collection of penalties and fines.

### Smart and digital solutions

The LEZ system itself is a smart and digital solution, providing monitoring tools and data. The LEZ system allows authorities to ban the most polluted vehicles.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 3. Citywide Digital Twin | Data integration; Real-time traffic information & management; Real-time public transit & multimodal passenger information; Smart parking & smart charging |
| Action 13. Creating enjoyable cycling and walking routes | Cycling and walking routes are designed taking into consideration the LEZ area. |
| Action 17. Implementing priority blue green infrastructure projects at the district level | Blue Green areas correlated with LEZ |

# Action 16
# Development of a city-wide Blue and Green Strategy and Implementation Plan

SO1
SO2
SO3
SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 180 EUR | N/A |
| 87,840 KZT | |

| Timeframe | Scale and location |
|---|---|
| 2024–2025 | Citywide |

Potential source of financing

IFIs, Municipal budget

Targets

- Double the available public green space per person (up to 10m$^2$/person) by 2030
- Protect existing nature and rivers from recreational pressures and constructions
- Increase the surface water quality of the rivers in the city allowing swimming
- Reduce noise levels by 40% along the roads and dust levels by 75% per kilometre of green space

Benefits

- Improved well-being and public health, increased tourism, carbon sequestration, improved air quality, reduction of noise from traffic, less risks on flood, landslides and other natural disasters, climate resilient city
- Engaged stakeholder groups, including community-based organizations, marginalized citizens such as women groups, persons with disabilities, older persons, children and youth in public space planning and in green management
- Social equity and gender mainstreaming will be properly addressed in the Strategy and Action Plan

LU

Key stakeholders

Akimat Departments: Ecology and Environment, City Planning and Urbanism, Construction Land Relations; Municipal Enterprise; Almaty GenPlan

### Context and description

Developing and implementing a city-wide blue and green strategy for Almaty allows for addressing several of the challenges the city is facing such as the need for increasing the green space per capita, linking green infrastructure and the blue (water) network, addressing air quality and planning in the context of climate change by storing water and cooling the city in summer and developing a preventive approach for landslide risk mitigation. Further, integrating nature in the urban landscape enhances health and well-being of urban residents, improves social cohesion and supports a green economy, creating job opportunities and enhancing biodiversity.

In this regard, the Akimat prepared a draft Green Space Development Strategy 2030. Currently, there are 894 hectares of green space in the urban parts of the city, or 7.7 $m^2$ per person. The main goal with the Strategy is to reach 10 $m^2$ per person by 2030, considering polycentricity and addressing the missing link between green infrastructure and blue (water) network. Within the larger city area further green areas are located that are not included in these figures such as the Ile-Alatau national natural park, this considering that such nature area is rather surrounding the city than directly in the urban parts on which access to green is calculated based on international guidance. Over the past three years, more than 130,000 trees and shrubs have been planted in Almaty. The Almaty Ecology and Environment Department has published an interactive map of the green spaces of the city of Almaty in 2021. The new map (https://eco-almaty.kz/map/) is planned to contain information about the tree species, age, height and their condition.

The above-mentioned draft strategy includes references to continuation of planting trees in each year. Green spaces will grow to 5,000 $m^2$. Here, it is relevant to also develop a management plan to deal with, among others, irrigation of trees, and growth and maintenance of seedlings. As an information, New York City's more than 600,000 trees provide an annual benefit of 107 m EUR (52 billion KZT) for the city and its businesses – more than five times the cost of planting and maintaining them. Further, Almaty is working towards creating a green network to ensure the preservation of the city's ecosystems and to maintain its biodiversity. This will include a recreational park and green river corridor that crosses the city from the foothills to the lowlands and supports the city's natural ventilation.

Specially protected areas cover 31.3% of Almaty, 21 417, 6131 hectares (20 land pieces, which is of 4 land users): Ile-Alatau national natural park, the Main botanical garden, the State regional natural park Medeu and the Almaty museum. This makes it necessary to consider the issue of the land acquisition along the established boundaries of water protection belts with an aggregated calculation of the amounts associated with compensation to existing land users, as well as the forced acquisition of land due to their location in specially protected areas. In a final stage the city will be penetrated by a blue green network connecting across the city and delivering valuable services such as cooling, water buffering, etc. It is crucial to protect and improve existing nature and rivers. In a subsequent phase, the blue green network can be improved and grown while first addressing priority areas. Priority areas should be selected wherever such issues occur as landslides, mudflows, or floods, where urban heat island is formed, where green space is lacking at a local scale, or where other challenges are present to which blue green measures provide solution. It is important here to cover a range of timeframes and climate projections to inform future spatial planning and disaster risk reduction actions.

Specifically for mudflows, Almaty is protected by three dams installed on the Malaya Almatinka, Bolshaya Almatinka and Kargalinka Rivers. Considering that due to climate change, the risk on mudflows is increasing, an additional layer of protection may be needed. Converting the city to blue and green may also provide nature-based solution into mitigating the risks on damage from mudflows.

To assess the network, distribution, accessibility, quantity, and quality of a city's public spaces in a cost-effective way, UN-Habitat developed the city-wide public space inventory and assessment tool[19]. The tool

[19] https://unhabitat.org/city-wide-public-space-assessment-toolkit-a-guide-to-community-led-digital-inventory-and-assessment

takes a participatory approach, engaging communities and key stakeholders. Depending on the needs and local issues, the tool can be further enriched by covering aspects on migration, public health and environmental aspects such as climate change, urban heat island, mudflows, flooding, landslides etc., such that it is tailored for the needs of Almaty.

Last but not least, the development of the blue and green strategy and the implementation plan at city level has to be done considering also the provisions envisaged for the entire Almaty Agglomeration territory and the initiatives developed within this area.

### Legal and policy framework

Environmental Code 2021; Almaty Development Strategy 2050; the draft Green Space Development Strategy 2030, Interregional Action Plan for the Almaty Agglomeration development until 2030.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Perform a study and initiate a working group for developing a citywide blue and green infrastructure approach including defining priority areas, targets and a roadmap. This plan should considered aspects of land use and acquisition. | 12 months (2024) |
| 2. Develop a tree and green space management plan. | 4 months (2024) |
| 3. Integrate the citywide strategy in urban planning and in the building code. | Ongoing activity, starting with 2025 |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Strategy and roadmap for citywide blue green network | 150 | 73,200 |
| Development of a management plan for the blue green network | 30 | 14,640 |

**Estimated yearly OPEX**: N/A

### Smart and digital solutions

Digital platforms, tools and innovative approaches for mapping, co-creation and participatory urban design may be beneficial. Action 3 on the City Digital Twin can potentially support this action with different scenario modelling functions.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 2. Almaty Green Innovation Incubator | The development of the strategy will be done in cooperation with the GII. |
| Action 3. Citywide Digital Twin | Data integration |

| | |
|---|---|
| | Digital land-use and building permitting |
| Action 17. Implementing priority blue green infrastructure projects at the district level | All these projects will be incorporated in the strategy and specific measures will be defined. |
| Action 18. Increasing the water permeability of the city of Almaty | |
| Action 19. Preventing and curing landslide-prone situations | |
| Action 20. Awareness raising and education centre for landslide prevention | |
| Action 27. Development of a water saving plan | Correlation with the specific objectives and measures envisaged in the water saving plan |

# Action 17
# Implementing priority blue green infrastructure projects at the district level

SO1
SO2
SO3
SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 2,280 EUR<br>1,112,640 KZT | 0.28 kg C/$m^2$ carbon sequestration potential in areas covered by trees<br>1.4 tonnes of C/year captured by 5,000 $m^2$ surface covered with green infrastructure<br>0.005 tonnes of $CO_2$/year |

| Timeframe | Scale and location |
|---|---|
| 2025–2027 | The embankments of the Kishi River, Yesentai River and Ulken River; and the new districts under development |

Potential source of financing

IFIs, Municipal budget

Targets

- Have 2 pilot projects implemented at district level by 2026. In order to include the rivers and their embankments in the recreational park areas, the Akimat of the city of Almaty is developing around 40 km of walking routes along the Kishi, Yesentai, and Ulken rivers

LU

Benefits

- Reduction of smog and improvement of the air quality
- Improved health and social cohesion by increased recreational (green) areas, reduction in occurrences of heavy floods
- New developments and urban improvements are realized in both poorer neighbourhoods and richer parts of the city. Eco-gentrification must be avoided.

Key stakeholders

Akimat Departments: City Planning and Urbanism, Ecology and Environment, Construction, Land Relations; Municipal Enterprise, Almaty GenPlan; Private operators

### Context and description

Integrating green (soft areas, plants and trees) and blue (watercourses, ponds, lakes and storm drainage) elements allows for making urban environments more resilient, pleasant and healthy places to live, work and play. Green infrastructure is the interconnected network of multifunctional green spaces which provides multiple benefits and can accommodate sustainable development. These elements include parks, open space, trees, playing fields, woods, private gardens, allotments and green roofs and walls.

Developing blue and green integration at the district level provides important opportunity to address natural hazard (e. g. landslides, mudflows, floods) and climate change risks and to include and enhance citizen participation in the design and planning stage. With a participatory approach the various aspects on defining which areas are of critical value, what can be done about local pressures and how can risks be reduced can be brought together with expert opinions on risks and solutions.

Also, to ensure every resident has access to green and blue leisure places, city distance rules regarding access to green areas can be implemented, especially with the development of new districts. For example, this could be a regulation ensuring that every citizen has a small park (1 acre) within 400 m distance, a larger park (0.5 ha) within 800 m and a large green area (> 1 ha) within 1.5 km from their home. This links to the concept of the "15-minute city," where all basic needs, including green spaces, should be met within a 15-minutes walking or cycling distance from home.

### Legal and policy framework

The Environmental Code (2021), Almaty Development Strategy 2050, Almaty Master Plan.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Outsource study work per district to evaluate how to blue-green improve the area – start with 2 pilots. Develop an investment plan including study on possible financial sources. | 10 months (2025) |
| 2. Involve the public and interested parties following a participatory process and public consults when developing the district plans. | Ongoing activity (2025–2027) |
| 3. Implementation of the two pilots | 24 months (2026–2027) |
| 4. Map the lessons learned for further district developments. | 3 months (2027) |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Feasibility study, including the investment plans, for blue green infrastructure in 2 districts – (140,000 EUR/neighbourhood) | 280 | 136,640 |
| Implementation of blue green infrastructure at the district scale – 2 pilot projects (1,000,000 EUR/district) | 2,000 | 976,000 |

**Estimated yearly OPEX (thousands)**: 20 EUR / 9,760 KZT

### Smart and digital solutions

Digital structured questionnaires allow the community to take part in the mapping and analysis of their public spaces as well as to propose ideas on how to improve them. Also, different apps used at city level can include and provide real time information on walking routes at district level, their status, works undergoing in certain areas, events etc.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 2. Almaty Green Innovation Incubator | The implementation of the pilot projects will be done in cooperation with the GII. |
| Action 16. Development of a city-wide Blue and Green Strategy and Implementation plan | The pilot projects will follow the strategic objectives and specific measures envisaged in the city-wide Blue and Green Strategy. |

# Action 18
# Increasing the water permeability of the city of Almaty

SO1
SO2
SO3
SO4

**Estimated CAPEX (thousands)**

825 EUR
402,600 KZT

**Estimated annual savings**

For every 5% of tree canopy cover, stormwater runoff is reduced by 2% resulting in less sewerage needs.

**Timeframe**

2024–2027

**Scale and location**

Pilot area selected following a participatory approach

**Potential source of financing**

IFIs, Municipal budget, Private sector, Crowdfunding

**Targets**

- All (apartment) buildings newly authorized for construction to be fitted with rainwater harvesting (capacity > 5000 litres)
- Increase in open areas with permeable landscaping (> 30% of land area on a local level including public land)
- Reduction of number/impact of local flooding events; long term goal: maximum 10 cm of water on the road in case of 100-year rain-event.

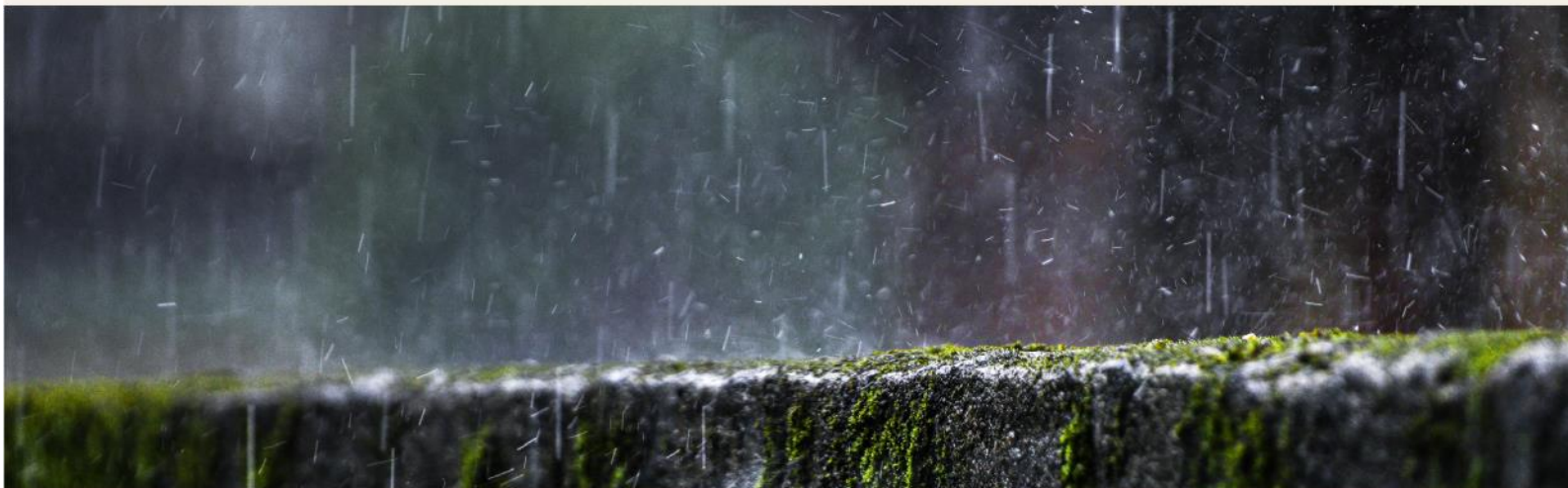
**Benefits**

- Increased climate resilience
- Rainwater use by citizens reduces water costs and needs
- Reduced needs and costs for grey infrastructure investments
- New developments and urban improvements are realized equally, in both the poorer districts and the richer parts of the city. Eco-gentrification is to be avoided.

LU

**Key stakeholders**

Akimat Departments: Ecology and Environment, City Planning and Urbanism, Construction;Municipal Enterprise, Almaty GenPlan, city private developers



## Context and description

Almaty is facing climate change impacts such as mudflows and flooding during heavy rainfall, or droughts and heat waves in summer. The city can become more climate resilient by implementing blue and green solutions. Further on, the measures foreseen in this action are in line with the regional planning, especially with the provisions foreseen for the Almaty Agglomeration.

In the current situation, impermeable surfaces increase the stormwater runoff rates. Large amounts of water coming together at once in the city and its sewers can cause problems especially when the water drags all kinds of debris with it and causes blockages. This action foresees to increase the permeability of the city of Almaty and contribute to overall climate resilience of the Almaty Agglomeration. Converting hard surfaces into multifunctional blue-green areas (ideally fitted with native, drought resistant trees and plant species, as the city is pursuing through its plan of planting one million tree) allows for better water drainage, water retention, cooling of hot spots and improvements of public green spaces. Abandoned built-up areas and fallow land are ideal locations for redevelopment and bringing (more) green and blue into the city. In highly urbanized streets, where the conversion of built surfaces to soft surfaces is not possible, large plants can capture rainwater.

By implementing water retention measures, the infiltration of rainwater can be improved, and local floods can be avoided. Indeed, such measures can help slow down and store rainwater instead of draining the water as quickly as possible with a sewer system. Keeping rainwater within the city and allowing water to infiltrate the soil and replenish bodies of water offers numerous benefits. Collecting and storing rainwater means a resource that can be used in times of drought. The green and blue areas provide a cooling effect during heat waves and in addition provide recreational space for residents.

Considered water retention measures include increasing the number of permeable surfaces (e. g. pavement that allows for infiltration), increasing the green and blue space over hard surfaces, and water buffering and infiltration (e. g. infiltration trenches in the streets, rainwater storage tanks for new buildings) at the district level. Such measures can be implemented along roads with low traffic, sidewalks, as well as along paved cycling and walking paths.

As an example, a general rule of thumb is that residential rain gardens average about 0.24 to 0.32 EUR (117 to 156 KZT) per $m^2$, depending on soil conditions and the density and type of plants used. Commercial, industrial and institutional site costs can range between 0.79 to 3.17 EUR (385 to 1,546 KZT) per $m^2$, based on the need for control structures, curbing, storm drains and underdrains. In any bioretention cell design, the cost of plants varies substantially and can account for a significant portion of the facility's expenditures. While these cost estimates are slightly greater than those of typical landscaping treatment (due to the increased number of plantings, additional soil excavation, backfill material, use of underdrains etc.), those landscaping expenses that would be required regardless of the bioretention installation should be subtracted when determining the net cost. Perhaps of most importance, however, are the cost savings compared to the use of traditional structural stormwater conveyance systems, which make bioretention cells quite attractive financially. For example, the use of bioretention can decrease the cost required for constructing storm water conveyance systems at a site. A medical office building in Maryland was able to reduce the amount of storm drainpipe that was needed from 243 to 70 meters – a cost savings of 21,100 EUR (10,248,000 KZT). A new residential development spent a total of approximately 88,000 EUR (43 million KZT) using bioretention cells on each lot instead of approximately 352,000 EUR (172 million KZT) for the traditional stormwater ponds that were originally planned.

When incorporated into the rules for urban planning and the building code, these measures can ensure climate-robust neighbourhoods when developing new streets or renovation projects. Rainwater harvesting has a double function, on the one hand decreasing the pressure on the drainage system during storms, and on the other hand providing the collected rainwater for future use such as for green space maintenance.

### Legal and policy framework

Environmental Code (2021), Water Code (2003), Almaty Development Strategy 2050, Almaty Master Plan. Interregional Action Plan for the Almaty Agglomeration development until 2030.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Identify locations that need (more) green and blue in improving the city's permeability | 8 months (2024) |
| 2. Set up a pilot to demonstrate the selected solutions in high priority areas. | 36 months |
| 3. Awareness raising campaigns | Ongoing during and post pilot project implementation |
| 4. Monitoring and evaluation | |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Develop a study on most appropriate solutions for increasing the water permeability of the city | 125 | 61,000 |
| Implement one pilot project | 700 | 341,600 |

**Estimated yearly OPEX (thousands)**: 10 EUR / 4,880 KZT

### Smart and digital solutions

Further develop GIS and digital solutions as these are important when monitoring the impacts of heavy rainfall events including defining locations of flooding before and after implementing the permeable infrastructure at city level. Also, smart water sensors may allow for monitoring river and surface water quality. Further ahead this may be plugged in the CDT, and different hydro-modelling tools could be developed.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 3. Citywide Digital Twin | Digital flood monitoring and pollution control |
| Action 5. Residential buildings retrofit programme | Water harvesting measures could be included in the residential building retrofit programme. |
| Action 27. Development of a water saving plan | Correlation with the strategic objectives and measures envisaged in the water saving plan. |

| | |
|---|---|
| Action 30. Green Industrial Innovation Park | Consider including the GIIP as a potential place for implementation of a pilot project. |

# Action 19
# Preventing and curing landslide-prone situations

SO1 SO2 SO3 SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 5,970 EUR<br>2,913,360 KZT | Reduced costs of landslide management |

| Timeframe | Scale and location |
|---|---|
| 2023–2027 | 14 prioritized high landslide risk areas |

Potential source of financing

IFIs, Municipal budget

Targets

- Avoiding further landslide-prone areas to emerge
- Curing the unsafe situations for all 14 prioritized high-risk areas within 5 years, and all high-risk areas within 10 years

LU

Benefits

- Improved rainwater drainage; prevention of soil erosion, landslides and associated damage; increased natural value of landscapes as part of the overall blue-green infrastructure in the city (see Action 16)
- Prioritization of action will not be unfavourable to poor neighbourhoods and staffing requirements will take full consideration of gender equality and equal rights for job opportunities.

Key stakeholders

Almaty Department of Emergency Situations; Centre for emergency situations and disaster risk reduction.

## Context and description

Landslides are commonly triggered due to one of four reasons: (1) seismic activity, (2) heavy rainfall/groundwater flow, (3) human activities and (4) deforestation. Almaty experiences increased rainfall and is in the seismically dangerous place in Eurasia. In addition, it has seen the increase of the number of landslides and mudflows, which indicates the higher vulnerability of the city and its suburbs and the entire Almaty Agglomeration territory.

Strong government action, implementation or regulation, delineating landslide-prone areas and having buffer zones and public outreach are key preventive elements. For example, removal of trees can be prohibited in high-risk areas and the enforcement of building codes and slope stability techniques can be effective both preventive and curative. In this context, developing an integrated urban forestry and green plan with a specific focus to reduce landslide risk can be a strong and cheap alternative to build resilience in a landslide-prone city and can be integrated in the blue and green strategy for the city. Another options for prevention is changes to the hydraulic structure of the rivers upstream and in the city. When preventive measures are insufficient case-by-case evaluation is needed to determine the extent to which vegetation or nature-based solution are adequate and can guarantee safety or whether grey engineering is needed.

One of the most challenging issues in addressing landslide mitigation is the selection of the technically most suitable and cost-effective mitigation measure. A first selection of the possible mitigation measures should be done considering the landslide characteristics (i. e. type of movement, material involved, rate of movement, groundwater conditions etc.). Secondly, possible socio-economical or environmental constrains should be considered. Available web tools, such as LaRiMiT (www.larimit.com), may be useful to this end.

In addressing landslide and mudflow risks for Almaty it is needed to GIS map high risk zones and disclose this to stakeholders and the public. The urgency for action has to be evaluated and whether preventive or curative measures are needed. Also, it has to be ensured that among the identified areas, zones which could entail risk in the future are unveiled. For the latter, preventive measures such as restrictions on project development or removing of vegetation may prevent future problems. This work should define the actions to be taken to reduce the risk of landslides, including the investment costs, responsible parties and a timeline. Also, this may lead to a decision-making instrument for slope planners and developers to determine whether to proceed with the construction of a new slope or how much mitigation work should be put into an existing failing slope (now or in a nearby future). On a case-by-case study has to be conducted on how to provide safety by nature-based solution, hybrid or grey infrastructure and whether other actions or restrictions are required for safety and for preventing the increase of the problem. Further, it is needed to have a monitoring and warning system for dangerous landslides and mudflow by making use of smart technologies. This may include online maps offering information about these areas.

This action has to be carefully coordinated with other actions that are already initiated at the level of Almaty Agglomeration. All the measures identified for Almaty city can serve as best practice examples for other vulnerable areas within the Agglomeration.

## Legal and policy framework

The Environmental Code (2021); Almaty Master Plan. Legislation/restrictions for avoiding landslide issues with new developments is needed.

## Implementation steps

| Step | Estimated timeline |
|---|---|

| | |
|---|---|
| 1. Evaluate the urgency for action and whether preventive or curative measures are needed. | 6 months (2023) |
| 2. On a case-by-case define and agree the needed actions. | 6 months (2023) |
| 3. Implement the needed actions per area. | 48 months (2024–2027) |
| 4. Smart monitoring and warning system | |
| 5. Monitor and evaluate the implementation process and lessons learnt. | Ongoing during implementation of actions. |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Prevention and urgency study | 150 | 73,200 |
| Case-by case study on needed actions (14 areas at about 30,000 EUR/ area) | 420 | 204,960 |
| Implementation of the needed action with 14 areas and 50.000 – 1 million EUR/area | 5,000 | 2,440,000 |
| Monitoring and warning system | 400 | 195,200 |

**Estimated yearly OPEX (thousands)**: 165 EUR / 80,520 KZT

### Smart and digital solutions

GIS and online maps provide general information to stakeholders and the public, while combining this with monitoring systems, such as internet-of-things sensor technologies. The landslide detection and alerting system can real-time detect landslides and issue instant alerts to the relevant actors[20] or allow for mass notification. Further, as a preventive measure, digitalisation and GIS (and 3D model being developed) can support the identification of urban areas prone to landslide.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 20. Awareness raising and education centre for landslide prevention | The results will be promoted via the awareness raising campaigns. |
| Action 27. Development of a water saving plan | Correlation with the strategic objectives and measures envisaged in the water saving plan |

[20] Zhi Liu - Smart Technologies for Emergency Response and Disaster Management (Advances in Public Policy and Administration) ISBN 13: 9781522525752

# Action 20
# Awareness raising and education centre for landslide prevention

SO1 SO2 SO3 SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 110 EUR<br>53,680 KZT | Reduction or prevention of fatalities, huge damages and associated costs following disasters through rapid and professional response |

| Timeframe | Scale and location |
|---|---|
| 2023–2027 | To be housed in an existing museum or facility, possibly at (or in the vicinity of) a landslide-prone location that is safe and illustrative, otherwise in a museum that has thematic fit such as the geology museum. |

Potential source of financing

IFIs, Municipal budget

Targets

- A defined approach on education and awareness for landslide prevention
- Reduction with 50% of feelings of discomfort or even panic among the wider public about landslides and associated risks (measurable in periodic surveys)
- Reduction with 70% of citizen complaints (e. g. for rejection of building permits in landslide sensitive areas)

Benefits

- Strengthen residents' psychological resilience to deal with landslides among other natural disasters
- Disaster education of unemployed youth, physically challenged, elderly, women and school children should be encouraged. The education centre should be adapted for different population groups, including children and disabled people.

LU

Key stakeholders

Almaty Department of Emergency Situations; Centre for emergency situations and disaster risk reduction, education centres, etc.

### Context and description

To have understanding by the public and mitigate feelings of discomfort to even panic, it is required to build a public awareness and education program on landslides and to mobilize various stakeholders in the public, private, civil society and community levels into taking proactive measures for mitigation and prevention. Local communities aware about landslide hazards and their location would be in a better position, both physically and psychologically, to face the consequences. Inspiration may be gathered from similar programs in other countries that suffer from landslide risks. Elements to include are the multifaceted aspects of landslide management, especially preparedness, mitigation and response efforts. In this regard, case histories of actual past disastrous landslides can be used as valuable inputs for disaster education in general, and landslides in particular. Special attention can be given to the solutions implemented in Almaty and Almaty Agglomeration.

Communication and information material can be brought into one education centre, for example as part of the museum of geology, where it can be shared as an exposition. In addition, it may house or be involved in trainings for specific target groups (such as schoolteachers, NGOs, private volunteers and professionals engaged in disaster management), special awareness events and study days, etc.

At the same time, it is advisable to use other communication channels such as newspapers, social media, billboards, etc. to reach the public at large. As the community is usually the first responder to a landslide disaster, their role in containing damage is significant. Therefore, awareness and the development of community leadership in relation to landslide management, preparedness, mitigation, and response efforts is of outmost importance.

Specifically, when informed and educated, the range of stakeholders in slope management can be extended beyond land-use planners and technical personnel. Members of the public and communities in hillside areas that experience the consequences of failing slopes, whether it be loss of property, depreciation in real estate value, or even loss of lives, can be included. Slope planning approaches that incorporate both the requirements of the technical engineer and hillside residents deliver results.

### Legal and policy framework

Almaty Development Strategy 2050; Almaty Master Plan.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Develop a landslide awareness and education program. | 10 months (2023) |
| 2. Develop an education centre, bringing together exhibits for the public. | 6 months (2024) |
| 3. Set up awareness campaigns and emergency systems for businesses and communities. | Ongoing activity after completion of steps 1 and 2. |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Development of a landslide awareness and education program | 50 | 24,400 |

| | | |
|---|---|---|
| Development of an education centre housed in an existing museum or facility. | 60 | 29,280 |

**Estimated yearly OPEX (thousands)**: 3.3 EUR / 1,610.4 KZT

### Smart and digital solutions

Smart sensors can give early warning signs for landslides, digital platforms can be used to spread awareness, educate the public and send warnings in case of risks.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 2. Almaty Green Innovation Incubator | GII can support the awareness raising campaign with distributing the materials; organizing events and inviting the representatives of the centre to present the land-slide prevention initiatives; active participation in identification of suitable solutions for landslide prone situation. |
| Action 3. Citywide Digital Twin | Data integration<br>Real time warning information |
| Action 19. Preventing and curing landslide-prone situations | The results will be promoted via the awareness raising campaigns. |

# Action 21
# Development of an Integrated Waste Management Strategy (IWMS)

SO1
SO2
SO3
SO4

EN

WS
WA
IN

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 150 EUR | N/A |
| 73,200 KZT | |

| Timeframe | Scale and location |
|---|---|
| 2023–2024 | The IWMS will have a primary focus on municipal waste management but will also provide strategies for the management of all non-municipal waste streams, like healthcare waste, industrial waste, agricultural waste. |

Potential source of financing

IFIs, Municipal budget

Targets

- Develop a waste management system which follows the 2021 Environmental Code and provides for environmentally neutral governance of waste management activities and increase of resource efficiency.

Benefits

- Improved resource efficiency, clear recycling and recovery targets for Almaty
- Improved air, water and soil quality; reduction of GHG emissions
- ToR for development of IWMS shall set a clear requirement that the measures to be identified in the IWMS must take into consideration gender equality and equal rights to opportunities as well as consideration towards informal recyclers, resettlement and livelihood restoration related to investments in solid waste management infrastructure.
- Once the plan is implemented, additional benefits: resource savings in terms of increased secondary materials, waste-based compost or energy, improved operational costs and reduced energy consumption of the system

Key stakeholders

Akimat Departments: Communal Infrastructure Development, Ecology and Environment; Environment and Tourism Committee (Maslikhat), Tartyp JSC, Kazakhstan Waste Recycling LLP, EPR Operator, Tartyp

### Context and description

In the absence of a national waste management plan or strategy, local solutions can still be planned at the city level. There is a draft Waste Plan developed by the Maslikhat Environment and Tourism Committee that needs enhancement. Given the complexity of the waste sector, it is important that local waste strategies and action plans have holistic views in the pursuit of an integrated waste management structure, covering all technical, institutional, and financial aspects. Moreover, considering the Almaty Agglomeration concept and its territory, the waste management strategic planning should be done at regional level, starting with the city and its surrounding and incorporating all the other administrative units within the Agglomeration. Also, all the measures foreseen for treatment of special waste streams at Almaty city level should be coordinated with the objectives and provisions defined for Almaty Agglomeration in order to have a coherent and functional regional waste management system.

The IWMS will be able to define the following key aspects of waste management at local level:

- Vision and objectives of the city in the field of waste management for the next 10-15 years
- Targets to be achieved
- Actions which will be needed to achieve the targets and objectives
- Responsibilities assigned for each action
- Responsibility for monitoring the implementation of the strategy
- Monitoring plan
- Budget and source of funding for each action
- Institutional arrangements needed and organizational set-up
- Financial sustainability of proposed actions

An IWMS will be able to address, among other aspects, all prioritized challenges in a holistic way.

### Legal and policy framework

The Concept on Transition to Green Economy 2050.

The Environmental Code from January 2021 stipulates waste management hierarchy as the preferred order of waste management activities. In addition, it imposes restrictions on disposal of untreated waste. In order to plan their priorities and activities in the waste management sector, local authorities will need to develop integrated waste management plans or strategies.

Interregional Action Plan for the Almaty Agglomeration development until 2030.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Prepare detailed Terms of Reference for selection of consultant | 4 months (2023) |
| 2. Tender process for selection of consultant | 6 months (2023) |
| 3. Develop IWMS for Almaty | 12 months (2023–2024) |
| 4. Adoption of the IWMS by the Akimat | By end of 2024 |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Integrated Waste Management Strategy | 150 | 73,200 |

**Estimated yearly OPEX**: not applicable

### Smart and digital solutions

It is expected that smart solutions will be identified as priority measures in the IWMS, like route optimization software, or even an integrated waste management information system, which will enable the relevant department of the Akimat of the city of Almaty to receive, monitor and analyse real-time data on collection, treatment and disposal of municipal waste.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 2. Almaty Green Innovation Incubator | GII will be one of the key stakeholders engaged in the development of the IWMS due to their interest and expertise on circular economy initiatives. |
| Action 3. Citywide Digital Twin | Data integration |
| Action 22. Establishment of a construction and demolition waste (CDW) recycling facility | All these actions will be implemented in line with the objectives and measures envisaged in the IWMS. |
| Action 23. Feasibility Study for establishment of a biowaste management system | |
| Action 24. Feasibility Study for upgrading the existing waste sorting plant towards mechanical biological treatment | |
| Action 25. Implementation of separate waste collection system for dry recyclables | |
| Action 29. Feasibility study on WWTP modernization and industrial wastewater treatment options | |
| Action 30. Green Innovation Industrial Park | Specific waste management practices will be implemented at the GIIP premises, focusing on reduce, reuse, recycle and prevention of waste. |

# Action 22
# Establishment of a construction and demolition waste (CDW) recycling facility

SO1 SO2 SO3 SO4

**Estimated CAPEX (thousands)**

7,000 EUR

3,416,000 KZT

**Estimated annual savings**

Approximately 40,000 tonnes of raw materials substituted with secondary materials per year
80 tonnes of $CO_2$/year

**Timeframe**

2024–2026

**Scale and location**

Relatively close to the city centre and in the vicinity of intense construction sites. At least 50,000 t/year capacity for the first module.

**Potential source of financing**

PPP Construction companies, IFI

**Targets**

- Attain a recycling rate of CDW of at least 30% by 2026

**Benefits**

- Resource efficiency in construction materials
- Reduced illegal dumping of CDW, and therefore reduced contamination of soil
- Staffing requirements will take full consideration of gender equality and equal rights for job opportunities. Technical specifications for administrative building and other working premises will provide for separate utilities for male and female staff.

WS

**Key stakeholders**

Akimat Department: Communal Infrastructure Development; Construction companies and their association, Tartyp JSC, Kazakhstan Waste Recycling LLP, EPR Operator

IN

### Context and description

The integrated waste management system in Almaty needs to include a system for the management of construction and demolition waste, a valuable resource that is currently not used. This is justified in part by the significant and increasing construction activities in the city but also by an increase of illegal disposal of C&D waste on private and public lands. The waste is used for backfilling quarries or level land and is thought to increase the value of land once it is covered with a layer of topsoil. The practice is strongly opposed by active civil society and citizens who are sending in complaints and grievances regularly to the Akimat.

Different types of waste are being generated on municipal and private construction sites, like: (i) soil from digging; (ii) construction waste (mineral waste, bricks, wood); and (iii) demolition waste (bricks, concrete, joinery, flat glass, plastics, asphalt).

CDW has the potential to be recycled as secondary material. The main types of CDW which should be targeted for recycling are: concrete and reinforced concrete; asphalt concrete; building ceramics (bricks, etc.); broken rock materials; mineral (inert) waste and wood. The recycling facility will also be able to separate hazardous materials such as asbestos and paints.

Data shows that these five types amount to 80-85% of the total quantity of generated CDW. The predominant fraction in the construction waste, like concrete and bricks, is suitable after crushing to be used in road construction instead of primary resources like gravel and sand. Depending on the initial quality of the concrete, it could be even re-used for the same construction purposes. Most often, the recycled concrete can be applied for soil reinforcement, noise-protecting barriers, embankments, drainage material, temporary roads, sport facilities etc.

Once the CDW recycling facility proves its efficiency and effectiveness, the project can be upscaled to Almaty Agglomeration level.

### Legal and policy framework

The Environmental Code from January 2021 prohibits the disposal of CDW on landfills for municipal waste. It also prohibits the accumulation of CDW on places other than licensed for this. Construction waste is to be separated from other types of waste directly at the construction site or in a designated place.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Prepare detailed Terms of Reference for the selection of a consultant for developing a feasibility study. | 4 months (2024) |
| 2. Tender process for the selection of a consultant. | 6 months (2024) |
| 3. Feasibility study (including confirming site selection) | 10 months (2024–2025) |
| 4. Prepare detailed Terms of Reference for the selection of a consultant for detailed design and construction works. | 4 months (2025) |
| 5. Tender process for selection of company for construction works | 6 months (2025) |
| 6. Construction works and supply of equipment | 18 months (2025–2026) |

| |
|---|
| 7. Supervision of the construction works |

## Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Feasibility study | 200 | 97,600 |
| Construction works and supply of equipment | 6,500 | 3,172,000 |
| Supervision of the construction works | 300 | 146,400 |

**Estimated yearly OPEX (thousands)**: 210 EUR / 102,480 KZT

## Smart and digital solutions

The new recycling facility could be connected to an integrated waste management information system, which will enable the city to receive, monitor and analyse real-time data on availability of feedstock, treatment and recovery of CDW.
Community based monitoring of illegal disposal sites and publicly available continuous information on this may provide additional push to implement this action.

## Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 21. Development of an Integrated Waste Management Strategy (IWMS) | Specific measures included in the IWMS related to CDW should be implemented. |

# Action 23
# Feasibility Study for establishment of a biowaste management system and pilot project for green waste composting

SO1
SO2
SO3
SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 2,800 EUR<br>1,366,400 KZT | Depending on the solution in the feasibility study, potential energy savings or resource savings<br>Savings of chemical fertilizers and substitution with compost from organic waste through pilot project |

| Timeframe | Scale and location |
|---|---|
| 2023–2026 | Pilot project for green waste treatment, 25,000 t/year. Location for pilot is possible at the current location of the Tartyp sorting facility<br>10,000 tonnes of $CO_2$/year |

Potential source of financing

IFIs, Municipal budget

Targets

- Environmentally safe and economically beneficial management of organic waste, aiming at diverting significant quantities of biodegradable waste from landfill

Benefits

- Improved air quality; extended lifetime of the landfill
- Reduction of greenhouse gas emissions through reduced quantities of biowaste for landfill as well as stabilised waste fraction going to the landfill (in case MBT technology is selected)
- Reduction of leachate production
- Staffing requirements will take full consideration of gender equality and equal rights for job opportunities

WS
WA

Key stakeholders

Akimat Department: Communal Infrastructure Development; JSC Tartyp Almaty; Communal Enterprise "Zelenitsa" for green waste composting from public areas; private sector; Kazakhstan Waste Recycling LLP, EPR Operator.

## Context and description

At present, there is a lack of a system for separate collection and treatment of organic waste. Organic waste is reportedly the most significant waste stream generated in the city. Currently, there are 894 hectares of green space in the city, or 7.7 $m^2$ per person. The plan of the Akimat of the city of Almaty is to reach 10 $m^2$ per capita by 2030. This will lead to a substantial increase of the quantities of green waste.

There is a need for biowaste management system, which will divert significant quantities of biodegradable waste from landfill. Different organic streams may require different treatment technologies.

The action envisages the establishment of a biowaste treatment facility(ies) for separately collected organic waste streams. The targeted organic waste streams include:

- separately collected green waste from public areas generated through increased landscaping activities. The produced high-quality compost can be used back for landscaping activities or can be marketed for direct use in agriculture; and
- source separated food waste from commercial establishments (restaurants, canteens, markets, etc.) with subsequent expansion of the source separation system to households from individual houses.

Among various options, possible technologies include:

- composting of separately collected green waste (open windrows, aerated piles, etc.)
- in-vessel waste treatment of both food and green waste for production of high-quality compost
- small-scale anaerobic digestors for source separated food waste for energy production
- co-mingled treatment of source separated food waste with sludge from the WWTP.

The technology will be selected at feasibility stage, based on expected source separated quantities of organic waste and their actual source of generation. A potential pilot is to start with the composting of separately collected green waste at the current location of the sorting facility of Tartyp. Once the pilot project proves its efficiency and effectiveness, the action can be upscaled/replicated to other locations in the city, as well as at the Agglomeration level.

The proposed system will try to capture the entire quantity of green waste from public areas. The introduction of source separation of food waste could be initially piloted in the densely populated central part of the city and then upscaled to other commercial establishments (restaurants, canteens, markets, etc.) in the city and within the Almaty Agglomeration.

## Legal and policy framework

Almaty Development Strategy 2050.

The Environmental Code from January 2021 prohibits the disposal of food waste on landfills for municipal waste. It also requires that "*local authorities shall implement activities for reduction of quantities of biodegradable waste for disposal, including measures for their treatment, in particular by composting and recycling, including for production of biogas and (or) energy*".

## Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Prepare detailed Terms of Reference for selection of consultant for developing a feasibility study including market study of outputs. | 4 months (2023) |

| | |
|---|---|
| 2. Tender process for selection of consultant | 6 months (2023) |
| 3. Feasibility study (including site(s) identification, and operational model) | 10 months (2024–2025) |
| 4. Implementation of pilot project for green waste composting for waste stream coming from green spaces implemented by Zelenitsa communal enterprise. | 18 months (2025–2026) |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Feasibility study | 300 | 146,400 |
| Pilot windrow composting facility | 2,500 | 1,220,000 |

**Estimated yearly OPEX (thousands)**: 300 EUR / 146,400 KZT (composting facility)

### Smart and digital benefits

Biowaste management system could be connected to an integrated waste management information system, which will enable the Akimat of the city of Almaty to receive, monitor and analyse real-time data on the collection, treatment, and use of treated organic waste.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 21. Development of an Integrated Waste Management Strategy (IWMS) | Specific measures included in the IWMS related to green waste should be implemented. |

# Action 24
# Feasibility Study for upgrading the existing waste sorting plant

SO1
SO2
SO3
SO4

**Estimated CAPEX (thousands)**

300 EUR

146,400 KZT

**Estimated annual savings**

Replacement of fossil fuel-based energy with energy generated from waste to be estimated at feasibility stage

**Timeframe**

2024–2025

**Scale and location**

Premises of the existing waste sorting facility operated by Green Recycle Company, part of Tartyp waste management company

**Potential source of financing**

IFIs, Private finance, part of PPP

EN

**Targets**

- Increasing the utilization of municipal waste through energy recovery
- Diverting significant quantities of municipal waste from landfill

**Benefits**

- Decreased impact on the environment and human health through the avoidance of hazardous waste landfilling
- Extended life of the landfill
- Improved resource efficiency through extended life cycle of materials
- Reduced greenhouse gas emissions and leachate production (in case of biological treatment is selected)
- Staffing requirements will take full consideration of gender equality and equal rights for job opportunities. Similarly, technical specifications for administrative building and other working premises will provide for separate utilities for male and female staff.

WS

**Key stakeholders**

LLP "Green Recycle" Company, Communal Infrastructure Development Department of Almaty Akimat, Tartyp JSC; Kazakhstan Waste Recycling LLP; EPR Operator; Cement industry players

### Context and description

The action aims at the development of a feasibility study to establish the technical compatibility and economic viability of upgrading the existing waste sorting plant in Almaty to produce high calorific refuse-derived fuel (RDF) and reduce the quantities of biowaste for landfill through biological stabilisation. The end purpose is to maximize the quantities of waste for energy recovery and reduce the quantities of landfilled waste.

A sorting plant was established at the city's main landfill in 2018, as part of a Public-Private-Partnership between the Akimat of the city of Almaty and the private operator. The capacity of the plant is 550,000 tonnes of waste per year and is operated by Green Recycle Company, which is part of Tartyp Waste Management Company. In 2020, about 332,000 tonnes of mixed municipal waste were received and treated at the facility. Information from the Department of Communal Infrastructure Development indicates that about 42 thousand tonnes were segregated as recyclables, or about 12.5% of the received mixed municipal waste. Information from the plant operator indicates that the revenues from the sale of recyclables are currently insufficient to cover the costs of waste sorting.

The proposed action will investigate the possibility to produce high-calorific RDF by upgrading the existing waste sorting plant. The feasibility study will establish:

- Compatibility of the existing sorting equipment for an upgrade to RDF production
- Suitable technology for maximising the RDF production (through option analysis)
- Feasibility of adding biological treatment step for stabilisation of the biodegradable fractions
- Equipment and site requirements
- Conceptual design
- Market survey for uptake of RDF
- Financial and economic analysis of the proposed scenario
- Operational model

It is expected that the upgrade of the sorting facility will be tendered under FIDIC Yellow Book conditions and will comprise of design and built elements.

### Legal and policy framework

Almaty Development Strategy 2050.

The Environmental Code from January 2021 prohibits the disposal of several categories of waste on landfills for municipal waste, including paper and cardboard, plastic and packaging waste, glass packaging and metals.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Prepare detailed Terms of Reference for the selection of a consultant for developing a feasibility study. | 4 months (2024) |
| 2. Tender process for the selection of a consultant | 6 months (2024) |
| 3. Feasibility study (including market survey for RDF uptake and conceptual design) | 12 months (2024–2025) |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Feasibility study and conceptual design | 300 | 146,400 |

**Estimated yearly OPEX**: Not applicable.

### Smart and digital solutions

The upgraded waste treatment facility could be connected to an integrated waste management information system, which will enable the Akimat of the city of Almaty to receive, monitor and analyse real-time data on received quantities, extracted recyclables (by type), and RDF produced. In addition, depending on the selected technology, the upgraded sorting system may include advanced automated systems (e. g. enhanced resolution technologies like "near infrared" and "mid infrared" for increased efficiency in the recognition of targeted waste fractions).

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 21. Development of an Integrated Waste Management Strategy (IWMS) | Specific measures included in the IWMS related to green waste should be implemented. |
| Action 30. Green Industrial Innovation Park | RDF can be used in the GIIP. |

# Action 25
# Implementation of separate waste collection system for dry recyclables

SO1 SO2 SO3 SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 6,500 EUR<br>3,172,000 KZT | GHG savings from the substitution of virgin materials with secondary materials from the recycling value chain - 43,500 tonnes of $CO_2$/year |

| Timeframe | Scale and location |
|---|---|
| 2023–2024 | The proposed action will implement source separation scheme for municipal waste throughout the city. |

Potential source of financing

IFIs

## Targets

- Increase the quantities of recycled waste to 30% for dry recyclables by weight (about 55 thousand tonnes a year).

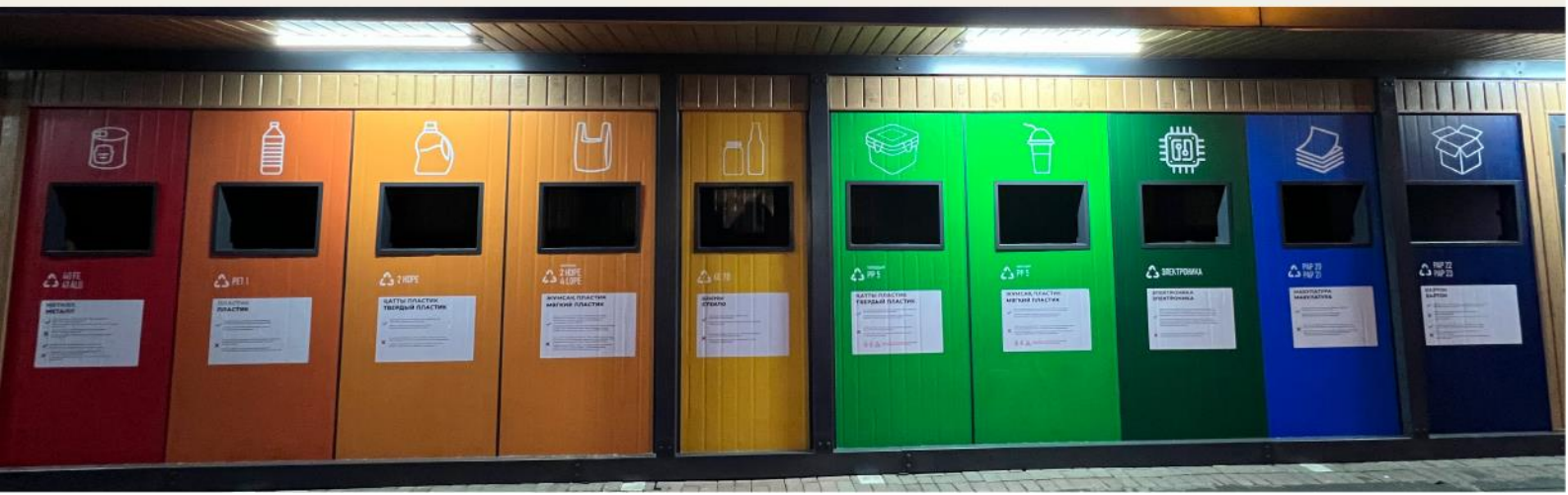
## Benefits

- Reduced pressure on the environment through waste prevention and reduced quantities of municipal waste for landfill; reduced service costs; increased resource efficiency
- The concept of the accompanying public education and involvement campaign will need to analyse the attitudes of different social groups and gender specifics and identify key awareness messages and public involvement approaches designed to the specifics of the different target groups.

WS

## Key stakeholders

JSC Tartyp (private waste collection operator); Akimat (Communal Infrastructure Development Department); LLP Green Recycle Company; Kazakhstan Waste Recycling LLP, EPR Operator



### Context and description

Although the Akimat of the city of Almaty has already initiated steps for source separation, an established system for separate collection of recyclables is not in place yet. Throughout the city, only 72 points of separate collection of dry recyclables have been established. At the same time, the legal framework establishes the requirement that dry recyclable waste should be segregated at source, separately from the wet and other municipal waste fractions.

The project will consist of the establishment of source separation system for dry recyclables from households and businesses. Four fractions will be collected separately from the organic fractions – namely paper/cardboard, plastic and plastic packaging, glass packaging and metal containers. A preliminary concept study will determine the exact system for separate collection, in terms of:

- Collection of all dry recyclables in one container – 1 bin system.
- Collection of glass separately from paper/cardboard, plastic and metal – 2 bin system.
- Collection of glass in a separate bin; collection of plastic and metal in a separate bin; and collection of paper/carboard in a separate bin – 3 bin system.

Another objective is to assess the possible source separation systems in view of maximizing the upcycling potential of the separately collected materials. The rest of municipal waste will be collected in a designated container for mixed municipal waste. Source separated dry recyclables will be further processed at the existing sorting plant, operated by the Green Recycle Company.

The action will need to be accompanied by an extensive public education and involvement campaign. Also, the action can be later extended to Almaty Agglomeration level as well.

### Legal and policy framework

According to the Environmental Code from January 2021, waste should be segregated at source in the following fractions:

- dry (paper, cardboard, metal, plastic and glass);
- wet (food waste, organic waste, etc.).

Almaty Development Strategy 2050 envisages that waste recycling should be increased by 80% by 2050.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Develop concept study for the selection of the optimal source segregation system. | 8 months (2023) |
| 2. Procure and supply the equipment (containers and collection fleet). | 8 months (2023–2024) |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Equipment for separate waste collection (containers and vehicles) | 6,500 | 3,172,000 |

**Estimated yearly OPEX (thousands)**: 650 EUR / 317,200 KZT

### Smart and digital solutions

Collected recyclables will be delivered to the waste sorting facility, which could be connected to an integrated waste management information system, this enabling the Akimat of the city of Almaty to receive, monitor and analyse real-time data on received quantities.

Besides, depending on the selected technology for the upgrade of the existing sorting plant in the city, the upgraded sorting system is expected to include advanced automated systems (e. g. enhanced resolution technologies like "near infrared" and "mid infrared" for increased efficiency in the recognition of targeted waste fractions).

In addition, pilot schemes can be implemented, connected to "pay-as-you-throw" system whereby source separation bins are equipped with card-readers and waste charge to households is then connected to the waste disposed only in the grey container.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 2. Almaty Green Innovation Incubator | Collection route optimization, IT solutions for improving waste collection |
| Action 21. Development of an Integrated Waste Management Strategy (IWMS) | Specific measures included in the IWMS related to waste collection should be implemented. |

# Action 26
# Developing a leakage reduction programme for drinking water supply

SO1
SO2
SO3
SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 2,100 EUR<br>1,024,800 KZT | Expected to be 1 million EUR over 2.5 years for each percentage of leakage reduction |

| Timeframe | Scale and location |
|---|---|
| 2024–2025 | Main pipelines of the drinking water distribution network of the city |

Potential source of financing

IFIs

Targets

- Reduction of non-revenue water to below 15% in main pipelines

Benefits

- Increased water use efficiency to improve Almaty's climate resilience and cope with future droughts
- Water tariffs could be lowered for those in need and derived from earnings on what is now non-revenue water
- Staffing requirements will take full consideration of gender equality and equal rights for job opportunities.

WA

Key stakeholders

Akimat Departments: Ecology and Environment, Energy and Water Supply; Almaty SU water utility company

### Context and description

The Akimat of the city of Almaty will develop a **non-invasive leakage monitoring and reduction program** to optimize the water supply efficiency and profitability of the drinking water distribution network. The aim is to reduce the volume of water lost due to leakages in drinking water supply networks, also known as non-revenue water. The "non-revenue water" in Almaty is estimated at approximately 37% in 2015 (secondary source) and 30% in 2020 (Almaty SU). The main source of the leakage is linked to aging infrastructure but also to illegal connections in the summertime. Some pipes have already reached their end of useful life. According to Almaty SU, 59% of the 3400 km of water pipes are deteriorated.

Repairing leaks could be approached by having specialized technicians in-house to carry out any necessary repairs. The difficulty, however, lies in identifying and locating the faults as the network is extended and mostly underground. Whether a technician needs to search for the leakage within an area of 1 $m^2$ or 1,000 $m^2$ can make an enormous difference. Therefore, the action proposes a **smart monitoring programme** for identifying leakages more quickly and locating these more precisely.

This can be done by making use of smart water technologies (Internet of Things) and comes down to locating potential leakages by comparison of expected water usage data to real-time water usage. Such comparison can be carried out by a software. When a discrepancy is found between the two datasets, the monitoring team can be alerted of the potential leak in the system. The location of the leakage can be identified by tracing back the water meter that provided the data showing a deviation. Once the leak is detected specialized technicians can be sent out to carry out a field-based inspection and repair the problem.

The monitoring system can be based on a partitioning of Almaty in water zones covering each about 5000 clients which function as a strategic metering area. In each zone water pressure can be continuously monitored through a passive system with active alarms. The Akimat of the city of Almaty could start with a pilot project on the main pipelines or in some zones. Based on the results, the monitoring program can be refined and rolled out. An extension could also include the providing of private water meters to clients leading to services such as on-site detection of leaks or client advisory to improve water efficiency. Once this system proves its efficiency, the programme can be extended to the entire Almaty Agglomeration area.

The return on investment for leakage repairs is expected to be highly profitable for the company and should therefore be considered an R&D investment. The total investment for the software development can be estimated at around 1,000,000 EUR, as well as a similar amount for investments in network monitoring systems within the city. The operational costs of the program are estimated to be about 500,000 EUR per year. These estimations are based on an example in the city of Lisbon (Portugal) but depend upon the scale and extension of the distribution network. The accumulated savings are estimated to be about 4 million EUR over 10 years' time for each percentage of leakage reduction in the Lisbon case. The water efficiency program is thus expected to be highly beneficial in terms of cost-benefit ratio. The achieved savings can be reinvested into further reducing the company's environmental impact. The cost of the smart monitoring program does not include the costs for the renewal of the water distribution network, which are considered as 'regular maintenance' costs.

A water distribution network needs to be continuously monitored and improved. Usage of the water distribution system means that its pipes will wear and eventually need to be replaced. The average lifespan of a network amounts to 50 to 60 years. The advantage of setting up a smart monitoring system is to identify problems more efficiently, meaning that replacement of the network can take place in phases and continuously. The program makes it manageable by focusing on continuously fixing smaller parts of the network, rather than replacing it all at once. Besides, regular maintenance of new pipelines can prolong the useful life of the network. The Akimat of the city of Almaty may therefore evaluate the possibilities to include

**non-destructive intervention methods** in the maintenance program for targeted renovations on new drinking water pipelines.

Examples of non-destructive (trenchless) repair methods include an epoxy pipe lining or cured-in-place pipe (CIPP). Epoxy pipe lining, also called *structural pipe lining*, *cured-in-place lining (CIPP),* or simply *pipe lining* is a trenchless sewer repair form without the need for digging up pipes. The lining process involves coating the pipes from the inside with a resin-saturated felt tube that later hardens into a strong "pipe-within-a-pipe" to seal off pinholes and corrosion. This method is supposedly creating a long-lasting and maintenance-free solution that solves pipe leaks. The mentioned advantages are mainly the cost-effectiveness, time-efficiency, endurance, non-destructiveness (no interruption of traffic and wastewater flows) and prolonged sewer lifetime. However, this method involves several technical challenges as well. The epoxy resin needs to adhere very well to the pipe, if not it can result in a decrease in water volume and flow rate and an increase in turbulence. Although considered a non-invasive method, pipe lining usually requires the removal of every valve in the system and disconnecting all supply lines from every fixture (faucets, tubs, hose bibs, commodes, etc.). In addition, the maintenance and repair of epoxy-lined pipes can be difficult since the lining is not high-pressure and heat-resistant. Whether epoxy lining is an adequate method as well depends on the condition of the pipelines. The epoxy lining process itself creates a certain amount of pressure on the pipe walls which may blow out weak spots. Therefore, pipe lining does not work on collapsed, back-pitched, incredibly fragile, or Orangeburg (tarpaper) pipes. Fragile pipes will get damaged when cleaned with hydro-jetting before lining. Therefore, for pipelines which have a very high wear degree it might be more convenient and cost-efficient to replace them. Besides, epoxy pipe lining also does not work very well on pipes 2 inches or less in diameter. The pipe diameter of small pipelines will be decreased too much by the lining.

### Legal and policy framework

Water Code (2003); Environmental Code (2021); Almaty Development Strategy 2050, contributing to the foreseen target of reducing the wear rate of the city's water supply networks. Rules for maintaining state accounting of waters and their use, state water cadastre and state monitoring of water bodies (2015). This action may provide leverage for a water tariff reform.

Municipal Energy Efficiency Plan 2030 – active leak detection system.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Develop a non-invasive leakage detection program based on smart water technologies, e. g. sensors, water meters, etc. | 6 months (2024) |
| 2. Pilot project of leakage reduction program on main pipelines:<br>a. Determine total leakage (%) in main pipelines using smart water technologies<br>b. Field-based (non-invasive) leak detection in main pipelines<br>c. Evaluation of the leakage reduction results | 18 months (2024–2025) |
| 3. Development and implement the maintenance program | Ongoing starting with 2024 |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Investment in software development for smart monitoring system | 1,000 | 488,000 |
| Investment in monitoring systems for main pipelines | 1,000 | 488,000 |
| Development of maintenance program | 100 | 48,800 |

**Estimated yearly OPEX (thousands)**: 500 EUR / 244,000 KZT

### Smart and digital solutions

Smart water technologies (IoT) are implemented for drinking water supply networks, which will enable the Akimat of the city of Almaty to receive, monitor and analyse real-time data on water supply efficiencies and non-revenue water (leakages). This can be done in an incremental way, from installing flow and pressure sensors at key sections/stations, to rolling out household smart meters. Satellite imagery, as a supporting, early step, could be also considered.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 3. Citywide Digital Twin | Data and knowledge sharing.<br>Water leakage detection and pipe failure modelling |
| Action 27. Develop of a water saving plan | Specific measures from leak reduction can be combined with water saving measures. |

# Action 27
# Development of a water saving plan

SO1
SO2
SO3
SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 380 EUR | N/A |
| 185,440 KZT | |

| Timeframe | Scale and location |
|---|---|
| 2023–2024 | Entire city of Almaty |

Potential source of financing

IFIs, Municipal budget

Targets

- Reduce water consumption with 25% and setting targets with the water saving plan by 2030 on (1) reduce Water Exploitation Index (WEI) to below 20%, (2) reduction of leakage percentage to below 15%, (3) increased degree of circular water usage in large-scale water consuming industries, (4) increased number of buildings with functional rainwater wells, (5) reduced risk on water supply outfall in climate scenarios, (6) development of a crisis management plan in case of water supply outfall.

Benefits

- Reduced water footprint of the city of Almaty, preventing depletion of natural water resources
- Staffing requirements will take full consideration of gender equality and equal rights for job opportunities.

WA

Key stakeholders

Akimat Departments: Ecology and Environment, Energy and Water Supply; Water Utility Company Almaty SU

## Context and description

Climate change in Almaty is projected to have increased temperatures, extreme precipitation events and frequency and intensity of droughts.[21] Melting glacial ice and a decrease in summer precipitation (July to September) increase the risk of water scarcity and droughts.[22] In addition, the water exploitation rate has shown an increasing trend in recent years, being between 20-30% and flagged as yellow. The **Water Exploitation Index (WEI)** is calculated based on the daily water consumption per capita (which is 130 for 2020, as provided by the water company Almaty SU) and total renewable water resources from the city between 2015 and 2019. There are four freshwater sources for Almaty, namely two rivers (Big and Small Almaty) and two underground water intakes of Almaty and Talgar fields. Water scarcity could thus become a matter of local interest due to climate change and WEI uptrend.

The Akimat of the city of Almaty will develop a **water saving plan** to increase its climate resilience and be ready for future droughts and water scarcity. The water saving plan will mainly focus on water management in an urbanized and industrial context. The plan will include the following types of measures:

- **Protective** measures aim to avoid the occurrence of water scarcity in the city. The protective strategy is based on the 3 pillars of water management – reduce, reuse and recycle – and needs to be stimulated in all public and private sectors.
- **Preventive** measures focused on the avoidance of the negative effects of droughts. In this context it is very much relevant and important to consider the impact of climate change for the city in the decades to come.
- **Preparedness** measures ensure the city can act adequately when drought and water scarcity strike the region. A crisis management plan can include a framework for optimal distribution of water resources in case of water scarcity, prioritized per sector, and a legal limitation on the use of depleted water sources.

The water saving plan will contain an updated assessment of water resources and water use, detailed actions to reduce, reuse and recycle water in the city of Almaty as protective measures. The combination of the reduce, reuse, recycle strategy will significantly contribute to a more waterproof and climate resilient city.

*REDUCE – Rational water use* aims at reducing the total water consumption of the city of Almaty. Possible actions to be included in the water saving plan for reducing the water footprint include:

- Reduce leakages in drinking water supply network
- Water audits for industry to make production processes more water efficient
- Investments in water efficient technologies
- Schedule irrigation to minimize evapotranspiration losses

*REUSE – Alternative water sources* can reduce the consumption of natural water resources and as such the depletion of groundwater. A lot of applications do not require drinking water quality, so grey water and rainwater can be (re)used instead. Private and public actors should be stimulated to harvest rainwater. A pilot project can include harvesting rainwater in public space. For example, the rainwater from a town square and the roofs of surrounding buildings can be collected in an underground reservoir under the square to be (re)used as source for a fountain on the town square or irrigation of urban green spaces. To stimulate private actors to harvest rainwater, like households, the Akimat can make regulations on a rainwater well with minimum volume (e. g. 50 L/m² roof) for new/renovated buildings and/or the water distribution company can provide a bonus for households, when not legally required, who voluntarily install a (functional) rainwater well with minimum volume. Moreover, harvesting rainwater will reduce the investment costs for drainage infrastructure, since less capacity is needed, and thus smaller diameters of pipes are required. The

[21] World Health Organization (WHO) - https://www.euro.who.int/en/health-topics/environment-and-health/Climate-change/publications/2009/protecting-health-from-climate-change-leaflets/protecting-health-from-climate-change-a-seven-country-initiative-in-the-eastern-part-of-the-who-european-region/the-project-in-each-of-the-seven-countries/kazakhstan

[22] https://www.unescap.org/sites/default/d8files/event-documents/Kazakhstan%20-%20Climate%20Change%20and%20Disaster%20Risk%20Profile.pdf

groundwater consumption of industries can as well be substituted by more renewable water sources with the aid of technology, e. g. surface water or rainwater can be converted to process water by means of on-site treatment installations. In conclusion, the following actions can be included in the water saving plan:

- Pilot project for harvesting rainwater in public space, e. g. town square fountain
- Pilot project for harvesting rainwater in a public building, e. g. the building hosting the Akimat
- Water audits for industries to investigate potential on alternative water sources
- Maximize reuse of grey water

*RECYCLE – Circular water use* should be the norm in the future. Technology is available for recycling water resources. For example, on-site industrial treatment plants are able to convert wastewater to process water, e. g. balance of 80% recycled and 20% effluent.

The success of the plan may further be increased with the development of a policy to support the implementation of the water saving plan (e. g. regulations, bonuses, subsidies, communication campaigns, etc.).

The water saving plan will also consider the regional circumstances, goal and objectives in line with the provisions envisaged for the Almaty Agglomeration.

### Legal and policy framework

Water Code (2003); National Water Management Program 2019; Rules for maintaining state accounting of waters and their use, state water cadastre and state monitoring of water bodies (2015); Interregional Action Plan for the Almaty Agglomeration development until 2030.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Water footprint study of the city, including:<br>○ Evaluate depletion degree of natural water resources of Almaty<br>○ Determine degree of water reuse and recycling in industry and set target<br>○ Risk-analysis for water supply outfall in climate change scenarios | 8 months (2023) |
| 2. Development of a water saving plan to reduce water footprint by 2030 | 8 months (2023) |
| 3. Prepare a Feasibility Study for a pilot project for implementation of the water saving plan as foreseen in the action on increasing the water permeability of the city, but also may include circular water use in industrial processes[23]. | 10 months (2024) |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) |
|---|---|

[23] https://docs.wbcsd.org/2017/06/WBCSD_Business_Guide_Circular_Water_Management.pdf

| | EUR | KZT |
|---|---|---|
| Water footprint studies | 100 | 48,800 |
| Develop water saving plan | 200 | 97,600 |
| Feasibility study for a pilot project on circular water use in industrial processes | 80 | 39,040 |

**Estimated yearly OPEX (thousands)**: Not Applicable

### Smart and digital solutions

Smart water technologies help to efficiently identify bottlenecks in the water supply system. Smart water management requires the integration of systems and a complex set of measures to monitor, control, and regulate the usage and quality of water resources as well as maintain the associated equipment (pipes, pumps, faucets, etc.). As such, smart water systems can gather data from multiple sources including the watershed, treatment plants and testing equipment, real-time visualization and modelling tools can then provide a nuanced understanding of pollution and water quality and quantity issues.

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Akimat Office for Green Project Implementation | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 2. Almaty Green Innovation Incubator | Data and knowledge sharing; identification of innovative solutions; co-creation of pilot projects |
| Action 3. Citywide Digital Twin | Water quality monitoring and consumption tracking |
| Action 5. Residential building retrofit programme | Specific measures from water saving plan can be combined with measures envisaged in these actions (e. g. water harvesting, water recycling etc.). |
| Action 17. Implementing priority blue green infrastructure projects at the district level | |
| Action 18. Increasing the water permeability of the city of Almaty | |
| Action 26. Developing a leakage reduction programme for drinking water supply | |
| Action 30. Green Industrial Innovation Park | |

# Action 28
# Wastewater collector retrofit

SO1
SO2
SO3
SO4

| Total CAPEX (thousands) | | Estimated annual savings |
|---|---|---|
| 22,110 | EUR | Cost savings |
| 10,789,680 | KZT | |

| Timeframe | Scale and location |
|---|---|
| 2023–2026 | Main wastewater collector of the city |

Potential source of financing

IFIs

Targets

- Close to 100% reduction of sewage leakage along the main collector from city centre to WWTP

Benefits

- Improved surface water quality due to reduced sewage leakages: reduce with 50% the level of $NH_4$ pollution in water bodies. In addition: reduced pollution and groundwater contamination, and improved wastewater services.
- Staffing requirements will take full consideration of equal rights for job opportunities.

Key stakeholders

WA

Akimat Departments: Energy and Water Supply, Land Relations; Water Utility Company Almaty SU (Tospasu); Kazakhstan Centre for housing and communal services modernization and development (Kazcenter ZhKH); Municipal Enterprise; Private operators

### Context and description

The Akimat of the city of Almaty will perform a **wastewater collector retrofit** to reduce the leakage percentage of the sewerage network. Most of the sewage network is more than 50 years old, and there are high losses (*'non-revenue water'*) due to deterioration of the network. According to the Almaty SU, 1900 kms (of 3500) of wastewater pipes are obsolete (54%) causing 30% of losses in the network. Sewage leakages have a negative environmental impact, contributing to the worsening trend in $NH_4$ pollution in water bodies of the city.

The priority is the retrofit of the **main sewage collector** from the city to the wastewater treatment plant, representing 16 km of pipes. However, there are technical and financial limitations for retrofitting projects in the city. The wastewater collector retrofit is complex because there is illegal housing on the land adjacent to and on top of the collector. Therefore, a **resettlement action plan** is needed for the works, and **land acquisition** is needed for a temporary pipe to be constructed above ground for the period of the works.

**Non-destructive (trenchless) repair methods** could be considered as well as an alternative or partial solution to replacing the old piping with a completely new system. Examples of non-destructive (trenchless) repair methods include an epoxy pipe lining or cured-in-place pipe (CIPP).

The Akimat of the city of Almaty might consider **hybrid solutions** as well. Depending on the condition of the pipe being lined, large portions may need to be replaced before the system can be lined. A camera-inspection, leak tests and field observations will identify the needs for the system. Budget and investment costs will also determine the choice of techniques. In some cases, the costs of a mixed solution (partial lining and partial replacement) might be more expensive than just a straight replacement of the entire system. A trade-off needs to be made depending on the condition of the sewage infrastructure and the consequences of replacement.

On average, costs for a full sewer replacement are ranging from EUR 150 to EUR 600 per meter.[24] The total prices depend on how much pipe is replaced, the diameters and materials; for example, if 16 km of main collector are replaced with a median cost of EUR 375 per meter, the total median replacement cost will sum up to EUR 6,000,000. Various methods are possible.

The cost of digging and replacing a sewer line is EUR 150 to EUR 1350 per meter. Trenchless sewer line replacement or repair costs range between EUR 200 to EUR 900 per meter, for example cured-in-place pipe lining (CIPP) (EUR 225 to EUR 750 per meter) or trenchless pipe bursting. The price depends on various factors, such as the pipe condition, ease of navigation, the amount of cleaning needed before the lining, and the accessibility of the pipe.

### Legal and policy framework

Water Code (2003); Environmental Code (2021); Almaty Development Program 2025; Municipal energy Efficiency Plan 2030 – on improving sewage network.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Inventory of the condition of main collector through: | 12 months (2023–2024) |

[24] US example see: https://homeguide.com/costs/sewer-line-repair-cost#repair

| | |
|---|---|
| a. Camera inspections<br>b. Leakage testing methods (e. g. air pressure leak test)<br>c. Field-based observations | |
| 2. Develop and implement a retrofit/repair program for the main collector:<br>a. Indicate sections which are eligible for non-destructive repair methods (e. g. epoxy lining)<br>b. Indicate sections which need total replacement<br>c. Evaluate the need for a separate collector solution while the collector is going through retrofit<br>d. Make cost-benefit analyses of replacement vs. lining, or hybrid solutions<br>e. Resettlement of impacted persons, if the case | 28 months (2024–2026) |
| 3. Leakage testing methods (e. g. air pressure leak test) | 2 months (2026) |

## Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| (Camera-)inspections of main collector (16 km) | 10 | 4,880 |
| Develop a retrofit program | 100 | 48,800 |
| Repair or replacing a main collector<br>Retrofit of main collector and the separate cost of digging related activities (16 km) | 12,000 | 5,856,000 |
| Resettlement allowing for repair | 10,000 | 4,880,000 |

**Estimated yearly OPEX (thousands)**: 24 EUR / 11,712 KZT

## Smart and digital solutions

Smart water technologies are implemented to identify bottlenecks in sewage system. At the minimum this should include smart sensors and built-in algorithms to optimize performance and reliability.

## Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Implementation Office for Green Projects | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 3. Citywide Digital Twin | Data collected about the main wastewater collector will be incorporated in the main database.<br>Pipe failure modelling |

# Action 29
# Feasibility study on WWTP modernization and industrial wastewater treatment options

SO1
SO2
SO3
SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 250 EUR<br>122,000 KZT | N/A |

| Timeframe | Scale and location |
|---|---|
| 2024–2025 | Municipal wastewater treatment plant (WWTP) and industrial platforms of the city |

Potential source of financing

Municipality budget, IFIs

Targets

- Improved wastewater treatment by modernization of the municipal WWTP with increased capacity, and mandatory pre-treatment of industrial wastewater

Benefits

- Improved surface water quality because of improved performance of the modernized WWTP and mandatory pre-treatment of industrial wastewater. Improved energy efficiency due to WWTP modernization and biogas production from sludge. Leaching from sludge lagoons is eliminated.
- Staffing requirements will take full consideration of gender equality and equal rights for job opportunities.

Key stakeholders

Akimat Departments: Energy and Water Supply,; Water Utility Company Almaty SU; Kazakhstan Centre for housing and communal services modernization and development (Kazcenter ZhKH); Municipal Enterprise; Private operators

WA
IN

## Context and description

Almaty has one public wastewater treatment plant (WWTP) which treats all municipal wastewater coming from Almaty, some nearby mountain resorts and 3 neighbouring cities (Talgar, Kaskelen), also including industrial wastewater. The capacity of the WWTP is around 640,000 $m^3$ daily; and the city of Almaty uses 360,000 $m^3$ during the summertime. In the current situation the capacity is sufficient, but due to population and city growth, the capacity of the plant may not be able to meet the demand soon, indicating the need for an additional facility being planned. A feasibility study on how to modernize the current WWTP therefore should also assess the option of building a new, modern and efficient WWTP benchmarked with state-of-the-art technology.

The feasibility study will define how to modernize the current WWTP and to increase its capacity. The mechanical and biological treatment (MBT) needs renovation and improvements. A continuous water quality monitoring is needed to evaluate the performance of the WWTP. An anaerobic digestor for the sludge can be installed for producing biogas (i. e. renewable energy source). The potential for nutrient (phosphorus) recovery from the sludge following digestion can be investigated e. g. precipitation of P in the form of struvite (chemical process; MgCl2 and alkaline – NaOH – addition) which can be applied as a fertilizer. This is the transition from a Wastewater Treatment Plant (WWTP) to a Water Resource Recovery Plant (WRRP).[25] Currently, the sludge is dried in lagoons on the territory of the WWTP and then landfilled (see image below), leading to pollution. Awaiting the installation of an anaerobic biogas and dewatering reactor, the establishment of a lining under the lagoons can prevent leaching.

Currently, legal requirements for the pre-treatment of industrial wastewater are not always implemented leading to pollution. Some industrial plants are causing problems with the sewerage system due to the low percentage of wastewater pre-treatment (mostly grease and sand catchers). Therefore, pre-treatment of industrial wastewater needs to be mandatory and on-site water quality monitoring installed such that industrial effluent is compliant with regulations and standards. Consultancy can be provided for enterprises and industries on on-site wastewater treatment options. For example, a circular water economy should be promoted with on-site recycling of wastewater to process water. Pre-treatment for industry may also reduce the needs for the WWTP by the city.

## Legal and policy framework

Water Code (2003); Environmental Code (2021); Municipal Energy Efficiency Plan 2030 on WWTP retrofitting and biogas from wastewater sludge treatment.

The legal requirements for silt and sludge management are weak and not clear enough. Improvement and enforcement of regulations on mandatory pre-treatment of industrial wastewater.

[25] R3 Water Project Europe - https://circulareconomy.europa.eu/platform/en/good-practices/different-ways-turning-wastewater-treatment-plants-resource-recovery-facilities

## Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Feasibility study for:<br>• The modernization of the current WWTP, including:<br>  ○ Estimate potential capacity of current WWTP (expansion)<br>  ○ Investigate bottlenecks in current MBT and potential solutions<br>  ○ Choose renovation technologies for mechanical and biological treatment (MBT)<br>  ○ Investigate potential for anaerobic digestion of sludge with biogas production, combined with nutrient recovery from digested sludge<br>  ○ Determine investment costs<br>• The building of a new WWTP (state-of-the-art technology), including:<br>  ○ Determine location and needed capacity<br>  ○ Choose state-of-the-art technologies<br>  ○ Determine investment costs<br>• The mandatory pre-treatment of industrial wastewater, including:<br>  ○ Provide consultancy for enterprises and industries on circular water use and on-site water treatment options<br>  ○ On-site monitoring of water quality from industrial effluents and implementing the enforcement policy<br>• Reaching conclusions on needed and most appropriate path forward including pre-treatment on industrial sites, modernization of the current WWTP and/or including a new facility in addition to the current one or to allow for phasing out the current one with a new single state of the art WWTP as final solution. | 14 months (2024–2025) |

## Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Feasibility study | 250 | 122,000 |

**Estimated yearly OPEX**: Not Applicable

## Smart and digital solutions

Smart water technologies are implemented to monitor water quality, allowing the Akimat of the city of Almaty to receive, monitor and analyse real-time data on WWTP performance

## Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Implementation Office for Green Projects | The OGPI will coordinate the implementation of all GCAP actions. |
| Action 23. Feasibility Study for establishment of a biowaste management system and pilot project for green waste composting | Sludge management |
| Action 28. Wastewater collector retrofit | Correlation with main features of the main wastewater collection pipeline |
| Action 30. Green Industrial Innovation Park | Pre-treatment of industrial wastewater |

# Action 30
# Feasibility Study for establishment of a Green Innovation Industrial Park

SO1
SO2
SO3
SO4

| Estimated CAPEX (thousands) | Estimated annual savings |
|---|---|
| 750 EUR | N/A |
| 366,000 KZT | |

| Timeframe | Scale and location |
|---|---|
| 2024–2025 | Former industrial zones |

Potential source of financing

IFIs, Municipal and State budget, Private sector, PPP

Targets

- Annual increase of share of innovative, smart and green business activities in the city; GDP with 3% increase after the first industrial park is operational

Benefits

- Rehabilitation of abandoned industrial zones, thus reducing soil pollution, achieving visual landscaping benefits, improving air and water quality
- Once the industrial park will be functional: new job opportunities for Almaty, citizens, reduced costs for shared facilities, increased resource efficiency, cleaner production, creation of green space in and around the GIIP
- Improved overall quality of urban living

IN

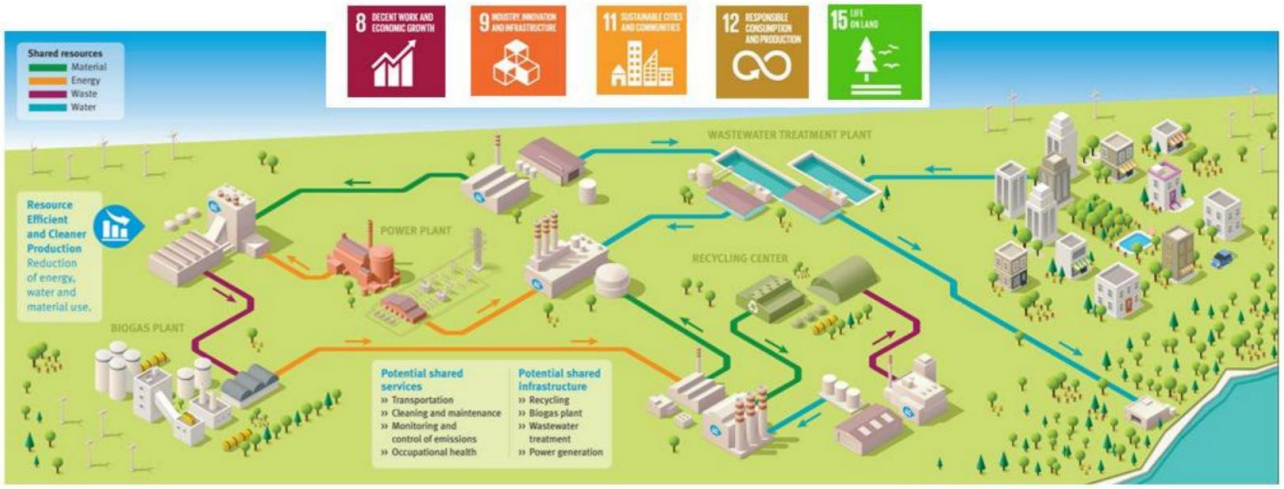
Key stakeholders

Akimat Departments: Ecology and Environment, Entrepreneurship and Investment, Construction, Land Relations; Department of Ecology of Almaty city; Universities in Almaty, Private business investors

## Context and description

Almaty has already some good experience with technological parks. The purpose of this action (on short term) is to develop a feasibility study for establishment of one industrial park where the focus will be on green and smart industrial elements. Once the feasibility study is approved, the next step (on long term) will be the construction of the **Green Innovation Industrial Park (GIIP).** The GIIP will be *an industrial park in which companies cooperate with each other and with the local community to reduce waste and pollution, efficiently share resources and help to achieve sustainable development, with the intention to augment economic gains and improve environmental quality.*[26]

Our vision is to transform one of the former industrial zones that is currently not in use anymore, to rehabilitate it and to repurpose it as a new multifunctional zone, where different companies could operate in a safe and environmentally friendly area, working towards industrial symbiosis. The image below is an example of an eco-industrial park (source: https://ec.europa.eu/jrc/sites/default/files/2017052324-thessaloniki-yvetot.pdf).




GIIP will have multiple benefits for the citizens, companies and the environment. Shared facilities and smart components will reduce the energy consumption of the GIIP. Also, the GIIP will bring additional benefits to the municipality via taxes and other revenues which could be all included in future green investments for the city.

The focus of the new industrial park will be on innovative technologies such as those used in IT sector and digitalization services, energy efficiency appliances, smart metering, recycling, new material development, green packaging, etc. Our aim is to attract investors from all over the world and where the businesses can develop organically bringing benefits to the city and the environment. The GIIP will be designed so that it includes sustainable elements such as: energy production from renewable sources, water harvesting, reusing and saving systems, smart elements related to energy efficiency (lighting, insulation, door openers, etc.), modern and efficient heating and cooling system, waste reduction and reusing (trying to attract investors that can complement each other, so that the lines of productions are trying to reduce waste as much as possible), and other elements to be defined in the feasibility study.

The feasibility study for the new GIIP will be developed considering also the provisions envisaged in the Interregional Plan for the Almaty Agglomeration.

[26] Source: https://www.unido.org/sites/default/files/2017-02/2016_Unido_Global_Assessment_of_Eco-Industrial_Parks_in_Developing_Countries-Global_RECP_programme_0.pdf

### Legal and policy framework

Almaty Development Strategy 2050 – aiming at diversifying the industrial activities in the city and to move the focus from trade to production

Almaty Development Program 2025 – aiming at modernizing the existing industrial enterprises; replacing the old production facilities with more environmentally friendly establishments.

Interregional Action Plan for the Almaty Agglomeration development until 2030. – aiming at establishing different industrial zones in the region.

### Implementation steps

| Step | Estimated timeline |
|---|---|
| 1. Preparing the feasibility study for one GIIP | 12 months (2024–2025) |
| 2. Networking with potential companies and private partners to invest and populate the park | Ongoing during step 1 |
| 3. Prepare and launch the tender documentation for construction of the GIIP | 6 months (2025) |

### Cost estimate

| Parameter | Estimated CAPEX (thousands) | |
|---|---|---|
| | EUR | KZT |
| Feasibility study | 500 | 244,000 |
| Tender documentation for construction of IITP | 250 | 122,000 |

**Estimated yearly OPEX**: Not Applicable

### Smart and digital solutions

Smart elements will be analysed in the feasibility study and included in the tender documentation for construction of the GIIP

### Correlation with other actions

| Action | Explanation |
|---|---|
| Action 1. Implementation Office for Green Projects | The OGPI will coordinate the implementation of all GCAP actions |
| Action 2. Almaty Green Innovation Incubator | Hosting the businesses incubated in the GII |
| Action 6. Almaty CHP-2 modernisation | District heating |
| Action 18. Increasing the water permeability of the city of Almaty | Water permeability measures to be implemented at GIIP |

| | |
|---|---|
| Action 21. Development of an Integrated Waste Management Strategy (IWMS | Reduce, reuse, recycle and prevention of waste |
| Action 24. Feasibility Study for upgrading the existing waste sorting plant towards mechanical biological treatment | RDF used in GIIP |
| Action 27. Development of a water saving plan | Water harvesting solutions |
| Action 29. Feasibility study on WWTP modernization and industrial wastewater treatment options | Pre-treatment of industrial wastewater |

# 6 Summary of GCAP actions and financial details

The central government has a significant role in determining the spending and investment policy of the Akimat of the city of Almaty. According to the Budget Code of the Republic of Kazakhstan, Cities of republican significance, as Almaty, can take credit from the State budget or issue government bonds to domestic market to support housing, employment, national projects (Art. 209). Local governments in Kazakhstan have no right to issue guarantees, which makes government-related entities' debt the only form of contingent liabilities for the city. In 2022 Fitch Ratings has affirmed Almaty's ratings at 'BBB' with Stable Outlook for the period 2021–2025.

The limit of the governmental crediting is defined on an annual basis by the central state planning body in agreement with the budget execution body. The annual amount of debt repayments (principal and interest) cannot exceed 10% of the budget revenues. (Art. 210)

Almaty budget revenue for 2022 is planned at 1.04 trillion KZT or 2 billion EUR. Based on the 2022 planned revenue, it can be defined that annual amount of debt payments cannot exceed 200 million EUR.

GCAP total investment needs are estimated at the amount of over 1.28 billion EUR (about 626.7 billion KZT) for the 2023–2027 period. Almost half of the total estimated CAPEX refers to investments foreseen for modernisation of CHP 2. This amount will be financed via state budget allocations. The other actions will be financed via a mix of sources, which in will include, but not limit to:

- Bonds (green bonds including), for financing investment in energy efficiency of buildings and upgrade of district heating infrastructure,
- IFI or state budget loans, for green public transport, improved water supply and treatment, and waste management,
- Municipal budget, for financing preparation of policy documents, feasibility studies, blue-green infrastructure, cycling and walking lanes, projects that can be implemented step wisely,
- Private sector or private public partnership - for a facility for construction and demolition waste.

The structure of financing is presented on the following graph:

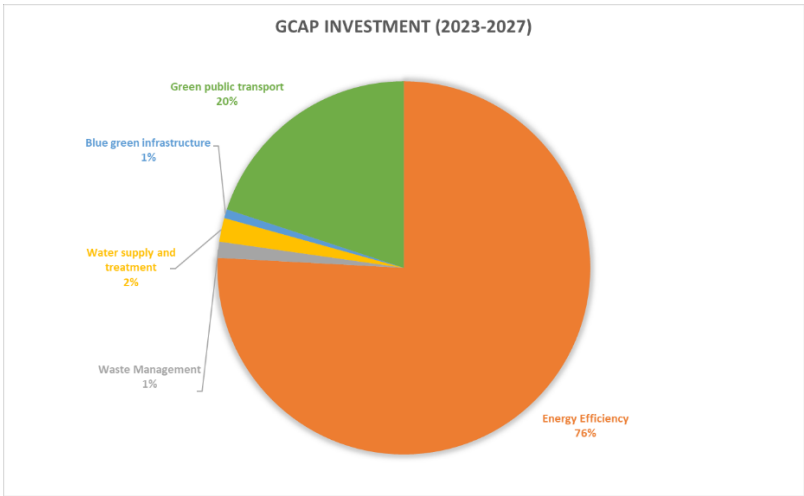



*Figure 9 Structure of GCAP investments (2023–2027)*

Energy efficiency measures will generate substantial annual financial savings, besides benefits in resource savings and reduced GHG emissions.

Municipal annual operating and maintenance costs related to implementation of proposed GCAP measures are estimated as approx. 1 million EUR. Other operating and maintenance costs, approximately 28.8 million EUR, related to GCAP measures in district heating, water services and waste management, public transport are to be recovered by service charges.

| Action no | Title of the action | Total CAPEX [thousands] | Timeline [thousands] | | | | | Yearly OPEX [thousands] | Source of financing |
|---|---|---|---|---|---|---|---|---|---|
| | | | 2023 | 2024 | 2025 | 2026 | 2027 | | |
| 1. | Akimat Office for Green Project implementation | € 165 | € 165 | – | – | – | – | € 20 | MB, IFIs, BDA |
| | | ₸ 80,520 | ₸ 80,520 | – | – | – | – | ₸ 9,760 | |
| 2. | Almaty Green Innovation Incubator | € 100 | – | € 100 | – | – | – | € 100 | MB, PS |
| | | ₸ 48,800 | – | ₸ 48,800 | – | – | – | ₸ 48,800 | |
| 3. | Citywide digital twin | € 5,000 | – | € 250 | € 2,000 | € 2,750 | – | € 500 | IFI, SB, MB |
| | | ₸ 2,440,000 | – | ₸ 122,000 | ₸ 976,000 | ₸ 1,342,000 | – | ₸ 244,000 | |
| 4. | Energy Efficiency Programme for public buildings and facilities | € 37,650 | – | € 5,300 | € 10,000 | € 10,000 | € 12,350 | savings | IFI, MB |
| | | ₸ 18,373,200 | – | ₸ 2,586,400 | ₸ 4,880,000 | ₸ 4,880,000 | ₸ 6,026,800 | savings | |
| 5. | Residential buildings retrofit programme | € 22,665 | € 165 | € 4,500 | € 4,500 | € 4,500 | € 9,000 | savings | PS, IFI, BDA, MB |
| | | ₸ 11,060,520 | ₸ 80,520 | ₸ 2,196,000 | ₸ 2,196,000 | ₸ 2,196,000 | ₸ 4,392,000 | savings | |
| 6. | Almaty CHP-2 modernisation | € 630,000 | – | € 25,000 | € 50,000 | € 50,000 | € 505,000 | € 15,000 | SB, IFI |
| | | ₸ 307,440,000 | – | ₸ 12,200,000 | ₸ 24,400,000 | ₸ 24,400,000 | ₸ 246,440,000 | ₸ 7,320,000 | |
| 7. | Rehabilitation and modernisation of the District Heating (DH) infrastructure | € 220,100 | – | € 5,000 | € 30,000 | € 50,000 | € 135,100 | € 6,500 | IFI, MB, SB |
| | | ₸ 107,408,800 | – | ₸ 2,440,000 | ₸ 14,640,000 | ₸ 24,400,000 | ₸ 65,928,800 | ₸ 3,172,000 | |
| 8. | Heat pumps and solar heating programme for residential buildings which are in areas not connected to DH | € 3,800 | € 50 | € 750 | € 1,200 | € 1,400 | € 400 | € 10 | IFI, PS |
| | | ₸ 1,854,400 | ₸ 24,400 | ₸ 336,000 | ₸ 585,600 | ₸ 683,200 | ₸ 195,200 | ₸ 4,880 | |
| 9. | Development of the Almaty Smart Grid Programme and pilot project implementation | € 1,000 | – | – | € 200 | € 400 | € 400 | € 35 | IFIs, MB, PS |
| | | ₸ 488,000 | – | – | ₸ 97,600 | ₸ 195,200 | ₸ 195,200 | ₸ 17,080 | |

| Action no | Title of the action | Total CAPEX [thousands] | Timeline [thousands] | | | | | Yearly OPEX [thousands] | Source of financing |
|---|---|---|---|---|---|---|---|---|---|
| | | | 2023 | 2024 | 2025 | 2026 | 2027 | | |
| 10. | Transit Oriented Development (TOD) – Applying TOD in satellite city development | € 500 | € 250 | € 250 | – | – | – | N/A | MB, SB, IFI |
| | | ₸ 244,000 | ₸ 122,000 | ₸ 122,000 | – | – | – | N/A | |
| 11. | Connecting different transport modes: multimodal hubs | € 445 | € 100 | € 245 | € 100 | – | – | € 80 | MB, IFI, SB |
| | | ₸ 217,160 | ₸ 48,800 | ₸ 119,560 | ₸ 48,800 | – | – | ₸ 39,040 | |
| 12. | Increase the visibility of school areas in the city | € 1,000 | € 200 | € 400 | € 400 | – | – | € 40 | MB, SB, IFI |
| | | ₸ 488,000 | ₸ 97,600 | ₸ 195,200 | ₸ 195,200 | – | – | ₸ 19,520 | |
| 13. | Creating enjoyable cycling and walking routes | € 21,750 | € 750 | € 5,000 | € 5,000 | € 5,000 | € 6,000 | € 200 | MB, IFI, SB |
| | | ₸ 10,614,000 | ₸ 366,000 | ₸ 2,440,000 | ₸ 2,440,000 | ₸ 2,440,000 | ₸ 2,298,000 | ₸ 97,600 | |
| 14. | Development of high-performance public transport network | € 277,800 | € 800 | € 50,000 | € 100,000 | € 52,000 | € 75,000 | € 5,556 | IFI, MB, SB, PPP |
| | | ₸ 135,566,400 | ₸ 390,400 | ₸ 24,400,000 | ₸ 48,800,000 | ₸ 25,376,000 | ₸ 36,600,000 | ₸ 2,711,328 | |
| 15. | Establishment of Low Emissions Zones | € 10,600 | – | – | € 500 | € 5,000 | € 5,100 | Savings | MB, SB, IFI |
| | | ₸ 5,172,800 | – | – | ₸ 244,000 | ₸ 2,440,000 | ₸ 2,488,800 | Savings | |
| 16. | Reaching a city-wide Blue and Green Strategy and Implementation Plan | € 180 | – | € 80 | € 100 | – | – | N/A | MB, IFI |
| | | ₸ 87,840 | – | ₸ 39,040 | ₸ 48,800 | – | – | N/A | |
| 17. | Implementing priority blue green infrastructure projects at the district level | € 2,280 | – | – | € 280 | € 1,000 | € 1,000 | € 20 | MB, IFI |
| | | ₸ 1,112,640 | – | – | ₸ 136,640 | ₸ 488,000 | ₸ 488,000 | ₸ 9,760 | |
| 18. | Increasing the water permeability of the city of Almaty | € 825 | – | € 200 | € 200 | € 200 | € 225 | € 10 | IFIs, MB, PS |
| | | ₸ 402,600 | – | ₸ 97,600 | ₸ 97,600 | ₸ 97,600 | ₸ 109,800 | ₸ 4,880 | |

| Action no | Title of the action | Total CAPEX [thousands] | Timeline [thousands] | | | | | Yearly OPEX [thousands] | Source of financing |
|---|---|---|---|---|---|---|---|---|---|
| | | | 2023 | 2024 | 2025 | 2026 | 2027 | | |
| 19. | Preventing and curing landslide-prone situations | € 5,970 | € 150 | € 420 | € 1,500 | € 1,500 | € 2,400 | € 165 | MB, IFI |
| | | ₸ 2,913,360 | ₸ 73,200 | ₸ 204,960 | ₸ 732,000 | ₸ 732,000 | ₸ 1,171,200 | ₸ 80,520 | |
| 20. | Awareness raising and education centre for landslide prevention | € 110 | € 25 | € 25 | € 25 | € 25 | € 10 | € 3.3 | MB, IFI |
| | | ₸ 53,680 | ₸ 12,200 | ₸ 12,200 | ₸ 12,200 | ₸ 12,200 | ₸ 4,480 | ₸ 1,610.4 | |
| 21. | Development of an Integrated Waste Management Strategy (IWMS) | € 150 | € 50 | € 100 | – | – | – | N/A | MB, IFI |
| | | ₸ 73,200 | ₸ 24,400 | ₸ 48,800 | – | – | – | N/A | |
| 22. | Establishment of a construction and demolition waste (CDW) recycling facility | € 7,000 | – | € 200 | € 3,400 | € 3,400 | – | € 210 | PS, PPP, IFI |
| | | ₸ 3,416,000 | – | ₸ 97,600 | ₸ 1,659,200 | ₸ 1,659,200 | – | ₸ 102,480 | |
| 23. | Feasibility Study for establishment of a biowaste management system and pilot project for green waste composting | € 2,800 | € 300 | € 500 | € 1,500 | € 500 | – | € 300 | MB, IFI |
| | | ₸ 1,366,400 | ₸ 146,400 | ₸ 244,000 | ₸ 732,000 | ₸ 244,000 | – | ₸ 146,400 | |
| 24. | Feasibility Study for upgrading the existing waste sorting plant | € 300 | – | € 150 | € 150 | – | – | N/A | IFI, PS, PPP |
| | | ₸ 146,400 | – | ₸ 73,200 | ₸ 73,200 | – | – | N/A | |
| 25. | Implementation of separate waste collection system for dry recyclables | € 6,500 | € 3,000 | € 3,500 | – | – | – | € 650 | IFI |
| | | ₸ 3,172,000 | ₸ 1,464,000 | ₸ 1,708,000 | – | – | – | ₸ 317,200 | |
| 26. | Developing a leakage reduction programme for drinking water supply | € 2,100 | – | € 1,000 | € 1,000 | € 100 | – | € 500 | IFI |
| | | ₸ 1,024,800 | – | ₸ 488,000 | ₸ 488,000 | ₸ 48,800 | – | ₸ 244,000 | |
| 27. | Development of a water saving plan | € 380 | € 100 | € 280 | – | – | – | N/A | IFI, MB |
| | | ₸ 185,440 | ₸ 48,800 | ₸ 136,640 | – | – | – | N/A | |

| Action no | Title of the action | Total CAPEX [thousands] | Timeline [thousands] | | | | | Yearly OPEX [thousands] | Source of financing |
|---|---|---|---|---|---|---|---|---|---|
| | | | 2023 | 2024 | 2025 | 2026 | 2027 | | |
| 28. | Wastewater collector retrofit | € 22,110 | € 150 | € 7,320 | € 7,320 | € 7,320 | – | € 24 | IFI |
| | | ₸ 10,789,680 | ₸ 73,200 | ₸ 3,572,160 | ₸ 3,572,160 | ₸ 3,572,160 | – | ₸ 11,712 | |
| 29. | Feasibility study on WWTP modernization and industrial wastewater treatment options | € 250 | – | € 125 | € 125 | – | – | N/A | MB, IFI |
| | | ₸ 122,000 | – | ₸ 61,000 | ₸ 61,000 | – | – | N/A | |
| 30. | Feasibility Study for establishment of a Green Industrial Innovation Park (GIIP) | € 750 | – | € 500 | € 250 | – | – | N/A | IFI, MB, SB, PS, PPP |
| | | ₸ 366,000 | – | ₸ 244,000 | ₸ 122,000 | – | – | N/A | |
| | **TOTAL:** | **€ 1,284,280** | **€ 6,255** | **€ 111,195** | **€ 219,750** | **€ 195,095** | **€ 751,985** | **€ 29,923** | |
| | | **₸ 626,728,640** | **₸ 3,052,440** | **₸ 54,263,160** | **₸ 107,238,000** | **₸ 95,206,360** | **₸ 366,968,680** | **₸ 14,602,570** | |

**Legend:**

€ EUR

₸ KZT (Kazakhstani Tenge)

BDA Bilateral development agencies

IFI International Financing Institution

MB Municipal budget

PPP Public-private partnership

PS Private sector

SB State budget

Almaty
Green City Action Plan

# Section 3 Monitoring, reporting and verification

# 7 Monitoring framework, evaluation and reporting

**Monitoring**

Monitoring and evaluation of GCAP is designed to understand and assess the results and outcomes of implementing the plan. It aims at identifying the most effective actions and informing the implementation team on how to adjust the ones that are not bringing enough results. The main purpose is to measure the impact GCAP actions have over the quality of environmental factors in Almaty. Also, it measures the progress towards achieving the established targets for each action. Furthermore, the monitoring system and the evaluations will give the possibility to understand the progress towards achieving the goals of the Almaty Agglomeration. Thus, both progress and impact of implementation will be monitored. The rationale behind the monitoring framework (Annex 1. Monitoring framework for GCAP implementation) is presented in the figure below.


A total number of 112 indicators have been identified for monitoring the GCAP implementation process. Out of these, 82 are progress indicators and 30 are impact indicators. Each overarching indicator is referring to all strategic objectives due to the synergy between the vision, strategic objectives and actions defined within this GCAP.

The monitoring tool includes 3 main spreadsheets presenting the monitoring and evaluation indicators. The first spreadsheet includes the overarching indicators (3) that are aligned with the vision and the strategic objectives.

The second spreadsheet refers to environmental indicators that must be monitored during GCAP implementation (30).

In case the implementation process starts for one action, then the supplementary indicators included in the third spreadsheet (82) will be used. All the indicators will enable us to understand the progress and impact of each action. For each of the action's target we have defined the format and measurement unit in which the data should be collected and processed in order to adequately monitor how the implementation of the GCAP is influencing the development of the city in relation with the environmental factors.

The Monitoring framework for GCAP implementation is a dynamic tool and allows tracking down the progress in implementation of each action.

**Evaluation and reporting**

The GCAP implementation will be closely monitored and evaluated by the Akimat Office for Green Projects Implementation (Action 1).

The OGPI will compile all the data received from sectoral departments and will produce an annual progress report for the GCAP implementation period. A summary of this report will be also made available to the public.

The monitoring of GCAP implementation process is intricate and will require additional training and support during the first two years of implementation. Thus, an engagement of an external consultant was foreseen in order to support the OGPI with the specific monitoring tasks, as well as optimizing the data collections sheets.

Additionally, two types of audits are foreseen during the first 5-year period of GCAP implementation:

- Internal audits – yearly, based on internal procedures. This will focus on understanding whether the internal procedures have been properly followed and if the specific established targets at the level of the Akimat have been reached.
- Third party audit – once in 5 years – this will focus on conducting a full assessment of GCAP implementation process, taking into consideration all elements, such as: technical, financial aspects and utilization of resources.

Almaty
Green City Action Plan


EBRD

Maira Karassayeva
Operational Leader

KarassaM@ebrd.com
www.ebrdgreencities.com

RWA – Arcadis

Reka Soos
Team Leader

reka@rwagroup.net
www.rwagroup.net

EcoSocio Analysts

Nargiza Ospanova
Local Project Coordinator

NOspanova@ecosocioanalysts.kz
www.ecosocioanalysts.kz