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ALBA IULIA

Alba Iulia

Green City Action Plan



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Message of the Mayor



Dear citizens of Alba Iulia,

I am honoured to share with you a significant step forward in shaping the future of our beloved city. Together, through dialogue, collaboration, and shared vision, we have developed ***the Green City Action Plan*** *— a comprehensive initiative that sets the foundation for a healthier, more sustainable, and more vibrant Alba Iulia.*

This plan is the result of months of joint effort, involving not only local authorities but also community members, businesses, and institutions. Your input, ideas, and concerns have been invaluable in creating a strategy that reflects the real needs and aspirations of our community. Through public consultations, stakeholder workshops, and participatory planning, we have crafted a roadmap that prioritises clean mobility, green public spaces, energy efficiency, waste reduction, and a smart, inclusive urban environment.

Our goal is clear: to enhance the quality of life for all residents, attract responsible investment, and position Alba Iulia as a leading destination for sustainable tourism. We envision a city where green spaces are accessible to all, where streets are safe and walkable, where innovation meets tradition, and where economic development goes hand in hand with environmental stewardship.

Implementing the Green City Action Plan is not just a policy commitment — ***it is a shared civic journey.***

I invite every citizen, institution, and business to take part in this transformation. Your continued commitment will ensure that our city grows not only in size and opportunity but in harmony and resilience.

Together, we are ***building a greener, cleaner, and more liveable Alba Iulia*** *— for ourselves and for generations to come.*

Gabriel Pleșa

Mayor of Alba Iulia

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Acronyms

AIDA-TL	Intercommunity Development Association of Alba for Local Public Transport
BEMS	Building Energy Management System
BESS	Battery Energy Storage System
CAPEX	Capital Expenditure
CCAMAP	Climate Change Adaptation and Mitigation Action Plan
CCTV	Video surveillance (closed-circuit television)
CDW	Construction and Demolition Waste
CEAP	Circular Economy Action Plan
EBRD	European Bank for Reconstruction and Development
EE	Energy Efficiency
EPA	Environmental Protection Agency
EU	European Union
EV	Electric vehicle
GCAP	Green City Action Plan
GHG	Greenhouse Gas Emission
GIS	Geographic Information System
GUP	General Urban Plan
HP	Heat Pump
HVAC	Heating, Ventilation & Air Conditioning
IFI	International Financing Institution
IoT	Internet-of-Things
IUDS	Integrated Urban Development Strategy

IWMC	Integrated Waste Management Centre
LED	Light-emitting diode (fixture)
MaaS	Mobility-as-a-Service
MBT	Mechanical Biological Treatment
MCC	Mobility Coordination Centre
MSW	Municipal Solid Waste
MVES	Multi-vector Energy Storage (System)
NBS	Nature-based Solution
NDC	Nationally Determined Contribution
NRRP	National Recovery and Resilience Plan
NzEB	Nearly zero Energy Building
OPEX	Operational Expenditure
PAYT	Pay-As-You-Throw
P&R	Park&Ride
PPP	Public-private Partnership
PT	Public Transport
REC/CEC	Citizen Renewable Energy Community
RES	Renewable Energy Sources
SCADA	Supervisory control and data acquisition
SDG	Sustainable Development Goals
SECAP	Sustainable Energy and Climate Action Plan of Alba Iulia
SO	Strategic Objective
STP	Public Transport Association Alba Iulia
SUDS	Sustainable Urban Drainage System
SUMP	Sustainable Urban Mobility Plan
WCI	Waste Collection Island
WEEE	Waste from electrical and electronic equipment
WWTP	Wastewater Treatment Plant

Executive summary

Alba Iulia is the capital city of Alba County. Situated in the central part of Romania, and hosting a population of approximately 75,000 people, the city has a **rich historical heritage intertwined with bold initiatives aiming for a contemporary development**. The transformation of Alba Iulia, progressing from a simple Neolithic settlement to a thriving modern urban centre, was undeniably shaped by its highly advantageous geographical and strategic position. Overlooking the Mureș Valley and situated at the convergence of the Ampoiului and Sebeș valleys, close to the Metaliferi Mountains, the city has consistently leveraged the benefits of its location and the wealth of natural resources in the surrounding area. Diverse and easily accessible routes extending in all directions contributed significantly to propelling the city into a political, administrative, cultural, military, and economic centre.

The European Bank for Reconstruction and Development (EBRD) Green Cities is an urban sustainability programme, with a financing volume of seven billion euros, launched in 2016 to address environmental challenges in urban areas. **Alba Iulia has joined the EBRD's Green Cities Programme in August 2023**, becoming the fifth city in Romania to step into the Bank's flagship programme that aims to assist cities in identifying and addressing their urban development challenges.

The ambition of the Municipality is to transform Alba Iulia into a smart, sustainable, and distinctive urban environment—one that honours its rich cultural heritage while embracing innovation to address current and future challenges. This transformation is rooted in a strong commitment to preserving the city's historical identity, ensuring that growth and modernisation enhance rather than diminish its unique cultural character. **The present Green City Action Plan (GCAP) serves this ambition and will address in a systemic manner the existing environmental and urban development challenges, while also addressing the Municipality's social concerns, including gender aspects**. It aims to provide input to optimise the city's financial and personnel capacity. It has been developed by the Municipality of Alba Iulia, together with the consultant consortium of RWA Group and Arcadis, under the close guidance of EBRD London and Bucharest team. The GCAP development process followed the EBRD methodology, which starts with a comprehensive assessment of the state of the urban environment and examines the pressures on the environment coming from seven sectors: transport, energy, buildings, industry, water, waste and land use.

The Municipality' strategic direction aligns with the **vision of the GCAP**:

People daring to act for sustainability

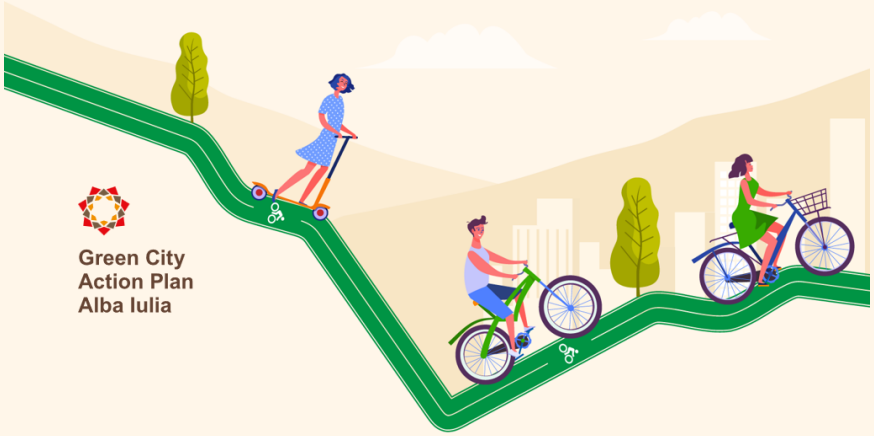


Figure 1 The vision of the Green City Action Plan

This vision reflects a belief that real, lasting change begins with empowered individuals and communities who are motivated to make a difference. In this vision, Alba Iulia is a model of how heritage and innovation can coexist, and how people can drive a collective endeavour toward a more sustainable and vibrant urban future. Four **strategic objectives** have been defined to serve the fulfilment of this vision:

Table 1 The strategic objectives guiding the Green City Action Plan



SO 1	Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level
SO 2	Increasing the efficiency of local resources for integrated and climate neutral development
SO 3	Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to needs regarding housing, leisure, digitalization and innovation are incorporated in an organic manner
SO 4	Enhancing the attractiveness of the city for tourists, by creating adequate infrastructure and diverse offers of sustainable tourism

The **GCAP outlines 23 actions** across the seven targeted sectors, focusing on sustainable mobility, resource use, circular economy, and energy efficiency. These interconnected actions aim to improve quality of life for residents and visitors.

Total investment needs established by the GCAP for the 2026–2030 period are estimated at the amount of approximately EUR 228.8 million. Transport, Energy and Buildings and Water Sectors are the ones where most of this budget will be directed. The total annual greenhouse gas (GHG) emission reduction resulting from the implementation of the GCAP short-term actions is estimated at approximately 17.350 tCO_2eq per year.

The table below provides an **overview of the 23 actions per sector**, highlighting the required investment costs, the estimated GHG reductions, and the implementation timeline.

Table 2 Overview of GCAP actions – investment needs, GHG savings and implementation timeline

SECTOR	ACTION	CAPEX (EUR)	Estimated GHG savings tCo_2/y	Timeline 26	27	28	29	30
IN Industry	1. Alba Iulia – more visitors and longer, sustainable stays	11,500,000	147	■	■	■		
	2. Incentivise green technologies and sustainable industrial practices	500,000	4,674.05	■	■			
	3. Partnerships with the private sector for new green industrial areas	4,000,000	N\A	■	■	■	■	
LU Land use	4. From street and district-level nature-based solutions to city-scale climate resilience	13,400,000	98.56	■	■	■	■	■
	5. Rehabilitate riverbanks for slow mobility and leisure	4,150,000	157.20	■	■	■	■	■
	6. Nature and blue small infrastructure for thriving communities	1,700,000	280	■	■	■	■	■
	7. Test and adopt regulations for blended green and social infrastructure design	7,300,000	20	■	■	■	■	■
WA Water	8. City-wide implementation of smart water network management and metering	2,500,000	57.77	■	■			
	9. Energy efficiency measures and integration of renewable energy sources in the water sector	6,100,000	46.21	■	■	■	■	■
	10. Water stewardship and cultural heritage-led urban regeneration	4,150,000	620.77			■	■	■
	11. Rehabilitation and extension of the water and wastewater network	32,000,000	38.51	■	■	■	■	■
TR Transport	12. Enhancing public transport sustainability with bus upgrades, network expansion, and tariff reform	23,785,000	306.6	■	■	■		
	13. Integrated measures for enhanced pedestrian, road, cycling, and public transport infrastructure	12,650,000	N\A	■	■	■	■	■
	14. Safe and efficient cycling network	32,820,000	344.99	■	■	■	■	■
	15. Construction of a Park&Ride facility and green multimodal mobility corridor	6,610,000	5	■	■	■		
WS Waste	16. Expansion, digitalisation and introduction of a comprehensive monitoring and control system to the Waste Collection Islands network	3,000,000	N\A	■	■			
	17. Material circularity and introduction of Pay-As-You-Throw system	1,500,000	3,839.43		■	■		
	18. Upgraded management practices for textile and organic waste fractions	1,620,000	91.24	■	■			
EN Energy	19. Citizen Energy Community microgrids and small scale / decentralised renewable energy sources	7,500,000	1,949.36	■	■	■	■	■
	20. Installation of integrated multi-vector energy storage systems	2,000,000	N\A		■	■	■	■
BD Buildings	21. Energy efficiency in public buildings	20,250,000	202.66	■	■	■	■	■
	22. Energy efficiency programme in residential/private buildings	28,800,000	3,933.67	■	■	■	■	■
	23. Smart and efficient public lighting	1,050,000	537.89	■	■	■		
	TOTAL COSTS	**228,885,000**	**17,350.92**					

City context and GCAP development

01

Introduction

EBRD Green Cities is an urban sustainability programme launched in 2016 to address environmental challenges in urban areas and has since invested EUR 7 bn in combined EBRD and donor finance. More than 50 cities in the EBRD's countries of operation are currently participating in the programme by developing and further implementing Green City Action Plans (GCAP). The GCAP development methodology follows a systematic and highly consultative approach.

The aim of the GCAP for the city of Alba Iulia is to address the existing environmental and urban development challenges in a systematic way, while considering its social concerns, including gender equality and access to equal opportunities.

The figure below outlines the main steps in the GCAP development process and the related outputs. It is to be noted that the reports developed within the Green City Baseline phase of the project (Indicator Database, Technical Assessment, Risk and Vulnerability Assessment, Smart Maturity Assessment), respectively the Policy and Urban Framework Report and the Gender Assessment Report are stand-alone documents available on the website of the Municipality. Chapters 1-4 of this GCAP rely on the main findings detailed in those reports.



Figure 2 GCAP development process

The ambition of the Municipality is to transform Alba Iulia into a smart, sustainable, and distinctive urban environment, one that honours its rich cultural heritage while embracing innovation to address current and future challenges. This transformation is rooted in a strong commitment to preserving the city's historical identity, ensuring that growth and modernisation enhance rather than diminish its unique cultural character. The Municipality is committed to continuously encourage active participation from citizens, businesses, and institutions in shaping Alba Iulia's future.

This strategic direction aligns with the **city's vision of "People daring to act for sustainability"**. It reflects a belief that real, lasting change begins with empowered individuals and communities who are motivated to make a difference—whether through greener mobility choices, supporting local initiatives, or engaging in responsible urban planning. In this vision, Alba Iulia becomes not just a place to live, but a model of how heritage and innovation can coexist, and how people can drive a collective movement toward a more sustainable and vibrant urban future.

General overview of the city

Alba Iulia, situated in the central part of Romania, has a rich historical heritage intertwined with its contemporary development. The city's population has steadily increased, with recent figures reflecting a rise attributed to various factors, including the establishment of the 1 Decembrie 1918 University and the growing tourism sector, strengthened by the restoration of the Alba Carolina Fortress, an attractive location for events catering to both the local community and tourists.

Highlights

The transformation of Alba Iulia, progressing from a simple Neolithic settlement to a thriving modern urban centre, was shaped by its highly advantageous geographical and strategic position. Overlooking the Mureș Valley and situated at the convergence of the Ampoiului and Sebeș valleys, close to Metaliferi Mountains, the city has consistently leveraged the benefits of its location and the wealth of natural resources in the surrounding area. Diverse and easily accessible routes extending in all directions contributed significantly to propelling the city into a political, administrative, cultural-historical, military, and economic centre. The city benefits from its proximity to the A10 highway towards Cluj-Napoca, A1 towards Sibiu and Bucharest, electrified railway connectivity, with airports in Sibiu and Cluj within approximately one hour drive.

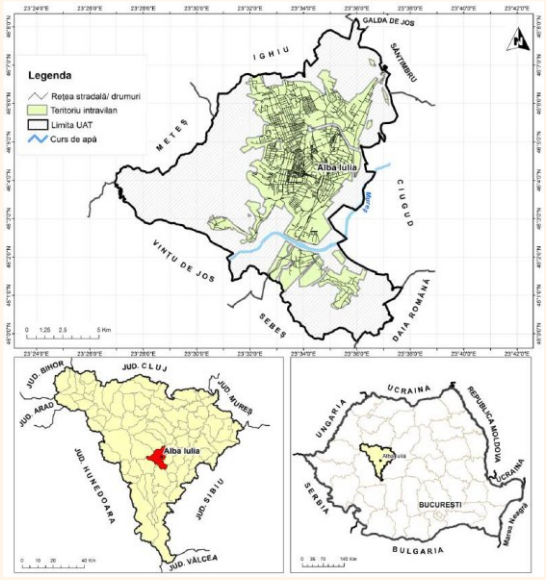


Figure 3 Geographical location of Alba Iulia
Source: IUDS, 2021-2030

Alba Iulia is the capital city of Alba County and the most developed city within the Alba Iulia Metropolitan Area. The Metropolitan Area includes the city of Alba Iulia itself and 22 neighbouring Administrative Territorial Units. The Integrated Urban Development Strategy (IUDS) for Alba Iulia Municipality, 2021-2030, clearly delineates a functional urban area, encompassing the city of Alba Iulia and 15 of the municipalities in the metropolitan area.

While the city acknowledges the central role it has in the development of the entire metropolitan area, the developed Alba Iulia GCAP refers only to the administrative area of the city itself in terms of detailed data collection and planning. The actions, however, have been conceived keeping in mind the overall goal for an integrated and cohesive development in the metropolitan area.

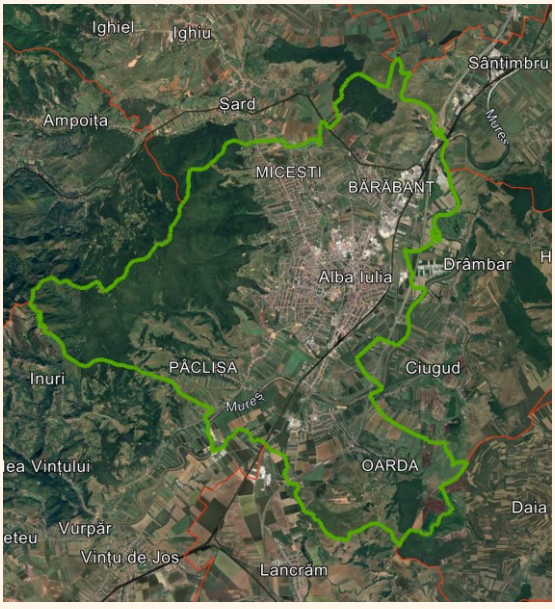


Figure 4 City boundaries

Demographic, social, and gender aspects

The city of Alba Iulia hosts a population of 74,342 persons according to 2024 estimates of the National Statistics Institute (NIS), showing an increase of 1.5% since the 2011 national census, when the population was counted at 73,229 persons.

The majority of the population of Alba Iulia falls within the 15-64 age bracket, the city presenting a proportion of non-working-age people (dependents) compared to the working-age population (dependency ratio) of 48.6%, in line with the national average of 48.1%. This can be considered a moderate dependency burden, but the presence of a slightly higher percentage of elderly population may signal future challenges in pension systems, healthcare costs, and potential labour shortages.

Alba Iulia has a **diverse ethnic and religious composition** reflective of its rich cultural heritage. Ethnically, the majority of the population identifies as Romanian. Nevertheless, the city is also home to ethnic Hungarians, Roma, and a small number of Germans. Each group contributes to the cultural mosaic of the region. This blend of cultures and faiths is historically rooted in Alba Iulia's role as a key political and cultural centre, particularly during its time as the capital of the Principality of Transylvania and its symbolic significance in Romania's history.

Alba Iulia, while being a historically significant and culturally rich city, faces **complex social and gender inclusion challenges**

Gender equality remains a challenge in representation and access to resources. While the overall workforce in the Municipality institutions is relatively balanced, there is a slight gender disparity in leadership roles, with women holding 12 out of 30 managerial positions. Significant gendered divisions exist in employment sectors; traditionally higher paying sectors like energy and construction are male dominated (men make up 75% of the workforce in the water, waste and energy sectors, and 67% in industry), limiting women's access to these opportunities. Conversely, women are overrepresented in lower paid sectors like education, health, and hospitality. A persistent cross-sectoral gender pay gap exists in Alba County, estimated at 5% in 2023, but it is significantly higher in sectors like manufacturing (20.3%) and trade (12%), often attributed to men occupying more managerial and highly skilled positions. Addressing deeply entrenched gender stereotypes and discrimination, along with systemic barriers like limited access to professional development for women, are key challenges.

In addition to gender disparities, social issues are intertwined with systemic barriers, socio-economic disparities, and historical patterns of marginalisation, particularly affecting underserved groups such as Roma women, the elderly, children in need, and individuals with disabilities. The socio-economic and demographic profile of the city underscores these challenges, emphasising the need for targeted interventions across key sectors. In this context, some of the most pressing social challenges faced by the city are the following:

- The ***marginalised community of Lumea Nouă***, where inadequate access to public utilities, informal housing, and limited educational opportunities perpetuate cycles of poverty and exclusion. Roma women in this area face discrimination based on ethnicity and gender, experiencing higher rates of unemployment, limited healthcare access, and vulnerability to domestic violence.
- ***Elderly women***, constituting 57.7% of the senior population, encounter gender-specific challenges such as financial insecurity due to pension gaps, lack of gender-sensitive healthcare, and heightened social isolation. Despite their significant demographic representation, there are limited tailored policies addressing their unique needs.

- ***Children, particularly those from low-income families***, face risks of school dropout, lack of access to quality education, and vulnerability to domestic violence or neglect. Although programmes like "Second Chance" aim to address these issues, more extensive systemic support is needed.
- ***Persons with disabilities*** often struggle with inadequate infrastructure and limited access to specialised services, particularly for mental health support, revealing gaps in service provision and community integration efforts.
- ***There is a clear need to develop a coherent and reliable database with social indicators at the city level***, including gender-segregated data.

To address the gender and social inclusion challenges, each action within the current GCAP has embedded the recommendations formulated in the Gender and Social Inclusion Report. The cross-sectoral recommendations emphasise the creation of job opportunities for all groups, free from discrimination and provision of access to economic opportunities as well as the implementation of the services-for-all principle. They stress the importance of informing, consulting, and engaging vulnerable groups like youth, the elderly, and minorities during the implementation of GCAP actions. Furthermore, Alba Iulia Municipality is actively engaged in supporting the young generation to develop competencies that will enable them to be competitive on the labour market. The current initiatives—especially the one related to the development of a Dual Campus for vocational training—will be continued and additional investments will be prepared in order to support the young generation. A key recommendation is the adoption and incorporation of gender equality principles into all municipal public policies and internal operational procedures, including promoting gender equality in decision-making and encouraging gender-sensitive data gathering across all sectors.

Policy landscape

The Municipality is engaged in a series of sustainable development projects and initiatives, including membership in various international organisations, and is a signatory to agreements like the Covenant of Mayors on Climate and Energy. The Municipality is actively pursuing a comprehensive approach to environmental sustainability, encompassing various sectors and initiatives to create a resilient and vibrant community. It performs a continuous monitoring of project progress since 2007 through the website https://proiecte.apulum.ro/, documenting a total of 157 projects with a combined grant funding of approximately EUR 300 million.

Besides EU, national and regional regulations, such endeavours are enabled by a series of local policies, of which the most important, along with their relevance for this GCAP, are listed below:

Table 3 Overview of the most relevant policies for GCAP Alba Iulia

Policy	Relevant aspects
Integrated Urban Development Strategy (IUDS) 2021–2030	It coordinates sectoral policies, including economy, transport and environment, and highlights priority investment projects such as the promotion of energy efficiency in buildings, street lighting, etc. It determines a set of measures, including the expansion of peri-urban forest areas in the upcoming years and a range of projects related to biodiversity to be developed between 2022 and 2030, demonstrating a holistic approach to environmental conservation.
General Urban Plan (GUP) (2012–2022, approved in 2014, currently in the process of updating)	The document outlines the Municipality's long-term development objectives. It has both a strategic and a regulatory character and is the main operational planning tool, forming the legal basis for the implementation of development programmes. The GUP should be updated every 10 years, depending on the evolution of social, geographical, economic, cultural factors and local needs. It proposes measures for the rehabilitation, protection and conservation of the

Policy	Relevant aspects
	environment, through the rehabilitation of existing parks and squares. The establishment of new green spaces aligned to the architectural style of the large blocks of flats and the specifics of the neighbourhoods of individual homes is also proposed through this document. It highlights the presence of technological risk areas producing soil pollution.
Air Quality Maintenance Plan in Alba County for 2021–2025	The plan foresees specific measures to reduce air pollution, i.e. PT system improvements, advancing energy efficiency in public buildings, etc.
Alba Iulia Municipality Sustainable Energy and Climate Action Plan (SECAP) 2030	The document foresees a set of measures, including the purchase of 13 electric buses and 17 charging stations in order to green the PT system. This action has already been concluded. In addition, it foresees a project currently under implementation, namely the purchase of 21 electric buses and 6 electric microbuses, intended to be delivered between September 2025 and June 2026. It presents a list of actions (some currently under implementation, others as proposals) for sustainable energy (climate change mitigation related), municipal buildings, tertiary buildings (industrial, commercial), residential buildings, public lighting, transport, local energy production from RES and several others, accounting for a total implementation cost of approx. 200 million EUR. It highlights the objective of securing grant funding for significant investment projects with the aim of augmenting green spaces within urban areas dominated by concrete structures. The plan includes a comprehensive Action Plan for climate change adaptation as well, with a list of 20 actions, some of which are currently undergoing implementation, the others being proposals. Some of the actions are listed below: • A 3-million-euro framework project for building a photovoltaic (PV) park through a PPP (public-private partnership) • Application to national programmes Green House and Green House Plus for public buildings • Implementation of smart metering systems for electricity and heat in buildings • Thermal rehabilitation of commercial buildings and offices (approx. 400 buildings) • Energy production from biogas from wastewater treatment plants (WWTP) and sewage treatment plants • Implementation of cogeneration projects for the production of thermal/electrical energy using biomass to supply energy to important tertiary buildings
Mobility and Connectivity Strategy for Alba County, 2022–2027	The most relevant measures for the GCAP are the development of the infrastructure for alternative fuels, including electric vehicle (EV) charging stations, the modernisation of the PT fleet, the establishment of partnerships for the development of intermodal public passenger transport terminals, and the development of sustainable urban mobility corridors.
Sustainable Urban Mobility Plan for Alba Iulia Municipality (SUMP), 2024	The plan indicates a series of measures, the most relevant for the GCAP being the following: • Purchase of EV for the PT fleet • Local Action Plan for the implementation of the use of EV, including for private companies • Adapting taxi licensing regulations in line with the needs of people with disabilities and environmental impact reduction targets

Policy	Relevant aspects
	• Development of residential car parks and rehabilitation of existing ones • Traffic management through sustainable urban mobility
Smart City Strategy for Alba Iulia Municipality, 2021–2030	It is the most important policy guiding the future urban digitalisation process. Its role is to facilitate the local community through the evolutionary iterations of the four levels of the trajectory of smart communities in the perspective of a lasting and sustainable development, namely: (1) the level of Digital City; (2) Smart City level; (3) the level of Intelligent City and (4) the most advanced level of Brained City ("Cognitive City").
Alba County Waste Management Plan 2020-2025	The most important measures are the following: • Reducing the amount of household and similar waste generated per capita in 2025 by at least 10% compared to 2017 • Halving the amount of food wasted by 2025 compared to 2017 • Maintaining the collection rate in urban settlements at 100%, and increasing the collection rate in rural settlements to reach full coverage • Action plan for an anaerobic digestion plant with a capacity of 18,000 tonnes/year
Circular Economy Action Plan for Alba Iulia (CEAP) 2023-2033	The plan provides a structured roadmap for the transition of Alba Iulia to a circular economy by 2033. It is based on EU principles and local needs, with its vision structured around the following four strategic directions: • Alba Iulia – Zero Waste City • Alba Iulia – Innovative City of the Future • Alba Iulia – Resilient and Healthy City • Alba Iulia – City of Opportunities for Everyone The plan outlines short, medium, and long-term actions tied to performance indicators.

Renewable energy sources in Alba Iulia

In 2021, Alba Iulia received the **European Energy Award for the most sustainable energy community in Romania**.[1] It is the only city in the country, and one of the few in Europe, included on the list of more than 100 cities that **use over 70% of their electricity from renewable sources**.[2]

The most notable potential for renewable energy generation in Alba Iulia is attributed to **solar energy and biomass**. These renewable sources are already being efficiently utilised at various scales within both the city of Alba Iulia and at county level. Nevertheless, the current exploitation falls short of its complete potential, indicating opportunities for additional investments and advancements in the field.

GHG emissions

The decarbonisation commitments of Romania align with EU climate goals, including achieving climate neutrality by 2050 and coal phase-out by 2032

[1] Source: https://www.apulum.ro/index.php/primaria/detail/municipiul-alba-iulia-prezentat-la-nivel-european-ca-model-de-bune-practici-in-implementarea-unor-politici-de-dezvoltare-energetic-durabil, accessed February 2024.
[2] Source: https://www.cdp.net/en/cities/world-renewable-energy-cities, accessed February 2024.

In 2021, Alba Iulia emitted approximately 228,000 t CO_2eq, marking a slight increase of 1.03% compared to 2008. Although reductions have been recorded in the municipal buildings sector, other sectors, such as transport and residential buildings, have seen increases. Per capita emissions in Alba Iulia (2.4 t/year) are below the national average (~3.8 t CO_2eq per year per capita). To achieve the overall target of reducing CO_2 emissions by at least 40% by 2030, the municipality of Alba Iulia is implementing measures such as improving the energy efficiency of buildings and expanding the use of renewable energy. For example, the Alba Iulia Energy Efficiency Improvement Programme establishes indicators such as:

- Reduction of specific energy consumption in municipal buildings by 16%;
- Reduction of specific energy consumption in residential buildings by 9%;
- Increasing the amount of renewable energy produced locally by 3 times;
- The share of high efficiency vehicles (minimum Euro 6) in the PT fleet to reach a minimum of 25%, etc.

In addition to adhering to NDC targets, emission reduction is likely to yield substantial environmental, social, and economic benefits in the medium and long-term as well.

Risks and hazards

Alba Iulia faces several significant risks and vulnerabilities exacerbated by climate change. The city's geographical location and socio-economic factors contribute to its exposure to various hazards. During the development of the baseline, the natural, anthropogenic and socio-economic risks were assessed. The table below indicates those risks which scored extreme or high, and their possible impacts on the GCAP sectors:

Table 4 Priority environmental and socio-economic risks and their possible impacts

Risks	Sectors affected and possible impacts	
Environmental – natural (physical, climatic) risks		
Increase in frequency of extreme rainfall events (***extreme risk***)	TR Transport	Debris and/or high levels of water on the road infrastructure cause road blockages, which lead to traffic jams, temporary disruptions and delays in PT. In addition, road blockages cause delays in emergency response.
	WA Water	Stormwater drainage system overflow leads to temporary urban flooding in certain areas of the city. Rapid silting of the stormwater collection network increases the costs and efforts needed for maintenance. The increased dilution of the wastewater causes disruptions in the functioning of the wastewater treatment plant (WWTP).
	EN Energy	The energy system is under high pressure due to the increased energy needs for the drinking water pumping stations.
	BD Buildings	Possible damage to structure and façade materials.
	IN Industry	Temporary disruptions of activity in affected areas cause economic damage.
	WS Waste	Water-swept materials following storm events increase the quantity of mixed and/or green waste. Waste is frequently washed into water bodies and green spaces, adding additional effort to the clean-up. Soil oversaturation with water due to intense precipitation can lead to leachate flow to the soil and groundwater.

Risks	Sectors affected and possible impacts	
	LU Land use	Areas identified as prone to urban flooding events require increased improvements in the drainage and sewerage systems. Excessive vegetation growth increases the need for landscaping activities.
	Cross-cutting	Such events affect vulnerable people (those with poor living conditions) disproportionately and delay the implementation of infrastructure or development projects. Underground communication infrastructure can also be affected, causing disruptions that negatively impact multiple sectors.
Increasingly frequent and prolonged heat waves and urban heat island effect (***extreme** risk*)	TR Transport	Energy/fuel consumption for cooling in public and private transport increases. In case of extreme temperatures, the pavement suffers damage, consequently, traffic might be restricted.
	EN Energy BD Buildings	Increased energy consumption for cooling. Growing demand for energy efficiency in buildings. Inconsistencies in renewable energy production due to several climatic hazards affecting the performance and integrity of production equipment (e.g. reduced yield of PV panels in high air temperature conditions).
	IN Industry	The need to interrupt work schedules during critical hours or to reduce work schedules to accommodate increased heat stress affects local production. Energy consumption increases to maintain industrial processes in optimal operating conditions. Potential increase in waste volumes due to faster deterioration of perishable goods. The risks associated with the storage of flammable goods are higher.
	WA Water	Water demand both from population and industry grows, leading to higher energy consumption due to increased pumping needs.
	WS Waste	Faster decomposition of the organic fraction leads to the generation of unpleasant odours, and a need for increased frequency of collection/transfer, to avoid public health hazards. Increased risk of fire at waste storage sites.
	LU Land use	The prevention of heat island formation requires planning and investments.
	Cross-cutting	Vulnerable people (the elderly, children or ill persons) are disproportionately affected by heat waves, and the need to ensure appropriate medical assistance for them increases the pressure on the health system. Communication infrastructure can be affected, potentially impacting multiple sectors.
Droughts (*high risk*)	WA Water	Possible water shortages for both population and industry, leading to decreased production in some industries and subsequent increase in prices. Possible interruption of some non-essential public services (e.g. street washing). Stress on surface water quality (eutrophication).
	WS Waste	Certain waste treatment technologies are affected by water shortages (i.e. composting, anaerobic digestion).
	LU Land use	Green space maintenance requires increased public spending. The increase in pest populations and the decrease in biodiversity put pressure on ecosystems health. Wildfire risk increase in areas with forests (i.e. Paclisa, Oarda).
Increase in mean temperatures (*high risk*)	TR Transport	The cooling needs in PT increase energy consumption for longer periods. Users' discomfort in PT vehicles not fitted with air conditioning.
	EN Energy	Prolonged periods when cooling needs increase, leading to increased energy demand. Increased need for energy efficiency measures in buildings.

Risks	Sectors affected and possible impacts	
	BD Buildings	
	WA Water	Increased water demand. Wastewater and stormwater collection systems require more frequent maintenance to avoid odours resulting from the faster decomposition of organic matter.
	WS Waste	Faster decomposition triggered by increased temperatures requiring more frequent collection of the organic waste to avoid odour complaints.
	LU Land use	Possibility of increased formation of heat islands. Prolonged vegetation cycle of urban greenery leading to increased maintenance cost and increased quantities of resulting green waste. Favourable conditions for the introduction of warmer climate species in city landscaping can increase biodiversity but also present a risk of introducing invasive species harmful to native ecosystems. Heat stress on urban greenery and agricultural crops can become an issue.
Environmental – anthropogenic risks		
Water pollution from improper wastewater treatment due to pressures from environmental factors and infrastructure features (*high risk*)	WA Water	The pressure on the WWTP may result in alterations of the quality of downstream surface waters (eutrophication).
	LU Land use	Water pollution has negative effects on biodiversity. There is an increased need for green barriers in the vicinity of sensitive receptors (e.g. around schools and kindergartens, hospitals, etc.).
	Cross-cutting	Potential public health issues with disproportionate impact on lower-income groups. Discomfort for users of public spaces. Decreased quality of life for citizens and tourists.
Water, air and soil degradation and subsequent public health issues due to improper waste management (*high risk*)	WS Waste	The need for permanent collection points for specific waste streams (i.e. bulky waste, green waste, etc.) in the city neighbourhoods increases.
	Cross-cutting	Decreased quality of life for citizens and tourists. Spendings for health services increases. Disproportionate impact on lower-income groups.
Air pollution due to other sources (*high risk*)	**Cross-cutting**	Decreased quality of life for citizens and tourists. Spendings for health services increases.
Socio-economic		
Lack of skilled workforce; ageing workforce (*high risk*)	**All sectors**	Expanding the scale and efficiency of service delivery becomes challenging.
Economic and energy crisis (*high risk*)	EN Energy	The energy system is under high pressure due to the increased energy needs for the drinking water pumping stations.
	WA Water	Water demand both from population and industry grows, leading to higher energy consumption due to increased pumping needs.

Smart maturity

The sectoral and cross-sectoral assessment revealed that **Alba Iulia is in its early integration stage of smart initiatives and digital transformation**. This means that so far, the Municipality has made considerable efforts to create the enabling environment for the adoption of smart solutions and is constantly including smart elements in all of its projects and activities. It also means that there is a clear vision and understanding of how to integrate data and how to optimise data usage, transfer and sharing between different actors. Still, there is room for improvement in all GCAP sectors and at the Municipality level.

The main challenges that the city faces concerning the digitalisation process refer mostly to the lack of capacities and limited investments in smart initiatives and digital transformation. All these aspects are visible both at the sectoral and cross-sectoral levels.

Green City environmental baseline and challenges

Green city state indicators follow all relevant aspects related to the state of the environment in a city, namely looking at air quality, surface and groundwater, soil quality, the amount, quality and share of green spaces in the city, biodiversity aspects, and climate change mitigation and adaptation status in the city. Collected data on state and also pressure indicators as per the seven GCAP sectors (Transport, Energy, Buildings, Industry, Water, Waste Management, and Land Use) was benchmarked following the EBRD - Green Cities methodology. The traffic light screening assessment resulted in indicators being "coloured" as green, amber, or red, according to their value when compared to benchmarks. A Technical Analysis Report was drafted, presenting the key findings following the technical analysis.

Linkages observed between the **state of the environment and the pressures the various sectors** of the economy and city development put on the environment are presented in the infographic below:

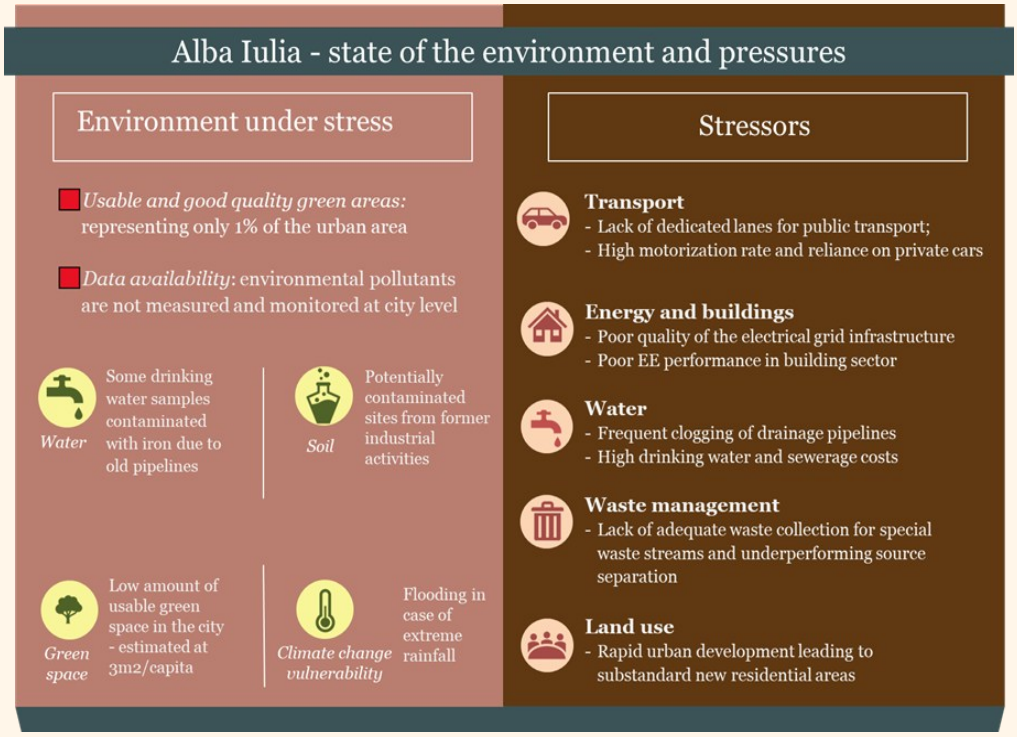


Figure 5 Snapshot of environmental conditions and sectoral stressors in Alba Iulia

The assessment concluded that the city is confronted with the following **challenges regarding the environment**:

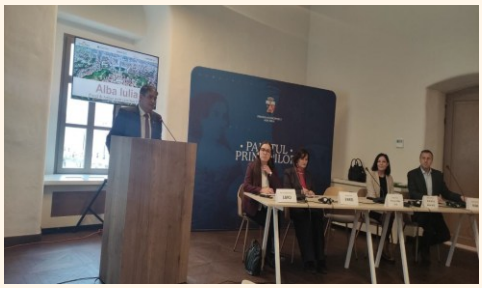
- The state of the environment is not routinely monitored in the city, as there are insufficient measurement stations for environmental indicators.
- There are sparse datasets available on environmental assets, with a low level of confidence in the available data.
- The amount of good-quality, usable green space per capita is low, and overall green space within the city limits is insufficient.
- Lack of connectivity of green spaces within the city limits hinders biodiversity increase and the provision of ecosystem services.
- There is a low amount of diversity in vegetation species present in green spaces, which decreases their resilience to climate stress and does not promote biodiversity.
- The city has low resilience to extreme climate events, in particular to floods resulting from extreme rainfall.
- Blue-green infrastructure implementation potential is insufficiently exploited within the city limits.

Stakeholder engagement process

The GCAP was developed by a team comprising representatives of Alba Iulia City Hall, experts from the RWA Group and Arcadis consultancy consortium, as well as representatives of the EBRD. Stakeholder engagement is key to building strong, constructive, and responsive relationship with the community, and for development of a robust and viable strategic development document for all stakeholders – authorities, business actors, academia and citizens. A wide variety of tools and methods were deployed throughout the process, including in-person meetings to facilitate direct engagement, online surveys to collect broad input from participants, and digital tools such as an online voting platform to ensure inclusive and efficient decision-making.

Throughout the development of the GCAP, 4 stakeholders engagement events were organised corelated with the GCAP development process, as follows:

Engagement event	Participants	Summary
Official kick- off meeting of the project 19th January 2024	Representatives of EBRD, the selected consultant—RWA Group/Arcadis—and Alba Iulia Municipality	The first interaction between the consultant team and the representatives of Alba Iulia Municipality aimed at introducing the GCAP methodology and the GCAP development action plan.
Project launch event and 1st stakeholder consultation meeting 14th February 2024	108 participants, excluding the project team and EBRD representatives (53% male and 47% female attendees) representing: the Municipality, regional and local authorities, NGOs, academia and think tanks, utility companies, and the private sector.	The event marked the official launch of the Alba Iulia GCAP process and served as the first stakeholder consultation. Opening remarks from the Municipality expressed appreciation for the EBRD's continued support of projects and sustainability ambitions in Alba Iulia and reaffirmed the commitment of the Municipality to becoming a Green City. The event received positive media coverage from both local and national news outlets, as well as business journals, helping to raise public awareness and support for the GCAP process.

Engagement event	Participants	Summary
		
	Figure 6 The launch event of the GCAP project	
2nd stakeholder consultation workshop 21st May 2024	33 participants (64% male and 36% female attendees) representing: Alba Iulia Municipality, local municipal infrastructure organisations and energy agencies.	The main objective of this in-person workshop was to review and validate the list of the identified challenges for Alba Iulia, together with the working group and representatives of municipal companies. The workshop also aimed to collect feedback on the proposed Vision and Strategic Objectives for the Alba Iulia GCAP. An online public survey to prioritise challenges was launched in early June 2024, followed by the development of a long list of potential actions.
3rd stakeholder consultation workshop 3rd October 2024	32 participants (56% males and 44% female attendees) representing: the Municipality, local transport company, energy agency and water company, NGOs, the EBRD, and the consultant team.	The workshop aimed to present the long list of proposed actions and to prioritise actions for each sector through live online voting. The representatives of local and regional stakeholders responded positively to the proposed actions and suggested including additional measures to support their implementation. The consultation process continued also after the workshop by launching a public survey in November 2024.
4th stakeholder consultation workshop and presentation of GCAP 4th April 2025	34 participants (65% male and 35% female attendees) representing: the Municipality, transport, energy, water, and waste management agencies and operators, NGOs.	The main objective of the workshop was to present and discuss the detailed draft actions. The stakeholders responded positively to the proposed actions and suggested several additional measures. Discussions emphasised the importance of the tourism industry in Alba Iulia and its potential integration with mobility and blue-green infrastructure initiatives. Stakeholders were invited to submit written feedback on the draft actions within two weeks.
		
	Figure 7 Participants at the fourth stakeholder consultation workshop	

Green City Action Plan

02

Vision of the Green City Action Plan



People daring to act for sustainability

Alba Iulia has many strengths to rely on. It had an outstanding role throughout the country's history, its magnificent built heritage and vibrant cultural traditions showcasing that significance. It has the scale to allow for a good quality of life, both in terms of urban dynamics and opportunities, and the absence of the hectic pace typical for megacities. Proactive and engaged leadership, as well as conscious civic engagement, are deeply rooted in city governance. In addition to the city itself being a touristic gem, it is located along important touristic routes, the surrounding natural landscapes providing ample opportunities for exploring the environment.

Yet, its most important assets are the people, the Albaiulians who dare to turn their dreams of better living conditions and improved environment into action. This GCAP is an inspiration to guide them in their commitment to overcome environmental challenges and advance on the path of green development.

Pivotal actions developed with and for them will allow for transforming the city into a bike-friendly town, integrated in the sustainable mobility system. These actions also offer practical guidance to the transition to an energy system relying on renewable sources, strongly supported by the people of Alba Iulia. Creating additional, better quality and connected blue-green areas in the city will ensure an improved environment, making the city vibrant and alive not only in central areas and times of celebration, but also all over Alba Iulia and in everyday moments.

That is how Alba Iulia continues to be the cherished home of its residents and an inspiration for others: by passing on local traditions, working towards the well-being of its citizens, and promoting the future perspective of a climate-resilient, green city.

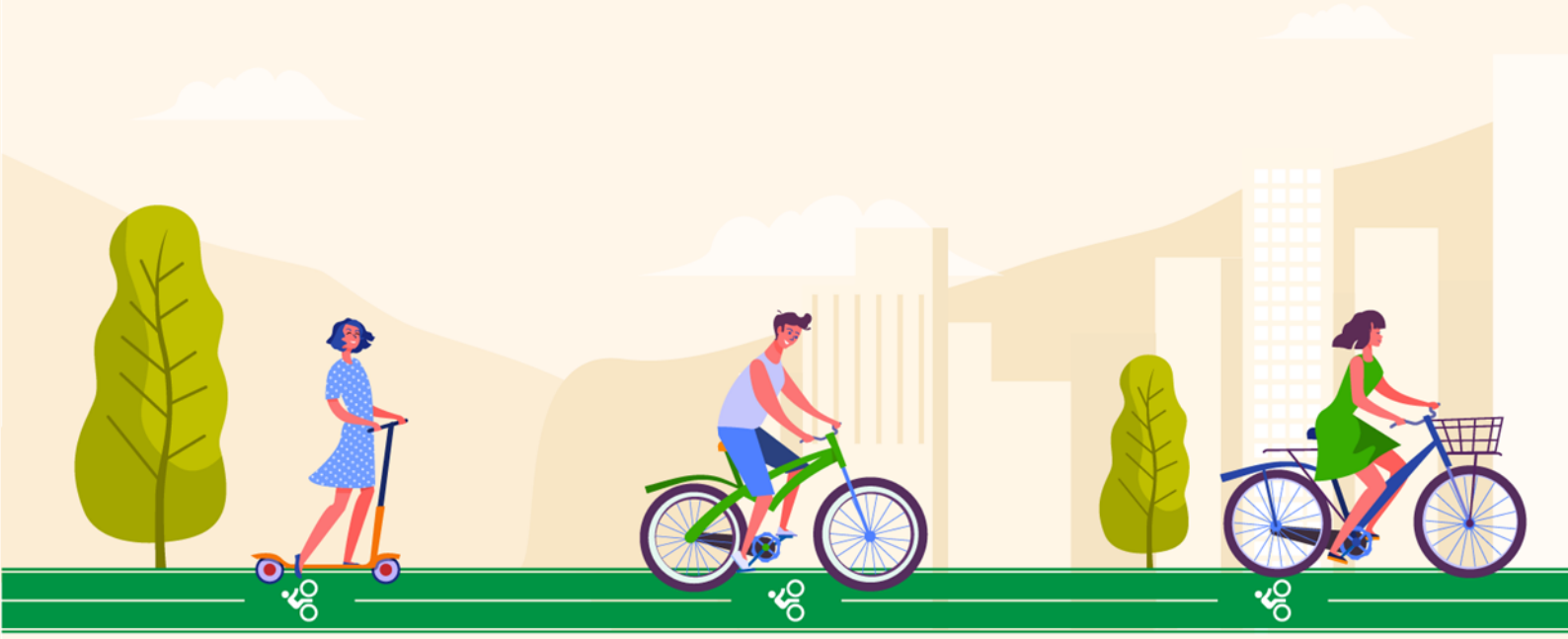
Strategic objectives of the Green City Action Plan

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

SO 4 Enhancing the attractiveness of the city for tourists, by creating adequate infrastructure and diverse offers of sustainable tourism





Green City
Action Plan
Alba Iulia

Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

Actions foreseen under this objective follow a visionary approach to municipal infrastructure development, which considers both the city and the urban sprawl. Strategic planning aims for creating synergies with metropolitan development and for future-proofing the municipal infrastructure.

The process is conceived to be innovative and to allow for co-creation, making use of the bold and novel approaches coming from local academia, businesses, and civil society to sustainable urban mobility, and wise management of the water system within a collaborative development framework.

Green City
Action Plan
Alba Iulia



Increasing the efficiency of local resources for integrated and climate neutral development

Alba Iulia will step on the path of energy transition. It will maximise energy efficiency through the gradual replacement of fossil fuels with renewable energy sources, building retrofit programmes and smart solutions. It will adopt a circular approach to resource use and industrial processes, achieving to turn waste into a resource.

Recognising our interdependence from a healthy natural environment and the multiple benefits of nature, the city will avoid the depletion of its natural resources, and for this aim it will embrace a regenerative approach to urban land management. Interconnected green areas will ensure clean air and health benefits for people.



Green City
Action Plan
Alba Iulia

Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

This objective has in view a collaborative working environment between the Municipality, the universities and the private sector. Alba Iulia intends to embrace digital transformation and to invest in capacities in terms of smart city, thus these actions support its efforts pursuing city smartification. Fostering digitalisation and innovation can be best achieved by programmes dedicated to the involvement of the young generation in public administration, planning and decision-making as well.

The city neighbourhoods have to be re-invented in order to transform these into multifunctional areas for everyday life, work, learning, and playing activities. This can be done by conducting urban design and refurbishment actions, within a people-focused ‘sticky city’ approach. A ‘sticky city’ successfully attracts and retains people, talent, and investment over the long term.

That is how we will have sustainable neighbourhoods with both market value and affordable housing, well connected to amenities and promoting an eco-friendly and inclusive way of living.

Green City
Action Plan
Alba Iulia



Enhancing the attractiveness of the city for tourists, by creating adequate infrastructure and diverse offers of sustainable tourism

The actions foreseen under this objective will maximise the city's charm and ensure that it remains a vibrant and attractive city, where visitors are happy to prolong their stay. Neighbouring areas will be connected through thematic routes, tours and multi-day tourism packages, combining several topics, like 'wine and dine' with history, or experiencing nature combined with 'wine and dine' offers, but also sustainable mobility, coupled with a healthy brunch and immersion into religious traditions and history. Options for ecotourism and showcasing rural lifestyle, slow living, etc. will be conceived as well.

Simultaneously, new research fields will be promoted both at university and vocational level in multiple fields. Alba Iulia will be promoted on international touristic digital platforms, highlighting the diversity of experiences this welcoming city will offer to visitors.

Green City actions

The GCAP includes **23 actions clustered per sector**. For ease of understanding and coherence, the presentation of actions for each sector starts with an overview of the sector, where a brief description of key characteristics and the main challenges of the sector are indicated, followed by corresponding actions.

Total investment needs established for implementing the 23 Actions in the coming 5 years are estimated at the amount of 228.8 million EUR. Transport, Energy and Buildings and Water Sectors are the ones where most of this budget will be directed.

The order in which the sectors are presented in the GCAP is intentional. The main sector foreseen to drive the future sustainable development of the city is **Industry**. This includes both the development of traditional manufacturing industries towards greener production, as well as significantly increasing tourism in the city to achieve its full potential. **Land Use** and **Water** sectors include actions with components that would significantly support an increase in the number of tourists through highlighting the natural assets the city and its immediate surroundings have. Additionally, actions in these sectors enhance the user experience and time-spending options that tourists, as well as residents, would have while in the city. **Transport** actions play a significant role in ensuring seamless connectivity and promoting sustainable mobility for all users, be it residents, commuters, business visitors or tourists. **Waste** sector actions, while ensuring municipal services at the highest standards, also support current city initiatives towards achieving circular economy goals and synergise with actions related to green industrial development. Lastly, **Energy and Buildings** sector actions propose innovative approaches towards incorporating RES and best practices in the system and comprehensively tackle current challenges of the building stock.

Certain actions presented in the present GCAP are also referenced in other policy documents (either national, regional or local) and are in their development stage or close to implementation. They are also included in this GCAP, since this is the main strategic document which will guide the green development of Alba Iulia.

For all these actions, the GCAP presents the estimated budget based on the available data from pre-feasibility or feasibility studies. The estimated CAPEX of these actions can be further refined and adjusted during the technical detailed design, contracting and/or implementation stage. **All actions foresee investments**, and additionally certain actions qualify also as policy measures.

All GCAP actions will contribute to the following **Sustainable Development Goals** (SDGs)[3]:

Table 5 The contribution of GCAP actions to SDGs

	Sustainable Cities and Communities		Gender Equality
	Climate Action		No Poverty

Besides these, each GCAP action will also contribute to other specific SDGs. These are presented separately in the sector overviews below.

[3] *Please note that the content of this publication has not been approved by the United Nations and does not reflect the views of the United Nations or its officials or Member States. For more information on the SDGs please visit the United Nations Sustainable Development Goals web site at https://www.un.org/sustainabledevelopment.*

Table 6 Overview of GCAP actions highlighting their ***correspondence with the strategic objectives***

Sector		Action	SO 1	SO 2	SO 3	SO 4
Industry	1	Alba Iulia – more visitors and longer, sustainable stays	✓	✓	✓	✓
	2	Incentivise green technologies and sustainable industrial practices		✓	✓	
	3	Partnerships with private sector for new green industrial areas	✓	✓	✓	
Land use	4	From street and district-level nature-based solutions to city-scale climate resilience	✓	✓		
	5	Rehabilitate riverbanks for slow mobility and leisure	✓	✓	✓	✓
	6	Nature and blue small infrastructure for thriving communities	✓	✓	✓	✓
	7	Test and adopt regulations for blended green and social infrastructure design	✓	✓	✓	
Water	8	City-wide implementation of smart water network management and metering	✓	✓	✓	
	9	Energy efficiency measures and integration of renewable energy sources in the water sector	✓	✓		
	10	Water stewardship and cultural heritage-led urban regeneration	✓	✓	✓	
	11	Rehabilitation and extension of the water and wastewater network	✓	✓		
Transport	12	Enhancing public transport sustainability with bus upgrades, network expansion, and tariff reform	✓		✓	✓
	13	Integrated measures for enhanced pedestrian, road, cycling, and public transport infrastructure	✓		✓	
	14	Safe and efficient cycling network	✓		✓	✓
	15	Construction of a Park&Ride facility and green multimodal mobility corridor	✓		✓	✓
Waste	16	Expansion, digitalisation and introduction of a comprehensive monitoring and control system to the Waste Collection Islands network	✓	✓	✓	
	17	Material circularity and introduction of Pay-As-You-Throw system	✓	✓	✓	
	18	Upgraded management practices for textile and organic waste fractions	✓	✓	✓	
Energy & Buildings	19	Citizen Energy Community microgrids and small-scale / decentralised renewable energy sources	✓	✓	✓	
	20	Installation of integrated multi-vector energy storage systems	✓	✓	✓	
	21	Energy efficiency programme in public buildings	✓	✓	✓	✓
	22	Energy efficiency programme in residential/private buildings	✓	✓	✓	
	23	Smart and efficient public lighting	✓	✓		✓

Industry



Sector overview

The industrial sector plays a key role in Alba Iulia's local economy, covering a wide range of activities, including ceramics, automotive parts, metalworking, chemicals, pharmaceuticals, building materials, wood processing, mining, textiles, and food production. Industrial areas are mainly concentrated on the city's outskirts, in the northern, southern, and eastern part, although some production facilities are dispersed within mixed-use areas within the city's boundaries.

Over time, Alba Iulia's economy has changed significantly, shifting from traditional industries to a growing focus on tourism, services, and small-to-medium enterprises. Nearby cities like Sebeș and Blaj have become industrial hubs, inducing Alba Iulia to define its own green and innovative industrial identity. To support this, a new 342,000 m² economic development area has been designated between the A10 highway and the city's ring road, aiming to attract investors and high-tech companies to revitalise the sector.

From an environmental perspective, current industrial operations generally meet regulations. Wastewater is usually treated on-site before being sent to the city's treatment plant, with oversight from the Environmental Protection Agency (EPA) and water management authorities. However, legacy pollution from historical industrial sites remains a concern. Former industrial areas such as Refractara, Avicola Pâclișa, and the Apulum S.A. hazardous waste disposal site are flagged as potentially contaminated, though no recent environmental monitoring data is available.

Alongside this, being the historic capital of the country, Alba Iulia is becoming increasingly recognised as a cultural and tourist destination, gradually shifting the focus of its local economy. Investments in heritage, cultural attractions, and public spaces, along with a growing number of visitors, are pushing the city toward a more service-oriented development model. Alba Iulia has managed to invest considerably amounts of money for rehabilitating the Alba Carolina fortress. Many of the historical buildings have been rehabilitated and currently projects are implemented within the interior spaces of the fortress. Tourism is becoming a major driver of growth and employment, with more attention from both local authorities and the business sector. Despite its potential and strategic location, the sector still faces challenges, particularly in promoting longer stay trips. Tourist traffic, particularly in the city centre, also places pressure on the transport system, which prompted investments in new parking facilities near the fortress. While efforts are being made to manage this growth, the strain on infrastructure persists.



Figure 8 The Changing of the Guard – a cherished tradition and a popular tourist attraction

Policy documents, such as the IUDS and the GUP, support a sustainable tourism model, through initiatives like eco-tourism circuits, riverfront cycling paths, and new parks and leisure areas to enhance environmental quality while preserving Alba Iulia's historical character.

To help address the above-mentioned needs, this GCAP recommends actions tackling challenges within the broad Industry sector, specifically targeting tourism or cross-sectoral issues linked to economic development. These actions are expected to improve environmental performance, attract responsible investment, support the shift to circular economy practices, and create higher quality jobs, complementing Alba Iulia's broader economic move toward tourism, innovation, and services.

Figure 9 Challenges, short- and long-term actions in the Industry sector

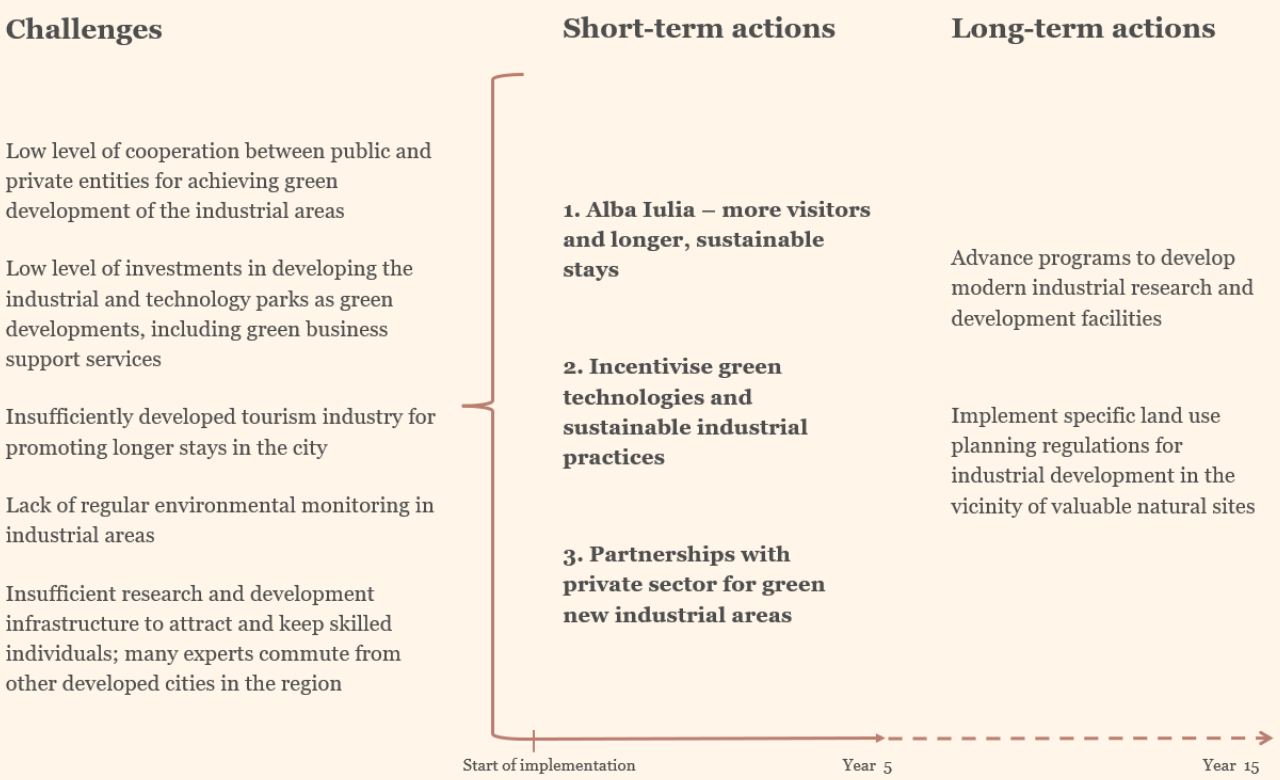


Table 7 Contribution of Industry actions to SDGs

Action	Contributing to SGDs				
ACTION 1. Alba Iulia – more visitors and longer, sustainable stays	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	8 DECENT WORK AND ECONOMIC GROWTH	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	4 QUALITY EDUCATION	
ACTION 2. Incentivise green technologies and sustainable industrial practices	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	8 DECENT WORK AND ECONOMIC GROWTH	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	4 QUALITY EDUCATION	10 REDUCED INEQUALITIES
ACTION 3. Partnerships with the private sector for green new industrial areas	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	8 DECENT WORK AND ECONOMIC GROWTH	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	4 QUALITY EDUCATION	10 REDUCED INEQUALITIES

ACTION 1
Alba Iulia – more visitors and longer, sustainable stays

IN
Industry

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2028	147 tCO_2eq/year	11,500,000 EUR

GOAL OF THE ACTION

This action aims to establish sustainable and engaging touristic options that showcase Alba Iulia's unique heritage, promote eco-friendly exploration, and encourage visitors to extend their stays while benefiting the local community and economy.

CHALLENGES ADDRESSED

- Insufficiently developed tourism industry for promoting longer stay trips
- Underutilised recreational potential along the riverbanks

BENEFITS

- Boosting the tourism industry by attracting more visitors and increasing the tourism revenues
- Encouraging growth and success for existing local businesses while fostering opportunities for new ones
- Enhancing community involvement by showcasing local heritage and attractions
- Promoting sustainable tourism practices and encouraging active, healthy lifestyles
- Streamlining tourism services and improving their accessibility through digital tools and platforms

TARGETS

- Establish the Agro-Hub 3 years after GCAP adoption
- 3 new touristic routes extending beyond the citadel walls
- Develop at least 4 Multi-Day Tourism Packages, in the first year of implementation
- Launch the Alba Iulia city travel app
- Establish at least 4 new bike rental hubs
- Place at least 10 digital information panels at strategic positions along the routes in the next 5 years
- At least 20% increase of overnight stays compared to reference of first year of implementation, 5% yearly increase afterwards

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

SO 4 Enhancing the attractiveness of the city for tourists, by creating adequate infrastructure and diverse offers of sustainable tourism

Context

Alba Iulia, once an affluent industrial hub, has gradually transitioned toward tourism and service-based industries, driven in part by workforce migration to nearby industrial centre of Sebeș. This action aims to strengthen the local economy and tourism industry of Alba Iulia and establish and Agro-Hub and a comprehensive tourism and marketing plan for the city, showcasing its unique cultural and historical landmarks alongside the nearby natural attractions. This will create a cohesive tourist destination and visitors' experience. The goal is to increase the area's attractiveness to a diverse range of tourists, encouraging longer stays, with a strong focus on sustainability and community engagement.

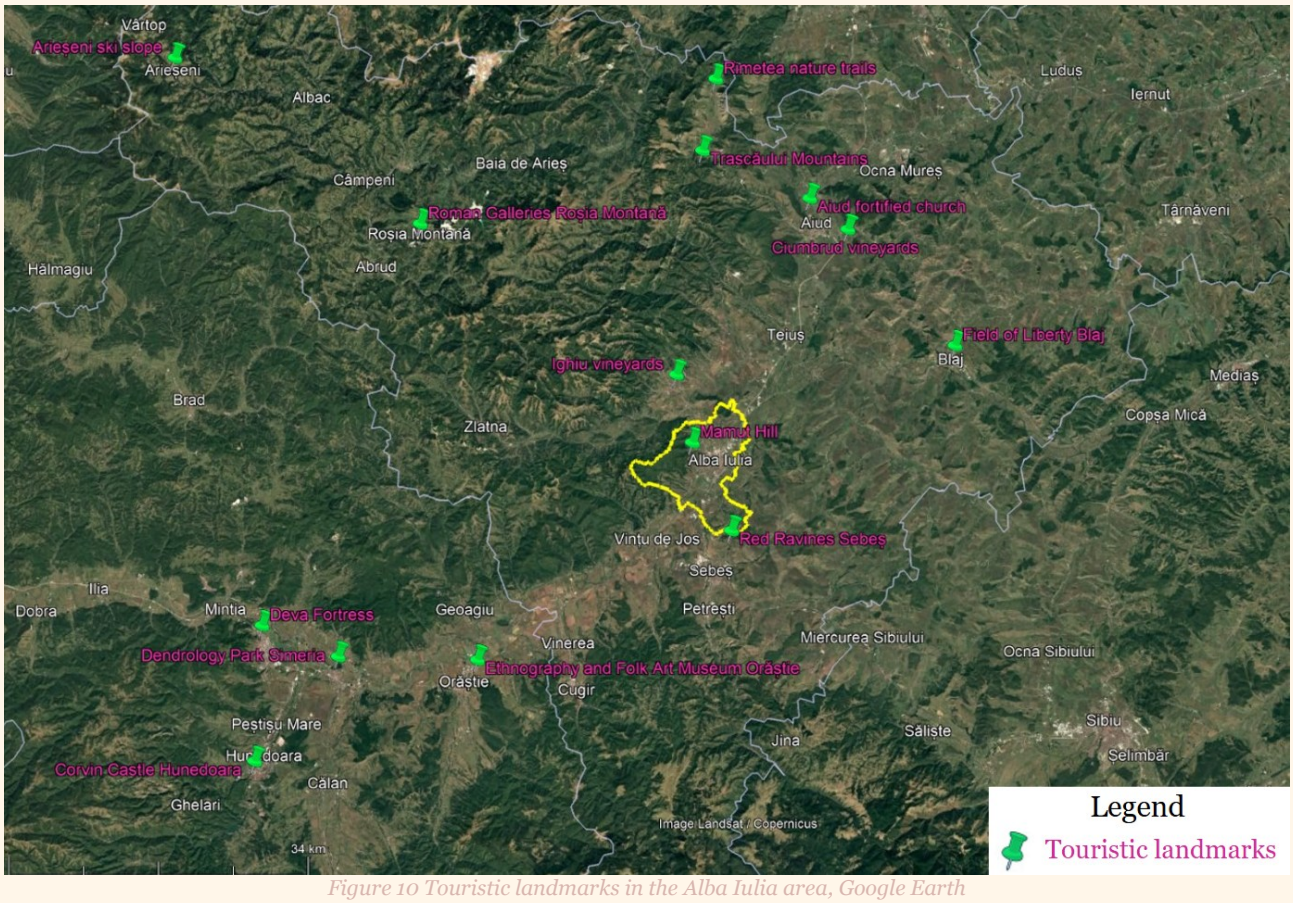


Figure 10 Touristic landmarks in the Alba Iulia area, Google Earth

Description

The initiative will establish an Agro-Hub to showcase local produce and products, establish thematic routes, design multi-day tourism packages, and invest in modern digital tools to provide easy access to information at key locations like the train and bus stations. Their promotion on international tourism platforms and partnerships with local businesses will ensure an inclusive approach, create economic opportunities while preserving cultural and natural assets.

1. Agro-Hub

The Agro-Hub aims to be entralised platform or facility that connects different actors in the agricultural value chain. It will be established in a historic building within the fortress, which has easy access for both product delivery and visitors. The Agro-Hub will showcase local producers and will also represent a central area for visitors to get to know and taste the local produce and cuisine. The building will include dedicated space for local market, cooking and serving areas, and convertible spaces for dining, events, fairs, etc. The renovated historic building in the fortress will act as a seasonal and traditional produce market for locals and

tourist alike, but also a food hub, leisure place and periodic thematic food festival scene. Additionally, schools and businesses could rent out kitchen spaces for cooking classes and food-related team building events.

2. Thematic routes

Thematic routes will include historical buildings, wildlife observation areas, parks and other local features that align with the theme. These will be designed to be walkable and accessible for cycling. Proposed routes:

- Ampoi riverside pedestrian route, with associated nature-based landscaping, nature observation and climate-resilient resting areas
- Citadel to Mamut Hill Trail (hiking/biking)
- Historic walking/biking route (train station → Citadel) with key landmarks, immersive historical experiences, augmented reality stops, shaded areas, and storytelling panel areas

3. Multi-day tourism packages

These will be designed for different visitor types, including families, adventure seekers, nature lovers, and culture enthusiasts, established through, partnerships with local hotels, restaurants, and transport providers. All packages will be available to book via the City Travel app. Proposed tourism packages:

- *From Fortress to Forest – Eco-Trail Adventure*

Exploring eco-trails connecting the Carolina Citadel to the Mamut Hill and Trascau Mountains. Scenic hikes, birdwatching and cycling routes, while experiencing slow living and local crafts in nearby villages.

- *Wine, History and Nature – Ciumbrud Vineyard Experience*

Starting in the Alba Iulia's historic centre, learning about centuries-old connections to viticulture. Continue to Ighiu and Sard, renowned for their centuries-old winemaking traditions, before concluding in Ciumbrud, for a vineyard tour, wine tastings, and food pairings.

- *Legends and Landscapes – Historical Experience*

Uncovering ancient legends and historical mysteries with a journey to the Trascau Mountains, spending the night, tasting local wines and traditional food; after a nature hike or bike trail, return to Alba Iulia for a torch-lit nighttime tour of the Carolina Citadel, ending with a heritage dinner within the citadel walls.

4. Bike rental hubs (complementary to Transport sector *Action 14.*)

Changing mobility behavior and offering alternative mobility options both for residents and tourists is one of the key initiatives of Alba Iulia Municipality. The Bike rental hubs will be:

- Located at key access points: train station, citadel, Ampoi riverside route, and Mamut Hill trail, encouraging sustainable and low-emission transport options; facilitating access to thematic routes and major attractions
- Integrated with PT services
- Easy rental via a user-friendly feature in the city travel app
- Each hub includes an information and marketing panel
- Supports both guided and self-guided bike or walking tours

5. Alba Iulia City Travel App

Building on Alba Iulia's existing tourism marketing efforts focused on the Citadel, this action expands the strategy to include a broader range of natural and cultural landmarks. While several promotional tools already exist (e.g. the E-Alba Iulia app), this action will consolidate them into a single, interactive, user-friendly platform that integrates tourism and mobility services. Key features of the City Travel App:

- Real-time updates: PT schedules, bike rental hubs, parking info
- Navigation tools: walking/biking routes and points of interest
- Comprehensive tourist info: landmarks, museums, cultural sites, restaurants, events
- Accessibility and interactive features to support user engagement

6. Digital information panels

Developing digital information panels in key locations will enhance the visitor experience by providing real-time updates on attractions, events, and transport while offering interactive maps and multilingual content for better navigation. These panels will also promote local businesses, and engage tourists through QR codes and digital storytelling, making Alba Iulia a more connected and visitor-friendly destination.

Implementation steps

Agro-Hub

1. International design contest for the chosen historic building in the fortress to be transformed into an Agro-Hub and food hall.
2. Contracting renovation works, amenities and appliance installation and works supervision
3. Liaison with local producers and restaurants to rent out space in the Agro-Hub
4. Design yearly event calendar and advertise the Agro-Hub

Developing thematic routes

5. Establish a working group for the sector, criteria for choosing thematic areas and planning/operational meetings' schedule.
6. Perform options analysis on thematic routes and choose 3 preferred thematic routes to implement and promote.
7. Design and implement sustainable touristic infrastructure: birdwatching observatory, natural playgrounds and rest areas.
8. Improve accessibility with clear signage, floor markings and adequate lighting.
9. Develop info package, both physical and digital materials.

Designing Multi-Day Tourism Packages

1. Perform options analysis on tourism packages and choose 4 preferred ones to implement and promote.
2. Create themed experiences.
3. Establish partnerships with accommodation providers, transport companies, restaurants, etc.
4. Provide digital access through Alba Iulia City travel app and major travel booking platforms.
5. Develop tourism packages info, both digital and physical, aimed at both travel agencies and tourists.

Bike rental hubs

1. Perform options analysis on bike fleet selection, technology options, maintenance solutions and informational panels.
2. Develop feasibility study for the site selection and needed infrastructure.
3. Organise public procurement process.
4. Incorporate the bike rental feature in the city travel app.
5. Launch pilot project.

Alba Iulia city travel app

1. Assess existing tourism initiatives, such as the E-Alba Iulia app, and identify gaps and areas for improvement.
2. Perform options analysis for the app core features and functionalities.
3. Choose the development approach (in-house or outsourcing) and build a prototype based on the existing E-Alba Iulia platform.
4. Engage local businesses to support and integrate their services into the app.
5. Promote app and routes on widely used travel platforms like TripAdvisor and Google Maps, etc.

Digital information panels

1. Perform options analysis to determine best locations and panel features.
2. Organise public procurement process for 10 digital information panels.
3. Install panels and ensure regular maintenance.

Stakeholders

Alba Iulia Municipality; private sector and businesses – local producers and service providers; Alba Iulia Tourism Information Centre; cultural and educational institutions; local media and NGOs focused on nature conservation and ecotourism, such as: Biciclim Alba Iulia Association, National Association of Ecological and Cultural Rural Tourism Alba Iulia, Albamont Ecology and Mountain Tourism Club, Professional Association of Tour Guides in Transylvania

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Development of the Agro Hub	10,000,000	100,000
Thematic routes	1,000,000	30,000
Multi-day tourism packages	100,000	5,000
Bike rental hubs (3 hubs x 50,000 EUR/hub)	150,000	10,000
Alba Iulia City Travel App	150,000	20,000
Digital information panels (10 panels x 10,000 EUR/panel)	100,000	5,000
Total	**11,500,000**	**170,000**

Social and gender aspects

- Expanding tourism creates employment opportunities across various sectors, bringing benefits to local communities. Job creation will follow inclusive recruitment principles.
- Development of or accessing existing support programmes for women's economic participation in tourism / women entrepreneurship programme, including mentorship.
- Engaging local stakeholders (residents, producers, businesses, cultural institutions, youth organisations) ensures that the actions reflect the needs of the local community.
- By focusing on safety, accessibility, and meeting the needs of all kinds of travellers, tourism infrastructure becomes more welcoming and inclusive for everyone. This helps break down gender-related barriers and ensures fair opportunities for people to enjoy and benefit from tourism.

Smart and digital aspects

- Digital tools and smart technologies play a key role in enhancing both accessibility and visitor engagement. Features like mobile apps, self-guided tours, and real-time information make it easier for travellers to explore destinations independently, ensuring everyone can enjoy the experience, regardless of their abilities or preferences.
- Interactive tools create more engaging and memorable experiences, connecting tourists to the cultural and natural stories of the area in innovative ways.

ACTION 2
Incentivise green technologies and sustainable industrial practices

IN
Industry

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2027	4,674.05 tCO_2eq/year	500,000 EUR

GOAL OF THE ACTION

This action aims to promote green technologies and sustainable industrial practices. Establishing a citywide air quality monitoring network to track pollution in real-time will support evidence-based decision making, progress monitoring and citizens' awareness. By incentivising businesses and industries to adopt sustainable and low-emission solutions, the initiative will support the city's green economic development.

CHALLENGE ADDRESSED

- Lack of cooperation towards achieving the green development of the industrial areas
- Lack of sufficient investment in developing the industrial and technology parks as green developments, including green business support services
- Lack of public-private partnerships to support the socio-economic development of the city
- Lack of routine environmental monitoring in industrial areas - potential contamination in historical industrial sites located within city boundaries
- Lack of competitive business clusters

BENEFITS

- Promoting eco-friendly industrial growth, making Alba Iulia a competitive location for investors
- Enhancing the city's compliance with national and EU environmental policies
- Fostering partnerships between the Municipality, universities, and businesses
- Reducing pollution by monitoring and controlling emissions
- Contributing to overall community health and well-being

TARGETS

- At least 10 businesses certified as green in the first two years, scaling up to at least 50 green business certifications issued by year 5
- Businesses supported in reducing energy consumption by 20% within five years, compared to GCAP approval year as baseline
- Local, green-certified business representatives supported to attend at least 1 international workshop every year on sustainability topics and green technology transition
- Relevant staff within Municipality to attend at least 1 green procurement training
- At least 10 air quality monitoring stations installed during the 5-year implementation period

STRATEGIC OBJECTIVES AIMED AT

SO 2 — Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 — Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

Context

Alba Iulia is actively embracing green technologies and sustainable practices to enhance its urban and industrial landscape. The commitment of the Municipality to attracting new investors and fostering industrial growth is highlighted by ongoing projects aimed at developing industrial areas outside the city. While the city has made progress in modernising urban infrastructure and in tourism, challenges such as air pollution due to vehicle exhaust emissions, potential historical industrial pollution, and lack of continuous environmental monitoring remain concerns regarding public health and citizen's quality of life.

Description

This action includes key measures such as establishing a Sustainable Business Certification framework and the implementation of a smart air quality monitoring network across industrial areas, in high-traffic zones, and residential neighbourhoods to track pollution levels effectively and inform decision-making.

First, the city encourages investors and businesses to embrace greener production technologies and to routinely integrate sustainability into their operations, contributing to lower carbon emissions and decreased air pollution. Second, it prioritises investments in air quality monitoring and public awareness, leveraging real-time data to support informed decision-making.

1. Incentives for green technologies and sustainable practices

Many green technologies, like EV, renewable energy use, resource efficiency, can be expensive to adopt initially but offer significant long-term benefits. Incentives can act as substantial boosts by making these technologies more affordable upfront, encouraging more businesses to invest in such solutions. As demand grows, production costs decrease, making green solutions even more accessible.

Alba Iulia Sustainable Business Certification

Alba Iulia Sustainable Business Certification would be implemented as a pilot project to encourage businesses to integrate green technologies and sustainable practices, contributing to a cleaner and more environmentally responsible local economy.

To ensure its effectiveness, the initiative will begin with a feasibility study, including an options analysis. To obtain such certification, businesses will be evaluated based on their environmental footprint, considering key factors such as energy and resource efficiency, waste management practices, water conservation, applied green procurement practices, and carbon emissions reduction initiatives.

Businesses can qualify under different levels, such as Basic, Advanced and Excellent.

Certified businesses may receive tax reductions or exemptions, grants and subsidies to invest in green technologies and networking opportunities

Certified businesses will be promoted on a dedicated platform and on the Alba Iulia city travel app.

Green Procurement Policy

Green procurement policies are essential for municipalities aiming to lead by example in sustainability. By prioritising environmentally friendly materials, services, and technologies in public procurement, Alba Iulia can drive demand for sustainable solutions and reduce its carbon footprint.

The Municipality has integrated noticeable sustainability measures across construction, infrastructure, and energy-efficient transportation projects. Ongoing initiatives demonstrate a systematic commitment to making sustainability a priority.

To integrate and complete the current efforts, make them more visible and promote them as a good practice model, the Green Procurement Policy would cover key areas such as renewable energy and energy-efficient utilities such as public lighting, sustainable office equipment and supplies, eco-friendly food procurement for municipal events, and partnerships with suppliers with demonstrated commitment to sustainability.

2. Air quality monitoring and control measures

Smart Air Quality Monitoring Network

This smart infrastructure will improve decision-making, public health, and sustainable urban planning by providing accurate and continuous air quality data. Real-time air quality sensors will be installed in key locations, especially industrial areas and high-traffic zones, as well as in the vicinity of sensitive receptors (hospitals or schools), to continuously monitor pollution levels. A public online air quality dashboard will display real-time data of the different locations, enabling residents, businesses, and authorities to track air quality conditions and take proactive steps to reduce pollution and improve air quality.

Implementation steps

Alba Iulia Sustainable Business Certification

1. Identify clear sustainability criteria, aligned with national and EU environmental policies and standards.
2. Carry out feasibility study to establish financial incentives such as tax breaks or grants for certified businesses. Engage with stakeholders (local experts, university, NGOs and businesses) to ensure feasibility and buy-in of proposed certification programme.
3. Define the certification process, detailing the application, evaluation, and certification levels.
4. Establish a dedicated evaluation committee and a public recognition strategy.
5. Launch and promote the certification programme.
6. Offer support to certified companies to participate in international forums on sustainability, innovation, and green technology adoption.
7. Monitor, perform third party audits and promote certified businesses while also evaluating the compliance with business certification criteria.

Green Procurement Policy

1. Establish clear objectives for the green procurement policy, aligned with national and EU sustainability goals.
2. Develop a sustainability criteria framework for public procurement.
3. Provide training for the municipal procurement personnel and local businesses on green procurement practices.
4. Establish partnerships.
5. Start the pilot procurement process in selected sectors (street lighting, office supplies) and monitor process.
6. Provide tax benefits and establish a local sustainable supplier registry.

Smart Air Quality Monitoring Network

1. Establish a working group and define the scope of the monitoring network (key pollutants, air quality regulations priority monitoring areas) together with relevant stakeholders.
2. Open call for partnerships (universities, tech companies, private sector).
3. Conduct public procurement for selecting Internet-of-Things-based (IoT) air quality sensors.
4. Install monitoring stations, calibrate and test for accuracy.
5. Set up a public interactive platform for real time air quality data, including heat maps and visual alerts. Cross-reference with city travel app.
6. Establish data collection and management system for the operation of the network.
7. Conduct public awareness campaigns.

Stakeholders

Alba EPA; local businesses; Procurement Department within the Alba Iulia Municipality; universities with local presence; tech companies in the city; local NGOs with an interest in air and environmental quality.

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Alba Iulia Sustainable Business Certification	100,000	25,000
Green Procurement Policy drafting, adoption and training	100,000	
Smart Air Quality Monitoring Network (sensors and monitoring stations, IT system, awareness campaigns)	300,000	15,000
Total	**500,000**	**40,000**

Social and gender aspects

- New job opportunities will be created. Job creation will follow inclusive recruitment principles.
- Action offers opportunities for gender mainstreaming in the business sector, by promoting a respectful and inclusive work environment free from discrimination or harassment. These aspects will be considered as additional criteria for the business certification system to be adopted.
- Participation will be gender balanced during the consultation process regarding the green procurement policy.
- Air quality monitoring in low-income and high-risk communities will be a priority.
- Data transparency on sustainable local businesses will raise awareness in the local community.

Smart and digital aspects

- The integration of continuous air quality monitoring into municipality services and the provision of a digital dashboard with real-time information for citizens will improve evidence-based decision-making. The action will increase local awareness on air quality issues and the detection of pollution instances will be more accurate. This measure is directly related to measures envisaged in *Action 23*.
- Businesses will be encouraged to adopt smart solutions that enhance sustainability and reduce environmental impact via different information programmes implemented by the Municipality with the support of the information centre.
- These measures will be aligned with Alba Iulia Smart City projects to improve energy efficiency and resource management.

ACTION 3
Partnerships with the private sector for new green industrial areas

IN
Industry

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2029	N\A	4,000,000 EUR

GOAL OF THE ACTION

This action seeks to strengthen the collaboration between the Municipality and the private sector in developing a new industrial area dedicated to attracting green investments, promoting the circular economy, enhancing resource efficiency, and boosting local economic growth.

CHALLENGE ADDRESSED

- Lack of cooperation towards achieving the green development of the industrial areas
- Lack of sufficient investment in developing the industrial and technology parks as green developments, including green business support services
- Lack of public-private partnerships to support the socio-economic development of the city

BENEFITS

- Attracting green investments and creating new job opportunities in the recycling and sustainability sectors
- Reducing waste while promoting circular economy practices
- Encouraging innovation in industrial practices
- Enhancing cooperation between businesses and local authorities to promote long-term sustainable growth and development

TARGETS

- One new green industrial area set up within 5 years of GCAP approval
- At least 3 partnerships/collaborations established between the Municipality and the private sector for circular economy within 5 years of GCAP approval
- At least 1 business in the city applying industrial symbiosis principles in the first 3 years after GCAP approval
- At least 2 small/medium-sized enterprises supported by the Business Incubator each year after the incubator is set up

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

Context

The city has the opportunity to assign dedicated space for circular and sustainable production in Alba Iulia on the newly planned industrial platform in the northeastern part of the city. Alba Iulia faces challenges in retaining qualified workers, as many commute to nearby industrial hubs like Sebeș, while also dealing with the environmental impact of still existing heavy industry and historically active, now decommissioned industrial platforms. In recent years, tourism has become the prominent economic driver in the city, with limited new development of manufacturing or other industrial facilities. Creating a dedicated green industrial area will promote the development of the manufacturing/services sector and help attract circular investments, generate jobs, and drive innovation in waste reduction and material reuse. Strong cooperation between the Municipality and the private sector will be key to the success of this initiative, ensuring synergy between businesses, investors, and local authorities to achieve long-term economic growth and environmental sustainability.

Description

The proposed action follows a multi-step approach, covering policy development, attracting investments, planning infrastructure, supporting businesses, and engaging the community.

Action development

Integrating the circular economy as standard practice in industry and as a priority in the city's development plans should be a key strategy. While industry development is already a focus, accelerating the growth of the green industry sector requires policies that reflect the same level of commitment. Facilitating the establishment of circular economy and industrial symbiosis businesses and attracting related investments would be supported by a fast-track permitting process, simplifying and expediting development. At this stage, the focus of the green industrial platform would result from an options analysis regarding the following sectors:

- Construction waste recycling - reusing old concrete and bricks, recovering scrap wood for reuse in construction, as biomass fuel or for other use, recovering steel and aluminium from demolished buildings;
- Recycling plastic waste – as construction material, 3D filament;
- Food waste recycling – composting for agriculture, biogas or food waste reduction programmes (partnering with supermarkets and restaurants);
- Textile recycling – fabric recycling, sorting and reusing clothes;
- Circular economy support – repair and refurbishment; reusable packaging for local businesses; reusable resources inventory; circular innovation support;
- Clean(er) production alternatives for general goods.

The proposed new site is in the northeastern part of Alba Iulia, well connected to railway and road infrastructure, between the city ring road and the A10 highway. The site will benefit from new utility connections, transport routes and proximity to other industrial hubs. Key infrastructure such as easy site access, supply of energy from RES, waste sorting and management facilities, and smart energy supply systems will also be considered.

Enhanced collaboration with the private sector

Setting up a cooperation model for green industrial projects will attract private sector investment, creating mutual benefits for both the city and businesses. By investing in green technologies, the city can boost growth in the sector, accelerating innovation and sustainability. Partnerships with universities, technical schools and/or waste management companies will support education and specialised workforce development through courses and innovation in waste management, green technologies, and circular economy. A Material

Exchange Platform could strengthen cooperation by helping companies register and enabling the recycling and reuse of materials in the manufacturing and construction sectors.

Business Hub

The aim is to establish a business incubator that supports new investments in green industry, recycling, material recovery, and upcycling while helping them find financial opportunities.

Support can vary from startup support, training, legal or financial assistance.

Implementation steps

1. Establish a working group with businesses, investors, and environmental organisations.
2. Develop a municipal circular economy strategy integrated into the city's economic development plan—this step is included in Waste sector *Action 17*.
3. Implement a fast-track permitting process.
4. Conduct an options analysis followed by a feasibility study and identify at least one priority green industrial activity for targeted development.
5. Ensure access roads, utilities, waste management facilities and operationalise the Green Industrial Area.
6. Establish a cooperation model and define contract terms and conditions.
7. Establish a business incubator and business support programme.

Stakeholders

Alba Iulia Municipality, private businesses, NGOs, universities and research centres

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Set up green industrial area	3,000,000	300,000
Business incubator and business support programme	1,000,000	100,000
Total	**4,000,000**	**400,000**

Social and gender aspects

- Developed new industrial facilities will align with social and gender best practices, offering employment opportunities for socially vulnerable people and ensuring that gender equity principles are adequately implemented.
- The Business incubator will promote social inclusion by integrating social and gender considerations into its development and implementation. Also, the business incubator will develop specific programmes and services dedicated to women entrepreneurship, including trainings and mentoring sessions.
- The design of the industrial area will incorporate the needs of diverse workers (e.g. childcare facilities).

Smart and digital aspects

- The action entails the opportunity to develop digital education programmes on green technologies and circular economy practices and/or to include digital knowledge and skills courses in the current curricula used by faculties of Alba Iulia Universities.

Land Use



Sector overview

Alba Iulia has undergone significant spatial and functional transformations, particularly influenced by the absorption of four neighbouring villages into its built-up area in 2014. This rapid urban development has put considerable pressure on municipal services and infrastructure. While the city's population has increased to a certain extent due to the university and the growing popularity of the city among tourists, it has a relatively low population density compared to its size, often characterised by low-density development in the newly added residential areas. The 2014 GUP is a foundational document guiding the city's long-term development and establishing a framework of spatial regulations. The upcoming revision of the plan is seen as an opportunity to create a more integrated and efficient framework for future developments.

A key land use aspect is the availability and quality of green spaces. Available data indicate that Alba Iulia has a low share of green space per capita, of approximately 16.22 m²/inhabitant (IUDS). This is well below European standards and those recommended by the World Health Organisation. The Local Decision 191/2021 maps the Green Spaces Registry, totalling approximately 895,000 m², which is about 1% of the total urban area. These green spaces are predominantly lawn-type (96.42%), often fragmented, they lack connectivity, and are unevenly distributed across neighbourhoods, providing limited value for leisure, biodiversity, ecosystem functions, and climate resilience. There are extensive areas along the banks of the Mures and Ampoi rivers with underutilised recreational potential. Public consultations have shown a strong resident preference for more high-quality green areas as the realistically usable, good quality green spaces only amount to approximately 3 m²/inhabitant.

Urban planning faces challenges in keeping the pace with new developments, and effective mechanisms to enforce compliance with good architectural practices on private property are insufficient. This has led to urban dysfunctions in new residential areas, such as a lack of essential urban services and infrastructure like adequate roads, water supply, sewerage, and rainwater drainage.

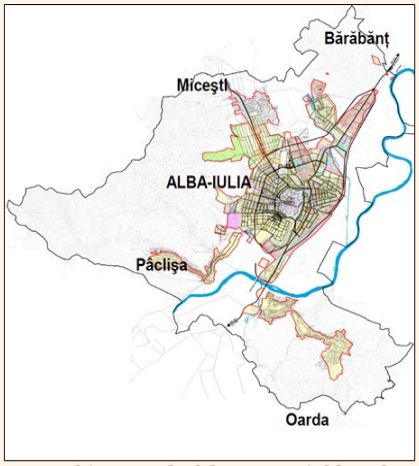


Figure 11 Geographic spread of the new neighbourhoods of Alba Iulia

Relevant policies and strategies in Alba Iulia aim to tackle environmental and urban development challenges through soil remediation, expanding green spaces, and enhancing climate resilience. Key plans include the Land Use Management Plan, the County Development Strategy, the Climate Change Adaptation and Mitigation Action Plan (CCAMAP)[4], the SECAP, the IUDS, and the GUP, the latter outlining goals like phased development, protected natural areas, cycling paths, and increase in public green spaces. Last, but not least, Alba Iulia has developed its Climate Contract under M100 cities Programme. This contract will help the Municipality to attract more funds for reaching climate neutrality. Several urban regeneration projects are

[4] https://fedarene.org/best-practice/integrated-action-for-climate-resilience-in-alba-iulia/

proposed under this contract. Alba Iulia would like to implement such projects in different areas of the city, focusing on rehabilitation of streets - such as Teilor, Calea Motilor, Piata I.C. Bratianu, etc., transforming them into pedestrian areas, leisure and green areas - or rehabilitate the Schit recreational area.

The proposed actions for the Land Use sector target increasing climate resilience, expanding the size and improving the quality green spaces, enhancing biodiversity, promoting non-motorised mobility through land use features, improving public health and well-being (especially for youth), increasing access to green areas, fostering community ownership, and ensuring a more equitable distribution of green and community facilities across neighbourhoods.

Figure 12 Challenges, short- and long-term actions in the Land Use sector



Table 8 Contribution of Land Use actions to SDGs

Action	Contributing to SGDs
ACTION 4. From street and district-level nature-based solutions to city-scale climate resilience	3 GOOD HEALTH AND WELL-BEING; 15 LIFE ON LAND
ACTION 5. Rehabilitate riverbanks for slow mobility and leisure	3 GOOD HEALTH AND WELL-BEING; 15 LIFE ON LAND
ACTION 6. Nature and blue small infrastructure for thriving communities	3 GOOD HEALTH AND WELL-BEING; 15 LIFE ON LAND; 4 QUALITY EDUCATION
ACTION 7. Test and adopt regulations for blended green and social infrastructure	3 GOOD HEALTH AND WELL-BEING; 15 LIFE ON LAND

CTION 4
From street and district-level nature-based solutions to city-scale climate resilience

LU
Land use

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2030	98.56 tCO_2eq/year	13,400,000 EUR

GOAL OF THE ACTION

Implementing nature-based solutions (NBS) at the neighbourhood level to enhance citywide climate resilience. This involves integrating blue-green infrastructure citywide, to mitigate climate risks and improve urban sustainability. This action provides the overall context for and strongly links to *actions 15, 20, 21 and 22*.

CHALLENGE ADDRESSED

- Limited connectivity of the blue-green network at citywide level
- Insufficient enforcement of public policies and regulations related to sustainable urban planning in the development of new and rehabilitated residential areas
- Underutilised recreational potential of land situated in the city
- The green areas between blocks of flats or on the outskirts of neighbourhoods do not fulfil appropriate functions in terms of health, aesthetics, and recreation facilities

BENEFITS

- Increased climate resilience
- Improved quality of life in the city
- Reduced costs related to flood damage, increased property values, and more attractive city for tourism
- Improved air quality, increased share of usable green areas, and improved biodiversity
- Increased recreational spaces, improved mental and physical health

TARGETS

- Increased green space per capita by 20% within 5 years
- Reduced urban heat island effect by 2°C in targeted areas after full implementation
- Improved stormwater management capacity by 30% in targeted areas after full implementation

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

Context

Alba Iulia is experiencing the impacts of climate change, such as increased frequency of urban floods during heavy rain episodes and urban heat islands. These challenges are compounded by limited green spaces and outdated municipal infrastructure. The budget and capacity of the Municipality for large-scale transformations are constrained, requiring innovative and cost-effective solutions to enhance climate resilience.

Alba Iulia has been proactive in climate planning, with initiatives such as the Climate Change Adaptation and Mitigation Action Plan (CCAMAP)[5]. This action builds on existing efforts to enhance urban resilience through NBS.

The GUP of Alba Iulia outlines the city's long-term development strategy, navigating the balance between immediate investment needs and opportunities for future development. The GUP has both a strategic and a regulatory character and is the main operational planning tool, forming the legal basis for the implementation of development programmes. It is being updated and this is an opportunity to include provisions on improving the citywide blue-green network through expansion, better connectivity and usability for leisure, biodiversity enhancement and sustainable mobility. These challenges have become apparent as the built-up area has increased with the addition of nearby villages, but infrastructure and amenities lagged behind.

Earlier city flooding risks dating back to 1970 have been resolved with preventive measures, such as embankments. Today, urban flooding at a rather local scale due to extreme rainfall has become a bigger threat. Excessive rainwater drainage is a challenge due to paved areas with limited green patches. Also, in recent years, summer storms have led to widespread clogging of the drainage systems across many parts of the city, a trend predicted to continue and worsen with climate change. Developing Alba Iulia according to the sponge city concept will mitigate urban flooding by enhancing the city's ability to absorb, store, and reuse rainwater. By integrating green spaces, permeable materials, and advanced water management systems, the city can reduce surface runoff, increase groundwater recharge, and improve overall resilience to extreme weather events. This approach not only addresses flooding but also promotes biodiversity, improves air quality, and enhances the quality of life for residents. Green urban spaces have a crucial role in carbon sequestration but their installation can also contribute to climate mitigation.

In addition, Sustainable Urban Drainage Systems (SUDS), as part of a sponge city approach, reduce GHG emissions compared to traditional urban drainage systems (grey infrastructure). The GHG savings of SUDS are mainly due to a reduced need for cement production, since less underground sewerage pipes, clinkers, paving, etc, are needed. The absolute value of the GHG savings will depend on the scale of the actions taken.

Part of the sponge city concept, rainwater harvesting (see also Water sector, *Action 8)* has a double function: on one hand, it decreases the pressure on the drainage system during storms, while it saves collected rainwater for future use, such as green space maintenance.

[5] https://fedarene.org/best-practice/integrated-action-for-climate-resilience-in-alba-iulia/



Figure 13 Sponge Cities[6]

Description

This action aims to implement NBS at both the neighbourhood and city scales. This involves integrating the sponge city concept, which focuses on managing stormwater through natural processes and blue-green design principles.

At the neighbourhood level, the project will involve creating green roofs, rain gardens, and permeable pavements to manage stormwater and reduce flooding.

At city scale, the project will include the restoration of natural water bodies, the creation of green corridors, and the enhancement of existing parks and green spaces.

Prior to implementation, a full evaluation is needed on how to integrate blue and green measures across the city. Based on pilot projects, NBS principles can be tested and refined. This will be an essential guidance when extending the number of projects initiated across the city.

A core principle of blue-green measures is community involvement. By engaging residents in planning, implementing, and maintaining these initiatives, a sense of ownership is fostered. This leads to long-lasting environmental benefits and solutions tailored to local needs. The collaborative approach enhances project success and strengthens community resilience and cohesion.

Land use data are available at the Cadastre Register. All these data are easily accessible by the Municipality and are already integrated into digital platforms in use. In addition, the Municipality has a digital database with all the construction permits and land use restrictions. All these are open-source data, providing the opportunity for a citywide location identification study for long-term implementation of blue-green projects.

[6] Source: Rethinking The Future website, https://www.re-thinkingthefuture.com/city-and-architecture/a2843-sponge-cities/.

To ensure long-term alignment, these measures would be integrated into the Municipality's overarching urban development plan, coupled with clear phasing, funding strategies, and measurable targets. Ensuring success implies also clarifying responsibilities, resource needs, and potential effectiveness across scales. This may include regulatory instruments such as planning codes or building regulations requiring NBS (e.g. green roofs, permeable surfaces, tree planting) in new developments or significant renovations, as well as incentive-based measures such as subsidies, grants, or tax incentives to prompt property owners to apply NBS when retrofitting their buildings or parcels. Simultaneously, actions need to be implemented in a multitude of public spaces. Such endeavours would set an example and are also crucial in achieving a coherent and solid blue-green network across the city.



Figure 14 Pilot project illustration: Reconversion of the outer moat area, eastern part of the Alba Carolina Fortress (Municipality website)

The pilot project targeting the outer Eastern Moat of the Alba Carolina Fortress is included in this action. This is a historic site that has the potential to be transformed into a vibrant green space and become a nucleus in the network of green spaces of the city. This project aims to regenerate and reconvert the currently unused and unsanitary moat on the eastern side of the Alba Carolina Fortress into a usable area that enhances the city's climate resilience and provides recreational opportunities for residents and visitors.

The pilot project of reconverting the Eastern Moat of the Alba Carolina Fortress falls within the strategic objectives and areas of intervention of the IUDS 2021-2030 of the Municipality of Alba Iulia, specifically: Strategic objective 3 - Connected, efficient, resilient city and Focus area 1 - Spatial planning and sustainable urban mobility. The study area of the project covers approximately 26,000 m^2 and is currently established as protected built area. The location includes the eastern outer moat of the Alba Carolina Vauban-type fortification, between the defensive elements of the fortification and the plot of the existing houses on Decebal and Octavian Goga streets. The fortress is included in the List of Historical Monuments (2015) of Alba County. Today, the area contains derelict sports fields (i.e. covered with concrete and deteriorated with dangerous cracks; old staircases and ramps; discontinuous pedestrian access). According to the requirements of the design theme, the proposed hard surfaces (alleys, squares, public amenities, etc.) will not exceed 10% of the total area of the green space represented by the project area.

Together with the implementation of the pilot project, a Guideline for Streetscape Design will be developed, specifically for the city of Alba Iulia, detailing how urban spaces should be designed to include blue-green features and other types of NBS which are both functional and aesthetic, well anchored into urban sustainable design principles.

The project aligns well with the principles of a sponge city:

- Water management: By capturing and reusing rainwater, the project helps manage stormwater, reducing the risk of flooding and promoting groundwater recharge.
- Green infrastructure: The reconfiguration of green spaces and the planting of diverse tree species enhance urban biodiversity and create permeable surfaces that can absorb rainwater. This reduces the urban heat island effect and improves air quality.
- Ecological restoration: The project focuses on ecological rehabilitation by minimising hard surfaces and enhancing green spaces.
- Sustainable urban design: Incorporating these blue-green measures into the Alba Carolina Fortress area demonstrates a commitment to sustainable urban design. This approach not only mitigates environmental hazards but also enhances the aesthetic and recreational value of the space.

Implementation steps

1. **Assessment**: Conduct a baseline study, including a detailed assessment to identify vulnerable areas and blue-green infrastructure potential. Explore the possibilities for integration with forthcoming city developments.
2. **Planning**: Develop detailed plans for blue-green infrastructure projects, see also *Actions 5, 6 and 7*
3. **Pilot Projects**: Implement NBS pilot projects in the city centre (Regenerating and reconverting to usable status the external Eastern Moat of the Alba Carolina Fortress).
4. **Community Engagement**: Involve local communities in planning and implementation from the outset at city scale, and subsequently at the pilot project level.
5. **Upscaling**: Implement the concept in other parts of the city as well. Develop a Guideline for Streetscape Design specifically to the City of Alba Iulia.

Stakeholders

Alba Iulia Municipality, Alba EPA, the Urban Planning and Land Use Department, Technology and Development Department, Alba Local Energy Agency (ALEA), environmental NGOs, residents, schools, businesses

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Citywide study to identify vulnerable areas and blue-green infrastructure potential	150,000	–
Feasibility study on the sponge city concept and NBS opportunities with measures such as: rainwater harvesting, bioswales along the riverbeds and permeable pavements	200,000	–
Pilot project Eastern Moat of the Alba Carolina Fortress	3,000,000	10,000
Restoration and construction of blue-green infrastructure in other pilot projects (see also *Action 5 and Action 10)*	10,000,000	250,000
Development of a Guideline for Streetscape Design	50,000	
Total	**13,400,000**	**260,000**

Social and gender aspects

- Equal access to green space for all community members will be ensured.
- Women's participation in planning and decision-making processes will be promoted. The Guideline for Streetscape Design will be gender mainstreamed. Also, the guideline will consider the needs of vulnerable persons and include elements that will have to be included in the future streetscape design to have inclusive green spaces all over the city.
- Local communities will be involved in the design and maintenance of green spaces. The proper representation of different stakeholders will be ensured in the design phase, and the same engagement opportunities will be offered to all, including vulnerable people.
- The maintenance of green spaces will offer new job and entrepreneurship opportunities. Job creation will align to inclusive recruitment practices.

Smart and digital aspects

- Opportunity to develop a hydraulic model to assess and optimise design of NBS interventions.
- Implementation of sensors to monitor air quality, temperature, and soil moisture.
- Use of apps and online platforms for community engagement and feedback.

ACTION 5
Rehabilitate riverbanks for slow mobility and leisure

LU
Land use

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2030	157.2 tCO_2eq/year	4,150,000 EUR

GOAL OF THE ACTION

Enhance the accessibility and attractiveness of the riverbanks along the Ampoi River in Alba Iulia to promote slow mobility (walking, cycling) and leisure activities, while improving the quality of the environment and increasing climate resilience through NBS.

CHALLENGE ADDRESSED

- Underutilised recreational potential of land situated in the city
- The green areas between blocks of flats or on the outskirts of neighbourhoods do not fulfil appropriate functions in terms of health, aesthetics, and recreation facilities
- Limited connectivity of the blue-green network at the citywide level

BENEFITS

- Increased surface area and quality of green spaces, improving possibilities for leisure
- Increased climate resilience through NBS thereby mitigating floods
- Boosting local non-motorised means of mobility in the overall modal share
- Biodiversity enhancement in citywide context

TARGETS

- At least 3 leisure areas created, distributed sustainable amenities to offer diverse leisure and sports opportunities, 5 years after GCAP approval
- 1.5 km of riverbank paths developed, with accessibility for both bicycles and pedestrians, 5 years after GCAP approval
- Rehabilitated river area, at least 500 trees planted

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

SO 4 Enhancing the attractiveness of the city for tourists, by creating adequate infrastructure and diverse offers of sustainable tourism

Context

Three rivers cross or border Alba Iulia: Mureș, Sebes, and Ampoi. The potential for recreation and sports along the banks is not yet fully used. Illegal waste dumping is a common occurrence, mainly along the Ampoi river, which crosses directly through the city. Rehabilitating these riverbanks can promote slow mobility and leisure activities, creating vibrant blue-green corridors and enhancing the city's liveability, thereby linking this action with *Action 4*.

Expanding the network of walking and bike paths along the riverbanks would improve possibilities for leisure and sports. This would also provide added value for tourism, for example by making the connection with several mountain biking trails near Alba Iulia (see also *Action 1* and *Action 14*).

The ecological state of Alba Iulia's rivers was classified as 'good' in 2020 under the Water Framework Directive. In terms of flooding protection, hydrotechnical works protect the three main water courses, safeguarding the city against river overflow. Climate change is expected to alter the Ampoi River's flow, increasing winter discharge and lowering summer flows, with the river expected to remain effective for climate resilience during heavy rainfalls.

Alba Iulia’s limited but well-maintained green spaces serve recreation, sports, and sanitary functions, yet demand for more is growing. Revitalising the Ampoi riverbanks with natural embankments, where suitable, could expand accessible green areas, enhance climate resilience, and provide spaces for walking, cycling, and socialising.

Description

This project aims to transform the banks of the Ampoi river into accessible, attractive, and sustainable public spaces, by developing walking and cycling paths, green spaces, recreational areas, and, where suitable, habitat restoration initiatives.

A feasibility study should guide the development of specific actions. The study would benefit from strong community participation, involving residents in the planning process to better meet their needs and preferences.

This action is also linked with *Action 15* in the Transport section on developing biking infrastructure from the city centre to relevant areas adjacent to the city. The riverbank is to be developed as part of this network, well-connected to it.

One of the proposed areas for blue-green infrastructure development is a 2 km stretch along the Ampoi river area, located in the vicinity of the Carolina Mall. Expanding this area could not only enhance the green space around the commercial buildings but also improve the quality of life and overall living conditions in the nearby neighbourhoods of Alba Iulia. If extended further, the project could also benefit the new residential developments in the Barabant and Orizont areas.



Figure 15 Location indication of the proposed new blue-green development area near Carolina Mall

The following aspects need consideration in designing the riverbanks:

- Accessibility: Improve access for pedestrians and recreational cyclists, for all ages and abilities, connecting with existing routes and mountain bike trails. Routes should be fitted with Wi-Fi availability and video surveillance.
- NBS: Address erosion risk, increase climate resilience, provide shading, and improve soil permeability.
- Recreational infrastructure: Install playgrounds, benches, picnic tables, boardwalks, public barbecue places, and sports facilities. This may also include pop-up markets.
- Topography and vegetation: Restore natural topography where deemed suitable and beneficial by the Water Authority; include native plant and pollinator-friendly species, and stabilise riverbanks where needed, to improve resilience, biodiversity and aesthetics.
- Climate resilience: Enhance riparian vegetation, introduce gravel substrate where needed, and plant trees to mitigate floods, droughts, and heat waves.



Figure 16 Somesul Mic riverbank with pollinator flora, boardwalks and walking paths (Cluj-Napoca Municipality*)*



Figure 17 Before and after (concept) example of Somesul Mic riverbank rehabilitation (Source: website of Cluj-Napoca Municipality)

Implementation steps

1. Complete a technical study on how to rehabilitate the riverbanks, thereby integrating community consultation for understanding needs and desires.
2. Deploy public procurement process and implement the works detailed above.
3. Implement awareness campaigns and community events to encourage public use.

Stakeholders

Urban Planning and Land Use Department; Alba EPA; City Manager; Alba Intercommunity Development Association (AIDA); the Alba Iulia Office of the Mures River Basin Management Administration within the National Administration Romanian Waters

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Technical study and public consultation	100,000	–
Works implementation: pedestrian and cycling infrastructure, natural rehabilitation of the riverbank area; leisure infrastructure along the riverbank (playgrounds, barbecues, picnic tables, benches and sport facilities)	4,000,000	100,000
Awareness campaigns and community events to encourage public use	50,000	5,000
Total	**4,150,000**	**105,000**

Social and gender aspects

- Walking and cycling paths will be made accessible to wheelchairs, strollers, and regular benches will be provided for elderly people and children to rest.
- Different organisations, including women and youth organisations will be consulted to understand their expectations and needs. These needs, respectively general health and safety aspects will be taken into account when designing new infrastructure features.
- Specific design elements addressing women's needs (lighting, emergency call points) will be included, paths will connect to PT routes, child-friendly elements reflecting women's disproportional caregiving responsibilities will be included.
- Improved safety of the new routes and green areas, through adequate lighting and railings
- Employment opportunities for women and underserved groups in the construction and maintenance phase. Job creation will align to inclusive recruitment practices.

Smart and digital aspects

- The new routes and green areas can be equipped with smart street lighting providing safety but also minimising light use to avoid disturbing animals. Potential synergy with digital components of *Action 23*.
- The project foresees Wi-Fi distribution infrastructure and installation of video surveillance. This allows for comprehensive data collection and analysis regarding, for example, the number of users, prevailing use, preventing illegal activities such as illegal fishing or habitat destruction, and supporting educational initiatives by providing access to information and resources about the local environment and biodiversity.
- Digital platforms should be used for community engagement and feedback.

ACTION 6
Nature and blue small infrastructure for thriving communities

LU
Land use

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2030	280 tCO_2eq/year	1,700,000 EUR

GOAL OF THE ACTION

This action aims to enhance urban resilience and liveability in Alba Iulia by expanding usable small-scale, blue and green spaces and implementing citywide pilot projects: Combining blue infrastructure for cooling and water retention with playing opportunities; Enriching playgrounds and schoolyards with natural elements, with the possibility of opening schoolyards to the wider public after hours; Developing nature-inclusive dead-end streets and other small parks. Implementation of these actions will expand the usable blue and green space for citizens.

CHALLENGE ADDRESSED

- Limited connectivity of the blue-green network at citywide level
- The green areas between blocks of flats or on the outskirts of neighbourhoods do not fulfil appropriate functions in terms of health, aesthetics, and recreation facilities
- Underutilised recreational potential of land situated in the city

BENEFITS

- Improvement of public health by promoting a more active lifestyle, providing a safe space for physical activities, social interaction, and recreation.
- Improvement of the young generation's well-being, learning and play, while contributing to their communities' ecological health, social cohesion, and climate resilience
- Enhancing groundwater recharge and reducing pressure on drainage systems
- Increased climate resilience by reducing the urban heat island effect and mitigating stormwater flooding
- Enhanced urban biodiversity and creating small habitats for a variety of animals
- Fostering a greater sense of appreciation and ownership among citizens for their city

(see additional benefits in action description)

TARGETS

- At least 1 location developed where blue and green infrastructure are combined with playing opportunities, e.g. interactive water playing areas or rain gardens with play elements, in the first 5 years of GCAP implementation
- 3 pilot projects implemented with schools and 5 tiny parks in the first 5 years of GCAP implementation
- A minimum of 15% increase in shaded areas through tree canopy coverage in pilot project locations after action implementation, with a focus on including a variety of native plant and tree species
- At least 1,000 persons (ensuring equal gender division) reached per year with digital features for pilot monitoring and increased awareness measures, after pilot implementation.

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

SO 4 Enhancing the attractiveness of the city for tourists, by creating adequate infrastructure and diverse offers of sustainable tourism

Context

Alba Iulia experiences urban challenges such as limited recreational spaces and stormwater management in need of improvement. The municipality's proportion of green space areas within urban limits is low and local green spaces often need quality improvement. The city's urban landscape includes underutilised areas like paved schoolyards, which are currently accessible only to the school community. Some dead-end streets could also allow for green space development.

The water management efforts in Alba Iulia have primarily focused on traditional grey engineering infrastructure. There is, however, a growing interest in NBS for water management and a shift to incorporating more NBS could enhance environmental sustainability and provide additional benefits to the community, as reflected also in the water sector.

This action aims to address these challenges by integrating blue and green infrastructure on small-scale spaces, creating multifunctional spaces that enhance urban resilience, environmental sustainability, and community well-being.

Description

This action involves the design of multifunctional spaces that combine water and green features with recreational areas for children, residents and visitors of all ages and community enjoyment while mitigating urban heat island effects through cooling and shading. The measures included here fit into the larger city-wide plan introduced in *Action 4*.

The focus here is on small interventions that make a difference locally and, taken together, also provide an improved overall urban city environment. These would thereby also improve quality of life in areas particularly in need of improvement, such as the newly developed neighbourhoods or areas prone to heat islands.

A first implementation of this action could be carried out in the Dual Learning Campus, which is being developed in the Ampoi III neighbourhood – see location on the map in figures below.



Figure 18 Location of pilot project highlighted in green, on the site of the future Dual Campus (Google Earth, 2025)

Elements considered are:

- Transform paved areas: Convert schoolyard and other suitable areas into vibrant green spaces;
- Public access: Make green spaces accessible to the public, enhancing ecological health and overall well-being. Facilitate public access to schoolyards outside school hours through agreements between schools and the Municipality;
- Increase local amenities: Small blue-green spaces boost local amenity and biodiversity values;
- Natural elements: Introduce large shade trees, water features, fruit and vegetable gardens, and natural playground equipment to encourage children to explore, learn, and play;
- Improve biodiversity: Extend native vegetation with trees, shrubs, flowers and grass beds;
- Climate resilience: Plant trees to capture carbon, filter pollutants, and mitigate urban heat island effects.



Figure 19 Example of a willow structure designed as a natural play/seating area (left) and nature-enhanced schoolyard transformation (right)

Of particular interest are pocket forests planted using the Miyawaki method, which tend to grow faster than the traditional style of forest planting and ensure increased carbon capture. The Miyawaki method consists of planting native species of all layers of forests in a dense manner, with heavy mulching. Competition among plants and minimal maintenance in the first year ensure quick growth with visible results.



Figure 20 Visual representation of a pocket forest inspired by the Miyawaki method (left) and small nature-enhanced urban park (right)

Furthermore, there is an economic benefit to the development of local blue-green spaces. It can significantly boost the attractiveness of the city to visitors. Green space can also boost the value of nearby properties, contributing to economic growth. Additional benefits include higher survival rates for seniors when they have easily accessible walkable green space; temperature buffering inside when trees are positioned next to buildings and lowering air pollution.

See also the link with *Action 2*, where air quality monitoring is included and to be made available to the public, showing the impact of nature on air quality.

The proposed pilot project is:

1. Combining blue infrastructure, for cooling and water retention, with playing opportunities. Pilot project: Dual Campus area - approx. 2 ha;
2. Enriching playgrounds and schoolyards with natural elements, and considering options for opening the schoolyard to the wider public after hours;
3. Having a nature-inclusive small park fitted in the school yard, with future replication in underused urban spaces and identified suitable dead-end streets.

Implementation steps

1. Develop a study to identify additional locations for action implementation, in addition to the designated pilot area:
   a) Conduct a baseline study including a detailed assessment to identify the neighbourhoods with the lowest access to open and amenity spaces and the highest need for public greening or blue infrastructure.
   b) Identify schools interested in playground transformation projects to include nature-based play areas.
   c) Map potential locations for transforming dead-end streets and other underused urban areas into pocket parks, showcasing different types of small blue and green spaces.
   d) Prioritise selected locations based on the need for NBS, such as stormwater management and urban heat island mitigation, or areas in need of urban regeneration.
   e) Develop a roadmap with timelines for extending the number of projects across the city and ensure start-up and implementation for aligning with the targets.
2. Develop detailed plans and implement the Dual Campus pilot project, gathering insights and lessons learned for further initiatives. Extend implementation to at least 3 pilot projects with schools and 5 tiny parks.
3. Develop digital features for monitoring pilot project features and increased awareness on climate resilience, biodiversity enhancement and social cohesion aspects of the pilot project and future replication plans.

Stakeholders

Urban Planning and Land Use Department; Alba EPA; Apa C.T.T.A. S.A. water utility company; Technology and Development Department; Department for Public and Private Domain Administration; County School Inspectorate; board and students from participating schools; parents' associations; NGOs and local communities.

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Study to identify future locations to replicate/scale up action implementation	100,000	
Detail plan development and implementation of measures: Green playground equipment; Blue infrastructure such as swales and rain gardens; Vegetation and planting supplies—samplings and materials (up to EUR 100 /m² of planted forest)—at least 1000 m² to be developed in the next 5 years; Full pilot implementation in Dual Campus area, 3 additional pilot projects implemented with schools and 5 tiny parks	1,500,000	100,000
Develop digital features for pilot projects and awareness increase	100,000	10,000
Total	**1,700,000**	110,000

Social and gender aspects

- Design safe, well-lit, and accessible spaces with facilities such as gender-neutral restrooms.
- Create family-friendly areas with amenities such as picnic tables, BBQ pits, and playgrounds to encourage family outings and social gatherings.
- Facilitate regular community events, including yoga classes, farmers' markets, and cultural festivals to appeal to diverse interests and encourage community participation.
- Ensure playgrounds are accessible to children of all ages, with natural elements like trees, rocks, and sand for exploration, as well as interactive water features.
- Ensure wider walking paths, levelled, well-maintained, and equipped with plenty of seating options for resting.
- Make public green spaces accessible to wheelchairs and strollers, while providing benches for older people and children to rest. Integrate sports facilities such as basketball courts, soccer fields, and skate parks to attract teenagers and promote an active lifestyle.
- Prioritise health and safety in the design of new infrastructure, including walking, jogging, and cycling paths that weave through green spaces to encourage both physical activity and relaxation. Conduct regular self-assessments to ensure the safety of nature-inclusive playgrounds.
- Promote community engagement by establishing shared gardens where residents can grow their own vegetables and flowers, encouraging healthy eating habits and social interaction. Stakeholder/community engagement mechanisms will include all underserved groups in project development to ensure local needs are met.
- Develop and implement a monitoring system for determining the effectiveness of the measures from a social and gender perspective. Analyse yearly the data collected and assess if the measures have been gender-mainstreamed and inclusive.
- Employment opportunities for women and underserved groups in the construction and maintenance phase. Job creation will align to inclusive recruitment principles.

Smart and digital aspects

- Deploying IoT sensors to monitor real-time environmental conditions.
- Use the data produced by the hydraulic modelling (envisaged in the previous *Action 5*). Consider also the weather forecasts and soil conditions. All this data should be used as input data for the irrigation system.
- Use Geographical Information System (GIS) mapping to identify optimal project locations for blue-green infrastructure projects.
- Integrate smart lighting in essential areas, while ensuring minimal disturbance to sensitive wildlife.
- Install biodiversity observation cameras for data collection and educational purposes.
- Place interactive QR code panels to provide information on planted species and maintenance guidelines;
- Develop citizen-engaging apps to encourage public participation in reporting issues, assisting with maintenance, and providing feedback on implemented projects.

ACTION 7
Test and adopt regulations for blended green and social infrastructure design

LU
Land use

TIMEFRAME	GHG SAVINGS	CAPEX
2026-2030	20 tCO_2eq/year	7,300,000 EUR

GOAL OF THE ACTION

When developing new districts in Alba Iulia, the aim is to create sustainable, inclusive, and resilient urban spaces by integrating green elements and community facilities in new and modernised areas. By updating urban development regulations, the city will ensure all necessary infrastructure is included. The creation of climate-robust neighbourhoods will involve the integration of parks, green spaces, and social amenities into urban planning. This will enhance community well-being, promote environmental sustainability, and ensure equitable access to public amenities for all residents.

CHALLENGE ADDRESSED

- Limited connectivity of the blue-green network at the citywide level
- The green areas between blocks of flats or on the outskirts of neighbourhoods do not fulfil appropriate functions in terms of health, aesthetics, and recreation facilities
- Insufficient enforcement of public policies and regulations related to sustainable urban planning in the development of new and rehabilitated residential areas
- Underutilised recreational potential of land situated in the city

BENEFITS

- Accessible community facilities and inclusive public spaces facilitating social interaction and strengthening community bond
- Access to all residents to public amenities promoting social equity and inclusion
- Access to green spaces encouraging physical activity, reducing stress and improving overall well-being
- Boost for local businesses, tourism and the overall economy
- Green infrastructure solutions, such as rain gardens and permeable pavements helping manage stormwater runoff and reduce the risk of flooding
- Improved air quality and reduced urban heat effect

TARGETS

- 100% of citizens in the city's new districts have access to quality green space within a maximum distance of 1,000 m after action implementation
- Access to basic community facilities ensured within walking distance for 100% of the citizens in new districts
- Residents' satisfaction in Micești-Orizont new district improved by 20% following the completion of the North Park project
- The development of the North Park in the Micești-Orizont neighbourhood completed by end of 2028
- At least 1,000 trees planted and wildlife habitats established in the Micești-Orizont neighbourhood, connecting green corridors to the new North Park, within 5 years after GCAP approval

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

Context

The rapid integration of neighbouring villages into the city of Alba Iulia has resulted in rapid development, but with substandard quality of such urban areas – poor infrastructure, car-dominated urban design, and insufficient services and utilities. This expansion places significant pressure on urban services, requiring revised public development policies and sustainable measures to address emerging challenges. Additionally, the city lacks extensive green areas, has an unevenly distributed and insufficient amount of usable green space per capita, falling below international standards.

Green spaces, including parks, community gardens, and walking trails, offer residents and tourists opportunities to relax, exercise, and connect with nature and thus are much needed in all areas. Additionally, these areas can host community events and activities and foster a sense of community and belonging.

By making the new districts more self-sufficient and ensuring necessary amenities are available, residents will be less likely to travel long distances to access such features. This, in turn, makes the districts more attractive to new residents, allowing them to enjoy a higher quality of life with everything they need close by.

The Micești-Orizont neighbourhood, located in the northern part of Alba Iulia (see maps below), has been identified as a key area to demonstrate the benefits of integrating green and community facilities in new projects, with the creation of the new North Park selected as a pilot initiative. The neighbourhood has a mix of residential, commercial, and undeveloped land, presenting a unique opportunity to create a vibrant, green, and inclusive urban space.



Figure 21 Map of Micești-Orizont neighbourhood with North Park area (Google Earth, 2025)

The action falls within the strategic objectives and areas of intervention of the IUDS. A feasibility study was already contracted for this park and the building permit is expected to be issued. To further enhance the neighbourhood, it would be beneficial to include additional green spaces while also addressing social aspects.

The location of the development of the new North Park in the Micești-Orizont neighbourhood (NW part of Alba Iulia) is highlighted on the map above and is delineated by the following streets: Stadionului street to the North, Azur street in the East and Garda Street to the West and South.

Description

The aim of this action is to create sustainable, inclusive, and resilient neighbourhoods across Alba Iulia. Rather than being mainly concentrated in the city centre, transition is needed to have social amenities and infrastructure more evenly distributed across all city areas. Comprehensive sustainable development standards and guidelines, inspections and incentives facilitate more equal quality-of-life standards across the metropolitan area.

This action puts into practice the Municipality's commitment to building sustainable, inclusive, and resilient neighbourhoods through a pilot in the Micești-Orizont district. The development of the 80,000 m² North Park will serve as the core intervention, integrating accessible community facilities and green infrastructure. This pilot directly supports targets related to environmental resilience, equitable access to services, and climate adaptation.

The future North Park is well connected to PT, with several bus lines and stops in the area, as shown on the map below.

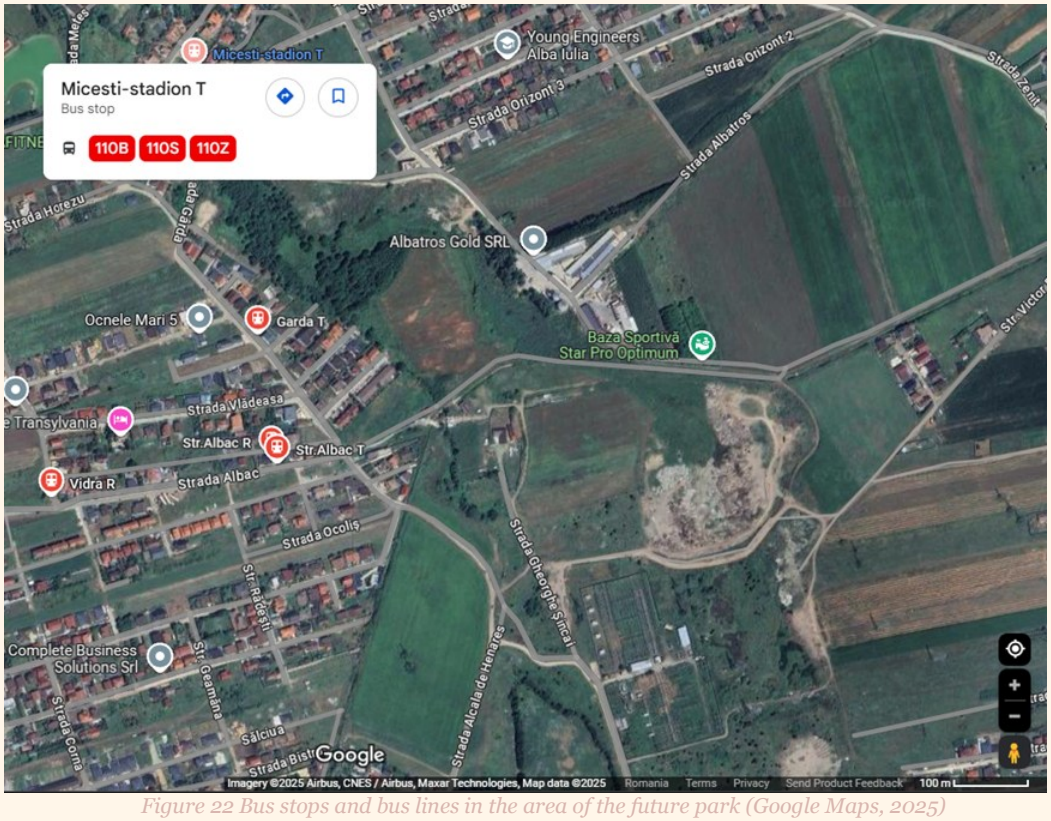


Figure 22 Bus stops and bus lines in the area of the future park (Google Maps, 2025)

As a pilot, the new publicly owned North Park will provide an example and leverage for the integration of green and community facilities. The area requires minimal intervention to protect existing nature. Suspended walkways will allow public access without harming the biotope. A water retention basin will manage stormwater and support local biodiversity. The central area will be transformed into an active recreational space with amenities like playgrounds, walking paths, community gardens, and social gathering spots. The park will improve air quality, enhance biodiversity, and serve as a green area, connecting nature and the community while educating the public about biodiversity.

The selected area is a special ecological area, characterised by a humid forest with high biodiversity. Given the ecological importance of this biotope, the landscaping strategy of the park proposes a minimal intervention, focused on protecting and preserving the existing nature. The interventions will be limited to

selective cleaning activities, without modifying or disturbing the natural vegetation, thus ensuring the maintenance of the ecological balance.



Figure 23 North Park pilot project in the Micești-Orizont Neighbourhood – design

The following components, objectives and actionable elements for the pilot are considered:

Component	Objective/benefit	Elements
Green corridors and park zones	Access to nature within 15 minutes for residents in the nearby area	Landscape planning based on ecological preservation, no-touch zones around humid forest
Community gardens	Promote food resilience and cohesion	Plot allocation and co-design process with residents
Community amenities	Improve well-being and inclusion	Outdoor gathering spaces, activity nodes, and micro-pavilion structures
Stormwater retention basin	Manage urban runoff and increase biodiversity performance	Integrate with nature topography; complete feasibility

Implementation steps

1. Construct North Park including suspended walkways, gardens, and gathering areas; complete under the Municipality's capital works budget.
2. In parallel, draft and adopt planning regulations integrating NBS requirements into zoning codes; led by a multidisciplinary team (including urban sustainability development experts, architects, landscape architects, and technical experts in transport, social, environmental aspects and others).
3. Scale improvements across Micești-Orizont informed by pilot evaluation; include support for private lot greening.
4. Prioritise underinvested districts with tailored interventions, using lessons from North Park's socioeconomic impact.
5. Enforce local regulations established by urban planning, starting with zonal urban plans for new districts.
6. Identify problem areas and prioritise interventions in deprived districts to reduce eco-gentrification, focusing on areas with the highest impact in terms of the number of beneficiaries.

Stakeholders

Alba EPA, Urban and Land Use Department, Technical Directorate of Development; residents and community organizations of the new districts; organizations focused on urban sustainability and biodiversity; developers and businesses investing in green and community facilities.

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Development of North Park in the Micești-Orizont neighbourhood and integration of nature and social amenities	7,000,000	200,000
Enforcement of local regulation on the integration of green and community facilities	–	25,000
Mapping problem areas, selection of priority projects	300,000	
Total	**7,300,000**	**225,000**

Social and gender aspects

- New developments will integrate green and community facilities inclusively and equitably, benefiting all residents. Projects like the North Park will prioritise safety and accessibility for all ages and abilities, including those with disabilities. In addition, the enforcement of local regulation will support the avoidance of eco-gentrification process, by providing the necessary tools and methodologies for the development of such integrated blue-green areas in other areas of the city.
- The project ensures equal access for women and men, promoting gender equality in planning, development, and maintenance. Women's participation will be encouraged throughout all project phases. Measures will ensure accessibility for people with disabilities, including vulnerable groups.
- Community-building activities, such as workshops, volunteering projects, and events, will foster social cohesion and pride in the new park, promoting an environmentally friendly lifestyle.
- Employment opportunities for women and underserved groups in the development and maintenance phase. Job creation will align to inclusive recruitment principles.

Smart and digital aspects

- Implementing smart and digital technologies can enhance the efficiency and sustainability of new developments or districts. The North Park can incorporate smart monitoring systems to track environmental conditions such as air quality, soil moisture, and park usage. These systems will provide real-time data to optimise maintenance and ensure the park remains healthy and vibrant.
- Digital engagement tools, such as mobile apps and online platforms—either existing or new, if needed—can involve the community in the planning and maintenance of the park. Residents will be able to provide feedback, report issues, and participate in decision-making processes through the existing digital channels (the online platform of the Municipality for reporting incidents/complaints).
- Additionally, energy-efficient technologies, such as solar-powered lighting and smart irrigation systems, can be installed to reduce the park's environmental footprint and promote sustainable resource use.

Water



Sector overview

The drinking water supply and wastewater collection systems in Alba Iulia are primarily managed by the regional operator, S.C. APA C.T.T.A. S.A. Alba. The main source of drinking water for the city is the Sebes river, supplied via the Obrejii de Căpâlna dam. The water infrastructure within the city includes extensive networks, with around 750 km of water supply pipes and 470 km of sewage pipes. While the sewerage system has wide geographical coverage in the city, some peripheral areas, formerly rural areas, still rely on septic tanks, the quality and structural integrity of which are uncertain.

Alba Iulia is generally well-served by water supply and sewerage infrastructure, with around 75% of the population connected to the drinking water network. Expansion and rehabilitation efforts are ongoing, showing positive trends in the length of the network and other infrastructure indicators. Drinking water quality at the outlet of the treatment facilities remains high, with nearly 99% of samples meeting national standards over the past seven years. In recent years, water consumption has increased, driven by population growth and urban development, including higher demand from businesses, public institutions, and industry. The city's water storage capacity can meet municipal needs for up to 24 hours, including reserves for firefighting. Per capita water usage falls within the optimal benchmark range. Non-revenue water, however, was nearly 32% in 2023—well above the water company's target of 22%. This was mainly due to ageing infrastructure and frequent operational inefficiencies. Extending the network to new and developing areas of the city is often delayed and misaligned with land use planning, largely due to administrative challenges that the Municipality is addressing partly through the current revision of the GUP.

The wastewater treatment plant in the Partoș district was modernised to meet European standards and can now serve up to 84,000 people. Alba Iulia's population has remained stable at around 74,000 between 2014 and 2024, with minor fluctuations from university students, indicating that the plant's capacity is adequate for current needs. However, in the future, the WWTP will have to comply with the provisions included in the new EU Directive on Urban Wastewater Treatment. Wastewater and rainwater are mostly collected through a combined sewer system, although newer neighbourhoods are equipped with separate stormwater networks.

Energy use – especially for pumping in both water supply and wastewater collection – is a major cost driver, leading to high water and sewerage bills for consumers. To reduce these costs, the operator has started using RES, such as PV systems, to partially cover its energy needs. A centralised supervisory control and data acquisition (SCADA) system is also being implemented to monitor key operational parameters across the integrated water system.

In terms of flooding risks, the city is well protected against river floods thanks to hydrotechnical works on the Mureș, Ampoi, and Sebeș rivers, managed by the Mures Water Basin Administration - Alba Water Management System. Urban flooding caused by heavy rainfall, however, remains a significant risk. This is mainly due to clogged or inadequate stormwater drainage systems.



Figure 24 The banks of the Ampoi river

Existing policy documents at county and municipal levels emphasise integrated approaches in the water and wastewater sector. Strategies include measures for network rehabilitation and extension, restoration of drainage systems and reservoirs. Policies also aim to reduce water losses, prevent source pollution, and inform consumers. The acquisition of ultrasonic meters in the city centre has already begun as an ongoing investment. Alba Iulia also included projects for stormwater network development and rehabilitation in its IUDS and CCAMAP.

Figure 25 Challenges, short- and long-term actions in the Water sector

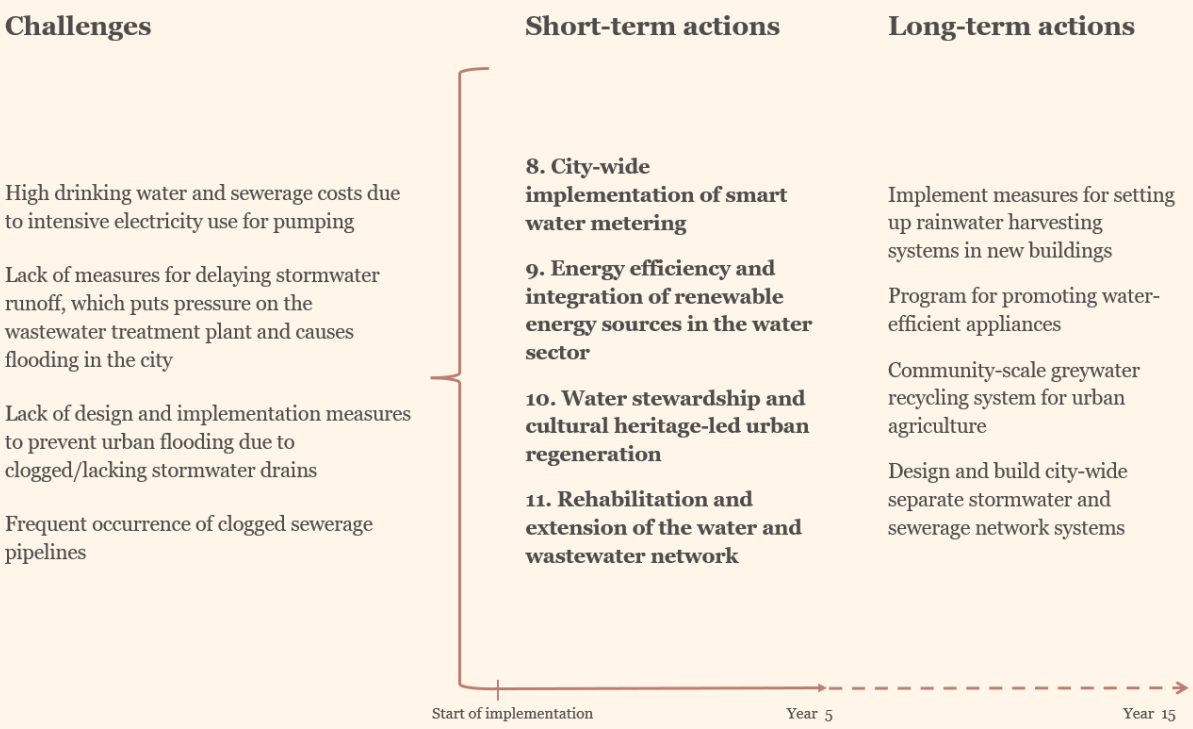


Table 9 Contribution of Water sector actions to SDGs

Action	Contributing to SGDs			
ACTION 8 City-wide implementation of smart water network management and metering	6 CLEAN WATER AND SANITATION	3 GOOD HEALTH AND WELL-BEING	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	10 REDUCED INEQUALITIES
ACTION 9 Energy efficiency measures and integration of renewable energy sources in the water sector	6 CLEAN WATER AND SANITATION	3 GOOD HEALTH AND WELL-BEING	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	7 AFFORDABLE AND CLEAN ENERGY
ACTION 10 Water stewardship and cultural heritage-led urban regeneration	6 CLEAN WATER AND SANITATION	3 GOOD HEALTH AND WELL-BEING	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	7 AFFORDABLE AND CLEAN ENERGY
ACTION 11 Rehabilitation and extension of the water and wastewater network	6 CLEAN WATER AND SANITATION	3 GOOD HEALTH AND WELL-BEING	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	10 REDUCED INEQUALITIES

ACTION 8
Citywide implementation of smart water network management and metering

WA
Water

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2027	57.77 tCO_2eq/year	2,500,000 EUR

GOAL OF THE ACTION

Optimising water management by enhancing efficiency, reducing maintenance and operating costs, promoting sustainability, and ensuring reliable water supply for urban areas.

CHALLENGE ADDRESSED

- Outdated water metering system and lack of integrated planning to update the infrastructure
- High drinking water and sewerage costs
- Lack of design and implementation of measures to prevent urban flooding

BENEFITS

- Reduced non-revenue water
- Water loss cost saving by early leak detection
- Lower maintenance and operational costs due to automation, remote monitoring and increase in operating efficiency
- Improving the response time of the water supply system
- Reducing revenue losses from inaccurate meter readings
- Overall control and monitoring of the water supply system
- Preservation of valuable natural water resources

TARGETS

- Smart metering system installed to the consumers (public and residential, commercial and industrial building/areas) – 90% of the consumers, 3 years after GCAP approval
- Water losses reduced by 5% after implementation

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

Context

Drinking water supply to Alba Iulia consumers is provided by the regional operator S.C. APA C.T.T.A. S.A. Alba through zonal water supply networks and drinking water treatment plants. Network development and rehabilitation works are constantly being undertaken, and these are reported yearly by CTTA Apa Alba. Consistent upward trends can be noticed both in the length of the network as well as in other infrastructure elements.

The centralised SCADA system is under implementation to improve monitoring of the operational parameters of the integrated water system.

Drinking water costs are high, mainly due to energy consumption, but also due to suboptimal use of drinking water, such as irrigation of municipal green areas with drinking water. These could be controlled through improvements in metering, allowing for better informed decision-making both from the part of the Municipality and the households.

Description

The purpose of the implementation of the smart metering system is to enhance the operational efficiency of the water system, reduce operational expenses and, therefore, increase the quality of the water services.

In the field of smart water management and operation of water supply systems, IoT systems ensuring the safety of drinking water are of utmost importance. IoT devices are equipped with sensors, actuators, and connectivity capabilities, allowing them to collect and transmit data across various stages of an asset's lifecycle, enabling real-time monitoring and data-driven decision-making. The real-time data provided by IoT devices supports continuous monitoring, predicts outcomes, and optimises processes.

The first step is to measure water consumption in real time, where connected sensors can track water consumption in households, public buildings and commercial users' premises. This data can be used to identify sources of water wastage or leaks and implement water saving measures. For example, sensors can detect water leaks in pipes and alert water managers.

Monitoring water consumption is essential for the water operator to manage the entire water supply and subsequent wastewater treatment process, i.e. from the abstraction, raw water treatment, drinking water distribution, and, at the end of the cycle, the wastewater treatment system. By monitoring water usage, the water resources can be managed efficiently, and consumers are billed for their actual consumption. IoT enables real-time data collection on water consumption and facilitates the remote reading of water meters.

Smart metering can be integrated in the digitalisation strategy of the water operator, including its connection to other management systems (i.e., SCADA), leading to the development of an intelligent water management system, which allows adjustment of water use based on public needs and constraints.

The water operator already started the acquisition of ultrasonic meters, installed in the city centre area. Therefore, the following features are necessary for full implementation of smart metering at city level:

- Installation of smart meters at water distribution points/consumers across the city (residential and public, commercial and industrial buildings/areas) to monitor water usage following an implementation programme, starting with the critical areas (high levels of losses or consumption)
- Automated sensors at critical points to monitor parameters such as flow rates, pressure, water quality or leaks, to identify possible damages and failures in the water supply system as well
- Data management and analytics platform for collecting, storing and analysing data from smart meters and sensors which includes a user-friendly app for consumers and utility managers, to be connected with the monitoring system (SCADA) developed by the water company
- Automated leak detection system and alerts

Another major benefit of implementing the SCADA system is its impact on process safety. By managing process alarms, the system can efficiently transmit the necessary information where it is needed. Additionally, certain decisions can be made automatically by the system, based on available information and the operator's approval.

Implementation steps

1. Develop the implementation plan, including an inventory of all consumers, assessment of metering infrastructure needs, and a strategy for installing the smart metering system.
2. Procure the necessary infrastructure (equipment, meters and software/application).
3. Install equipment/meters in accordance with the implementation plan, prioritising large consumers.
4. Integrate the software/application into the existing water management system.

Stakeholders

APA CTTA S.A. – Regional Water Operator; Alba Water Association; Alba Iulia Municipality

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Development of the implementation plan	100,000	
Procurement of the infrastructure (equipment/meters and software/application) (150 EUR/unit, up to 10,000 equipment units)	1,500,000	150,000
Installation of equipment/meters following the implementation plan	900,000	50,000
Total	**2,500,000**	**200,000**

Social and gender aspects

- Implementing smart water management and SCADA systems ensures efficient water distribution and real-time monitoring, reducing water loss and improving service reliability. This is particularly beneficial for vulnerable communities.
- Better leak detection and real consumption-based billing promote fairer water distribution, reducing disparities in water access between urban and rural populations.
- Transparency in water consumption data can empower consumers by giving them the ability to monitor and adjust their water use.
- The introduction of smart metering and IoT systems creates new job opportunities in technology-driven water management. Promotion of gender-balanced processes will be observed in employment, training and leadership roles within water utilities. Job creation will align to inclusive recruitment principles.

Smart and digital aspects

- IoT sensors enable real-time monitoring of water consumption, leaks, and pressure levels, while SCADA systems allow for remote control and automation of water distribution and treatment. Automated alarms and notifications help operators respond quickly to issues, improving water security and operational efficiency.

- Smart meters replace manual readings, ensuring accurate billing and enabling consumers to track their usage. Cloud-based data storage supports centralised monitoring, enabling water utilities to optimise distribution and reduce losses. Interventions will be both at household level (household-level smart meters) and at network level (flow/pressure/acoustic sensors). The introduction of smart metering will enable predictive maintenance of the system.
- Mobile apps and dashboards/digital platforms allow consumers to monitor their consumption, receive alerts, and adopt water-saving habits, while also allowing the Municipality and the water operator to adopt better water policies and transparent reporting.
- Water and wastewater system data will be used and integrated in the future Digital Twin of the city.

ACTION 9
Energy efficiency measures and integration of renewable energy sources in the water sector

WA
Water

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2030	46 tCO_2eq/year	6,100,000 EUR

GOAL OF THE ACTION

This action includes measures for increasing the energy efficiency of water supply and wastewater treatment operations, reducing energy intensity, using renewable energy for own consumption and implementation of gravity-fed systems to save pumping energy.

CHALLENGE ADDRESSED

- High drinking water and sewerage costs due to intensive electricity use for pumping
- Insufficient consideration of gravity flow potential for water/wastewater in planning and designing the water and sewerage networks

BENEFITS

- Lower maintenance and operational costs due to a decrease in energy consumption (use of renewable energy and gravity-fed system) and maintaining low tariffs for consumers
- Use of state-of-the-art installations/equipment with higher operating efficiencies
- Improved performance and reliability of water pumping systems
- The system less prone to breakdowns since it doesn't rely on external power sources

TARGETS

- Energy consumption of pumping systems reduced by 20% after action implementation
- Number of complaints related to water supply (high costs, interruptions of water supply, water restrictions) reduced by 15% after implementation
- >80% of the WWTP energy needs supplied from own sources after integration of PV systems and battery storage

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

Context

The high energy intensity associated with water pumping is a major factor driving expenses in the water management system of Alba Iulia. The potential to leverage gravity-fed water supply sections and integrate RES in the water sector remains largely underutilised. Projects aimed at system upgrade are essential in reducing energy intensity, as they not only reduce energy consumption and costs but create added value for both the company and consumers and contribute to decarbonising the sector as well.

Description

One of the main challenges in the water sector is the high cost of energy consumption associated with the pumping process. The potential to integrate RES and use gravitational flow for drinking water supply is acknowledged by both the water supply and wastewater treatment operator (CCTA Alba) and the Municipality. The newly planned industrial area located between the highway and ring road in the northeastern part of the city (see also Industry sector *Action 3*) could benefit from centralised storage and gravitational flow of drinking water for on-site companies. This approach would also count as a centralised, optimised on-site firefighting water reserve usage for industrial operations, thus eliminating the need for companies to maintain smaller, individual firefighting storage tanks. Additionally, integrating a comprehensive wastewater and rainwater management strategy into the site's development could support a broader vision for a sustainably designed green industrial area and attract private investors. Moreover, the use of state-of-the-art pumping stations and RES, such as PV systems, will help reduce grid energy consumption and enhance the resilience of the water management system.

1. Installation of PV panels and battery system on the premises of the WWTP

The installation of an on-grid PV system and additional ancillary equipment (6 inverters of 115 kW), as well as battery storage with ~665 kWp peak power (as per the financing application to the Ministry of Finance for RES installation at the WWTP, 2024) will allow the WWTP to reduce its dependence on fossil fuel-generated electricity, consequently its carbon footprint, and electricity costs. This system, combined with the existing biogas-based electric generator that processes on-site generated sludge, will increase the resilience and autonomy of the WWTP. The battery storage system will further allow the WWTP to potentially cover the entire energy consumption from renewable, green sources. The entire system will be located on existing, unused land on the premises of the WWTP and will cover approximately 11,000 m^2 out of the 13,000 m^2 vacant land available on the premises.

2. Installation of PV panels and upgrading pumping stations

Installing utility-scale PV power generation is modular, easily extendable and can be installed nearly everywhere. The aim is to reduce the consumption of electricity purchased from the public energy grid and contribute to the objectives of increased share of energy from renewable sources. To further decrease energy consumption, this initiative also involves replacing outdated or low-efficiency pumps and motors with high-efficiency models and optimising the energy performance of hydro-mechanical installations and equipment. By integrating smart pumping systems with RES and battery systems, this approach will enhance the operational resilience of facilities—reducing dependence on the public grid while maximising the use of renewable energy. The pumping systems will feature variable frequency drives that adjust water pump operation based on demand, seamlessly integrated into the water operator's SCADA system.

3. Installation of gravity-fed systems for water supply

Gravity-fed water systems utilise natural water flow, minimising the need for pumps and electricity. Water would be pumped into the high-elevation water tanks during low-peak energy consumption hours, increasing the resilience of the water supply system and optimising energy grid usage. Two of the areas where these solutions could first be implemented are the new industrial area in the northeastern part of the city and the

Mamut Hill area. Mamut Hill is one of the highest points in Alba Iulia, which makes it a strong candidate for a gravity-fed system which could supply lower-lying and nearby newly developing residential areas without relying on continuous pumping.

Implementation steps

1. Elaboration of update of the existing Feasibility studies for the WWTP, including the PV and battery storage system for the WWTP, the inventory of the pumping stations and identification of the area feasible for developing the gravity-fed system, analysis of the water source reliability, optimal reservoir/tanks locations and sizes, infrastructure requirements and cost-benefit analysis.
2. Elaboration of the technical design and the public procurement documents
3. Procurement of technical assistance for work supervision and project management
4. Contracting and implementation of works contracts

Stakeholders

APA CTTA S.A. – Regional Water Operator; Alba Water Association – public utility, Technical Department for Development, Investments and Public Works Subdivision, Department for Environmental Protection

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Elaboration/update of the Feasibility Studies	300,000	
Elaboration of the technical design and the public procurement documents	300,000	
Contracting technical assistance for works supervision and project management	500,000	
Contracting and implementation of the work contracts, including integration in the water operator's SCADA system	5,000,000	300,000
Total	**6,100,000**	**300,000**

Social and gender aspects

- Reliable water access during power outages or drought periods benefits all citizens, particularly vulnerable groups like elderly residents, persons with disabilities, and marginalised communities. Stable access to clean water reduces the risk of waterborne diseases, particularly benefiting vulnerable groups.
- Training and employment opportunities in construction, maintenance, and monitoring of the water system should encourage women's participation in traditionally male-dominated fields like engineering and water management. Job creation will align to inclusive recruitment principles. Small-scale enterprises, can operate with more predictable water costs.

Smart and digital aspects

- Integration of IoT and smart sensors throughout the network for flow, pressure and water quality;
- The SCADA system, with newly embedded automated valves and pressure control mechanisms would enable centralised control, allowing operators to remotely adjust water flow and early detect maintenance needs, regulate distribution, ensuring optimal performance with minimal energy use and reduced costs.
- Public engagement platforms could also provide real-time data on water levels and consumption, ensuring transparency and fostering responsible water management.

ACTION 10
Water stewardship and cultural heritage-led urban regeneration

WA
Water

TIMEFRAME	GHG SAVINGS	CAPEX
2028–2030	620.77 tCO_2eq/year	4,150,000 EUR

GOAL OF THE ACTION

The action consists in the implementation of a pilot project of solutions to manage ground and stormwater in a cultural heritage – rich urban area which needs regeneration. The detailed design of the pilot project will be chosen following an international contest for solutions. Plans will be developed to expand the concept to other areas once it is proven successful.
The action includes raising public awareness of the resilience benefits of the chosen technical solutions and the benefits of integrating sustainable water management solutions at city level.

CHALLENGE ADDRESSED

- Lack of measures delaying stormwater runoff, which puts pressure on the wastewater treatment plant and causes flooding in the city
- Lack of design and implementation of measures to prevent urban flooding due to clogged/lacking stormwater drains
- Frequent occurrence of clogged sewerage pipelines

BENEFITS

- Reducing demand on municipal drinking water supplies by using rainwater for non-drinking purposes
- Reducing runoff and its pressure on drainage systems
- Reduced green space irrigation costs
- Increased awareness of climate adaptation needs for citizens and households
- Preventing urban floodings
- Contribute to efforts of cooling the urban environment

TARGETS

- At least one rainwater harvesting system installed 5 years after GCAP approval
- Yearly irrigation needs for green spaces around the pilot area reduced by 50%
- At least 10% of residents reached with the targeted awareness campaign

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

Context

Stormwater management in the city is handled by CTTA Apa Alba. The National Land Improvement Agency built a stormwater conveyance channel for runoff from the nearby Mamut Hill. The responsibility for the use of the channel owned by the Agency and currently ill-maintained on several segments has been delegated to Alba Iulia Municipality at the end of 2023. The city has undertaken several works, aligned with works for road maintenance and improvement, to optimise stormwater drainage.

The wastewater collection system of the city is mixed, with about 60% of the stormwater network separated from the wastewater network and directed into the river, mostly in newly developed neighbourhoods such as Recea and Orizont. The system in the historic city centre and surrounding areas is, however, a combined rainwater and sewerage system. During heavy rainfall, the sudden influx of water can disrupt the proper operation of the wastewater treatment plant.

Works in the city's underground often need to take into account the many historical sites and cultural heritage assets that date back to the Roman period. Roman vestiges are abundant in and around the Alba Carolina Fortress. Works needed to preserve the cultural heritage often need to be combined with infrastructure works, to manage water and other urban utilities. The northeast corner of the Fortress, for example, has a natural spring which is currently diverted towards stormwater drains, thus presenting an untapped potential. The outside area on Nicolae Balcescu street, following on Decebal and Octavian Goga street also present a unique opportunity to showcase sustainable water management combined with urban regeneration and cultural heritage.

The potential for NBS and passive solutions in the water sector is significant and this action aims to address it. The effort focuses on sustainable water stewardship, minimising irrigation needs, and implementing alternatives to using drinking water for irrigation.



Figure 26 Indicative area of action implementation (ScribbleMaps, 2025)

Description

The action focuses on building a combined system of spring water and rainwater harvesting system and raingardens along the area outside the eastern wall of the fortress, in place of the decommissioned railway tracks on Octavian Goga, Decebal and Nicolae Balcescu streets. This would allow for showcasing roman period cultural heritage in the area, enhance the city's blue-green network to contribute to heat island prevention and increased climate resilience. Additionally, the action is a water management initiative aimed at demonstrating feasibility, benefits, and best practices for broader implementation in urban environments.

The goal of this action is to replicate and restore more natural water flow for the spring in the northeast corner of the fortress and stormwater collected within the urban context while contributing to additional urban benefits, such as showcasing cultural heritage, recreation function, valuing touristic features and increasing in quality of life. The project aims to:

- Sound management of spring water pooling in the northeastern part of the fortress, harnessing it's potential for use in irrigating nearby green spaces and cooling the area.
- Enhance stormwater water quality by incorporating appropriate treatment methods, such as filtration and/or retention,
- Reduce rain and stormwater runoff and peak flows by implementing detention and retention measures, as well as by increasing pervious surfaces,
- Minimise the need for drainage infrastructure and associated costs while improving local water reuse, and
- Integrate stormwater management into the urban landscape by designing multi-use infrastructure that enhances visual aesthetics and recreational amenities and showcases cultural heritage.



Figure 27 Example solutions for stormwater management in cities

Spring water features and raingardens fitted with plants that promote biodiversity and are designed as spaces promoting community engagement also serve as important landscape elements, integrating green spaces, water systems, cultural heritage assets and other urban infrastructure. Filtration mechanisms and other storage solutions enabling the recycling and reuse of rainwater for irrigation purposes would be implemented for green space management on adjacent streets or within the area of the fortress.

A design competition will be launched to identify the best solutions aligned with best international practice, as well as local urban planning and architectural/cultural heritage constraints.

Once the pilot project is implemented, an awareness raising programme will catalyse results, ensure inclusion of the area in touristic routes and promote expansion/replication of the solutions to other areas in the city. This further step of the action will be carried out under the guidance and with support from the Architecture and Technical Department within the Municipality and representatives of the Water Company.

Implementation steps

1. Archaeological research study in the target area
2. Launch an international competition of designs and technical solutions for the selected area.
3. Commission the feasibility study and select final solution; contract the development of the technical design; draft public procurement procedures.
4. Contract technical assistance for works supervision and project management.
5. Contract and oversee the implementation of the construction.
6. Develop an awareness raising programme and a promotion strategy during construction and following completion.

Stakeholders

Technical Department for Development, Urban Planning and Land Use Department, APA CTTA S.A. – Regional Water Operator, Alba Water Association – public utility body

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Archaeological study and works	500,000	
Launch international competition for design and technical solutions	200,000	
Feasibility study and selection of final solutions and elaboration of the detailed technical design and the public procurement documents	200,000	
Contracting technical assistance for works supervision and project management	200,000	
Contracting and implementation of works contracts	3,000,000	200,000
Awareness raising programme and promotion strategy during construction and following completion	50,000	20,000
Total	**4,150,000**	**220,000**

Social and gender aspects

- Rainwater harvesting and creating a network of raingardens reduce the risk of flooding, improve climate resilience and create a comfortable, usable and pleasant public space, benefiting also vulnerable and low-income communities.
- Mechanisms to ensure equitable participation and benefit-sharing, and to strengthen stakeholder engagement during design and implementation of rainwater harvesting systems will be developed.
- Equal opportunities for potential employment and training will be ensured. Job creation will align to inclusive recruitment principles.
- The benefits will be monitored by collecting gender-disaggregated data on outcomes/impacts (time saved, economic benefits etc).
- Green infrastructure, such as rain gardens and permeable surfaces, improves urban aesthetics, biodiversity and air quality, while recreational spaces benefit public health and social cohesion.

Smart and digital aspects

- The new investments in the rainwater network must be integrated in the existing SCADA system.
- Through the implementation of a digitalisation system, the operator can monitor in real time the operational parameters of the wastewater system.
- Local sensors and automation system can ensure smart irrigation of green spaces according to set parameters. Seasonal data analytics can be used for decision-making on landscaping design to optimise rainwater patterns with irrigation needs of chosen landscape.
- A combined hydraulic model should be developed to identify suitable configuration for interventions and simulate scenarios/interventions. This could be linked with existing plan to develop a citywide digital twin.
- The Municipality can develop a smart application for use of stormwater depending on the type of investments.
- Social media, interactive mobile apps, and GIS-based tools will be used to educate residents on rainwater harvesting benefits, provide live data on local water conservation efforts, and encourage citizen participation. All the above will be built on existing platform that are used by Alba Iulia Municipality. Gamification strategies, such as reward-based water-saving challenges, can further boost community involvement and behaviour change.

ACTION 11
Rehabilitation and extension of the water and wastewater network

WA
Water

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2030	38.51 tCO_2eq/year	32,000,000 EUR

GOAL OF THE ACTION

The existing water supply and wastewater system needs to be rehabilitated and extended to cover the ageing infrastructure and new requirements in supply, due to the pressure ensuing from the development of new residential areas.

CHALLENGE ADDRESSED

- High drinking water and sewerage costs due to intensive electricity use for pumping
- Insufficient consideration of gravity flow potential for water/wastewater in planning and designing the water and sewerage networks
- Lack of design and implementation of measures to prevent urban flooding due to clogged/lacking stormwater drains
- Frequent occurrence of clogged sewerage pipelines

BENEFITS

- Ensuring the provision of services at optimal quality standards
- Increasing the connection rates to the municipal services and thus reducing pollution
- Monitoring the water consumption
- Detection of failures/issues in the operation of the drinking water supply system and wastewater collection system
- Improved quality of life for new service beneficiaries
- Minimised savings in energy consumption and chemicals in the water treatment process as the losses within the network

TARGETS

- Pipeline failure incidents reduced by 5% annually
- Number of complaints reduced by 5% annually
- The connection rate to the water supply and wastewater collection system increased to 90% within 5 years after GCAP approval

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

Context

The city has a well-developed water supply and sewerage infrastructure; however, expanding the network into new areas is often difficult to implement and tends to lag behind the general land use development pace and planning cycles. This is primarily due to administrative challenges, which the Municipality plans to address through the current update of the GUP. Additionally, the city's water supply and sewerage network need regular upkeep to function adequately. There are several areas where the network needs repairing in the next planning cycle and CTTA Apa Alba is making constant efforts to ensure day-to-day operations run smoothly.

Description

Most of the repair and maintenance work in the water sector is needed for the sewerage network, with roughly three times as many interventions as for the water supply network. In addition to pipeline rehabilitation, there is a constant need for network expansion, as the city is continuously developing.

Sewerage pipeline cleaning works would allow for the simultaneous reinforcement of pipelines, where favourable, through CIPP (Cured-in-Place Pipe), a trenchless method. Although costlier than conventional pipeline rehabilitation, this method is faster and allows for minimal disruption to urban infrastructure while providing structural improvement and corrosion resistance. This method could be employed in areas where conventional, less costly works would be too disruptive, such as in the railway area, high traffic areas or in the historical city centre. Less sensitive areas are better suited for conventional rehabilitation via open trenches, performed according to a coherent schedule, synchronised with road maintenance and other infrastructure works.

The development of the city with newly built residential and commercial/industrial development areas creates the constant need for further expansion of existing networks to these areas.

The estimations of the investment costs for this action are based on the water supply and wastewater management system operator's implementation capacity and communicated indicative costs.

Implementation steps

1. Draft a network maintenance and expansion plan.
2. Develop the feasibility study and financing application in case of external financing.
3. Elaborate the technical design and public procurement documents.
4. Contract technical assistance for works supervision and project management.
5. Contract and oversee the implementation of the works contracts.

Stakeholders

Alba Iulia Municipality, APA CTTA S.A. – Regional Water Operator, Alba Water Association – public utility body

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Network maintenance and expansion plan	200,000	
Feasibility study	300,000	

Rehabilitation and expansion of water and wastewater networks, including design, construction and supervision: - EUR 500-1,000/m for wastewater pipeline rehabilitation and lining, depending on technology; 4 km/year, for 5 years – average value of EUR 700/m considered - EUR 300-400/m for network expansion; 10 km/year, for 5 years – average value of EUR 350/m considered	14,000,000 for rehabilitation 17,500,000 for expansion	300,000 200,000
Total	**32,000,000**	**500,000**

Social and gender aspects

- New jobs are required during the construction and operation of the extended water and wastewater networks. Gender equality and equal rights will be considered during recruitment. Local employment opportunities will be generated and underserved groups might access such job opportunities. The Municipality will strongly encourage service providers to employ members of underserved groups.
- Communication with all the impacted persons about the construction works that are to be done in the proximity of their households needs to be efficient: explanations will be provided regarding all the potential disturbances, duration of works and if the case the type of compensations to be provided and the procedure of accessing such compensations.

Smart and digital aspects

- The new investments have to be integrated in the existing SCADA system.
- Through the implementation of a digitalisation system, the operator can monitor in real time the operational parameters of the water supply and wastewater system.
- Smart meters would ensure accurate measurement of the water supply and consumption. Identify leaks and identify abnormal usage patterns.
- Water and wastewater system data will be used and integrated into the future Digital Twin of the city.

Transport


PRIMĂRIA
MUNICIPIULUI
ALBA IULIA
PRIMARIA MUNICIPIULUI
ALBA IULIA

Sector overview

The transport sector of Alba Iulia is one with many opportunities and is constantly evolving. One of the biggest issues regarding transport and traffic is commuting in and out of the city, as several industries attract workers towards Alba Iulia, but other close-by industrial cities, such as Sebeș, offer different working opportunities, hence putting pressure on the outgoing traffic flow as well.

Regionally, Alba Iulia has good connectivity with other developed cities such as Deva, Timișoara, Cluj-Napoca or Sibiu. The city has a recently rehabilitated central train station. The A10 highway passes right near and around the city, and a ring-road also serves for inter-city and freight traffic. New transport infrastructure is currently under development in Alba Iulia and the surrounding metropolitan area. There are two green ring roads that are currently under construction, one in the North part of the city and one in the Southern part.

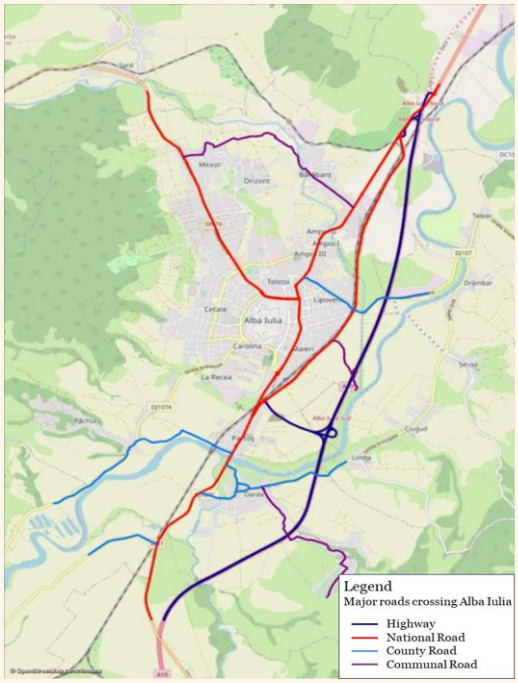


Figure 28 Major roads crossing Alba Iulia

According to the available data, in Alba Iulia there are 1.32 vehicles per household and 0.49 per capita. Cycling accounts for less than 5% of total trips, and the total length of the existing cycle lanes is 16 km in the city. A bike-share pilot is already fielding 240 e-bikes and 60 conventional bikes at 18 stations. Pedestrian space fares better inside the Alba Carolina Citadel but thins out in the fast-growing outskirts, where many streets still lack continuous pavements. Over 90% of residents can still walk to a bus stop in under 15 minutes, an indicator scoring high in the accessibility of alternative transport options.

AIDA-TL (Asociatia Intercomunitara de Dezvoltare Alba – Transport Local / Intercommunity Development Association Alba – Local Transport) is the entity responsible for organising PT in the city. The institutional setup is common for all over Romanian counties where such associations have been established for public services (water, waste, PT, etc.). The PT service is provided by STP Alba Iulia *(Public Transport Association – Societatea de Transport Public SA Alba Iulia*) under a contract with the AIDA-TL, wiring the neighbourhoods with the city centre and eight surrounding communes into the city. The fleet behind that coverage, however, is ageing, with 84 buses and minibuses of which currently only 13 are electric. Priority infrastructure is in its developing phase, with 9.54 km of dedicated bus lanes already established and several bus stops rehabilitated into smart stops. Considering all these aspects, the service still struggles to outcompete car usage. The 2022 update of the SUMP and the county's Mobility and Connectivity Strategy

both call for electrified PT, park&ride (P&R) nodes and continuous green mobility corridors. The roadmap developed by AIDA-TL targets a 100% zero-emission bus fleet by 2030.

Among the challenges in urban transport, the following are the outstanding: high car dependence, a mostly diesel-fuelled PT fleet and scarce charging depots, a worn two-lane road grid with bottlenecks on DN74, and the absence of an integrated ticketing/Mobility-as-a-Service (Maas) backbone. The proposed actions aim to tackle both demand and supply by electrifying and extending the bus system, reversing decades of car-centric street design, weaving a continuous cycling fabric and giving commuters a viable P&R alternative.

Figure 29 Challenges, short- and long-term actions in the Transport sector

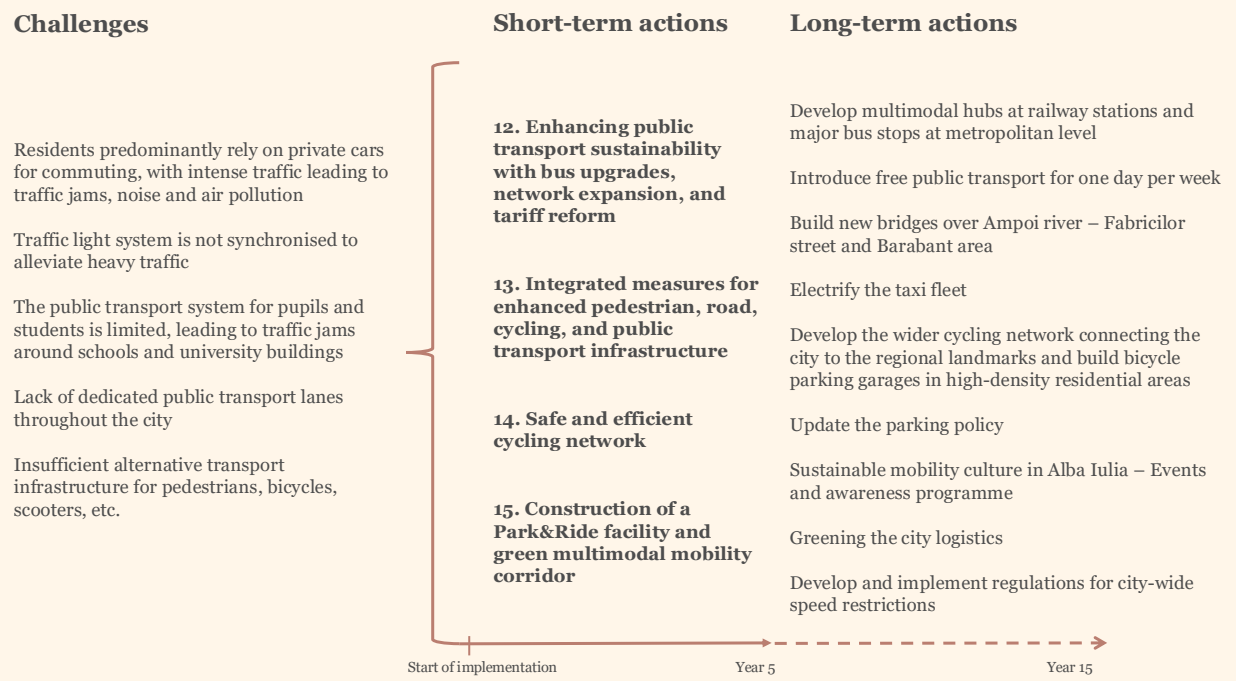


Table 10 Contribution of Transport sector actions to SDGs

Action	Contributing to SGDs			
ACTION 12 Enhancing public transport sustainability with bus upgrades, network expansion, and tariff reform	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	8 DECENT WORK AND ECONOMIC GROWTH	3 GOOD HEALTH AND WELL-BEING	10 REDUCED INEQUALITIES
ACTION 13 Integrated measures for enhanced pedestrian, road, cycling, and public transport infrastructure	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	8 DECENT WORK AND ECONOMIC GROWTH	3 GOOD HEALTH AND WELL-BEING	10 REDUCED INEQUALITIES
ACTION 14 Safe and efficient cycling network	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	8 DECENT WORK AND ECONOMIC GROWTH	3 GOOD HEALTH AND WELL-BEING	10 REDUCED INEQUALITIES
ACTION 15 Construction of a Park&Ride facility and green multimodal mobility corridor	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	8 DECENT WORK AND ECONOMIC GROWTH	3 GOOD HEALTH AND WELL-BEING	10 REDUCED INEQUALITIES

ACTION 12
Enhancing public transport sustainability with bus upgrades, network expansion, and tariff reform

TR
Transport

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2028	306.6 tCO_2eq/year	23,785,000 EUR

GOAL OF THE ACTION

This action aims to enhance the efficiency, accessibility and sustainability of Alba Iulia's PT system. This will be achieved through the modernisation of the PT fleet, infrastructure improvements, network extensions and measures to make PT more attractive and reliable for daily commuters and visitors. The current action focuses on introducing new PT routes and optimising existing ones, particularly during tourist events. Additionally, this initiative includes plans to restructure PT tariffs to complement the proposed improvements.

CHALLENGE ADDRESSED

- Residents predominantly rely on private cars for commuting, intense traffic leading to traffic jams, noise and air pollution
- The PT system for pupils and students is limited, leading to traffic jams around schools and university buildings
- Lack of dedicated PT lanes throughout the city
- Poor PT route management that doesn't properly service some areas while overservicing others

BENEFITS

- Better connectivity, reliability and punctuality of PT services
- Increased use of PT, improving modal split and reducing traffic congestion
- Improved average travel speed for PT via priority bus lanes
- Better coverage of the transport needs in the areas with limited access to PT
- Improved air quality and reduced GHG emissions

TARGETS

- 100% PT fleet of zero emission by 2030
- 5% decrease in the average PT travel time
- 10% increase in the number of regular PT users due to the improved service
- 40 bus stops rehabilitated by 2030

STRATEGIC OBJECTIVES AIMED AT

SO 1 — Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 — Enhancing the attractiveness of the city for tourists, by creating adequate infrastructure and diverse offers of sustainable tourism

SO 3 — Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

Context

The PT network covers the entire area of the city, yet not all neighbourhoods, especially the newly developed districts are sufficiently connected to the centre. To combat this challenge, the operator aims to extend the PT network. The possibility of extending the existing routes by increasing frequency or developing new bus lines during peak tourist seasons will also be assessed.



Figure 30 12-metre electric bus, STP Alba Iulia

PT in Alba Iulia faces challenges related to accessibility and affordability. Older vehicles often lack gender-sensitive features, such as adequate lighting, safety measures, or space for strollers, which can negatively affect women and parents, and the bus routes and schedules need to better address women's mobility needs. For low-income residents, transport costs may limit access to employment and essential services, although free travel is provided for the elderly. All these aspects open the opportunity to enhance the system as a whole and reap the environmental and social benefits of a green, reliable, accessible and sustainable PT.

Description

The action consists of 4 components:

1. Renewal of the bus fleet and installation of associated infrastructure

As part of the Municipality's commitment to sustainable urban mobility, the renewal of the bus fleet will play a central role in modernising PT services. This translates into the procurement of new, zero-emission electric buses. These will replace older diesel buses, significantly cutting GHG emissions and noise pollution while ensuring a smoother and more comfortable ride for passengers. The acquisition of new PT vehicles is an ongoing activity and will continue until the entire PT fleet is fully renewed. Additionally, the Municipality aims to establish dedicated bus routes for students. In this context, the action is targeting the procurement of 9 units of e-minibuses for students and 33 units of 12-metre e-buses. To support this initiative, the Municipality will invest in charging infrastructure at major bus depots, key bus terminals and mobility hubs, installing 8 fast-charging and 40 slow-charging stations (*see Action 15*).

By embracing a clean, efficient and passenger-friendly fleet, Alba Iulia is making a decisive step towards a PT system that is more sustainable, reliable, accessible and attractive to residents and visitors alike. This investment will help shift mobility patterns away from private vehicles, ultimately creating a more liveable and environmentally conscious city.

2. Rehabilitation of bus stops

Some of the bus stops in Alba Iulia have been rehabilitated, and modern smart equipment has been installed, providing information to passengers regarding upcoming buses and waiting times. The current EBRD-financed project also includes financing for upgrading bus stops situated on the roads to be rehabilitated. Still, the remaining bus stops in Alba Iulia are in moderate to poor condition. This component aims to

address the rehabilitation of at least 40 bus stops and install modern smart equipment, such as screens indicating arrival times, vending machines and validators.

3. **Extension/reorganisation of the PT network**

Generally, the city is experiencing the expansion of its residential environment in every direction. The Municipality is planning to extend the current PT network to connect the newly developed neighbourhoods between each other and the city centre, for the benefit of residents and commuters alike. At this stage, the targeted neighbourhoods are Micești and Orizont, covering the northwestern part of the city. The upcoming feasibility studies will decide how these areas will be served with the PT services.

The planned network extension will include route and service optimisation strategies to better support the tourism sector, through a comprehensive data analysis of tourists' mobility patterns and existing route performances. Key tourist clusters, such as the historic city centre, museums, the dendrological park, etc., along with major convention centres and hotel zones, will be identified to determine the route of a shuttle loop during peak tourism season. The PT services will also be supplemented during major tourist events. The possibility of reintroducing a bus stop within the fortress's boundaries will be explored. By combining this with a complete ban on car traffic within the fortress, a strong signal will be sent to encourage a mental shift towards more sustainable modes of transport for both regular car users and tourists in the fortress. This component will be integrated within the Alba Iulia city travel app component of *Action 1*.

4. **PT tariff restructuring**

This component will optimise the PT tariff structure and propose necessary adjustments to enhance accessibility and operational performance. The revised model will be data-driven, developed based on an analysis of travel behaviour, tariff elasticity studies and revenue projections to balance affordability and financial sustainability. Stakeholder consultations will be conducted to ensure that the system meets public expectations while securing sufficient funding for PT improvements. By introducing a revised tariff structure, Alba Iulia aims to increase PT ridership, reduce reliance on private vehicles, and uphold a fair, transparent, and efficient system that meets the diverse mobility needs of both residents and visitors.

Implementation steps

Renewal of bus fleet and installation of associated infrastructure

1. Develop a feasibility study for the new low-emission PT vehicles and associated infrastructure.
2. Obtain necessary permits and technical approvals for connecting the charging stations.
3. Conduct the tendering process.
4. Procure the low-emission PT vehicles and carry out the works required for installing and commissioning the charging stations, including training sessions for the operating personnel.
5. Invest in capacity building throughout the entire lifecycle of the bus (personnel for procurement, planning, exploitation and bus drivers, maintenance staff, technical workshop).
6. Ensure continuous monitoring and evaluation.

Rehabilitation of bus stops

1. Develop a feasibility study and designs for the newly rehabilitated bus stops.
2. Conduct a tendering process.
3. Rehabilitate 40 bus stops until 2030 and integrate smart and digital elements.

Extension of the PT network

1. Develop feasibility studies and demand analysis for route optimisation; coordinate this step with the tourism sector to optimise routes serving key tourist attractions and major events.
2. Define new routes and extensions, ensuring efficient integration with the existing PT network, while also assessing the needs related to new bus stops and other supporting infrastructure.
3. Prepare informative and marketing materials for the extended sustainable PT network and the additional services for tourists.

4. Launch extended PT services and additional lines.
5. Ensure continuous monitoring and evaluation.

PT tariff restructuring

1. Evaluate the current tariff system and propose necessary adjustments to enhance accessibility and operational performance.
2. Integrate the tariff system in the new MaaS app to be developed (*Action 15*).

Stakeholders

STP Alba Iulia, AIDA-TL, Alba Iulia Municipality, National Road Administration, residents, commuters, tourism sector

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Replacing rolling stock of fleet: 33 units of 12-metre e-buses, 600,000 EUR/unit; 9 units of e-minibuses, 400,000 EUR/unit	23,400,000	800,000
Rehabilitation of bus stops 5,000 EUR/bus stop, 40 bus stops	200,000	10,000
Feasibility and other studies for route optimisation and extension of the PT network, including additional service for the tourism sector	100,000	
Informative and marketing materials	10,000	20,000
Operational performance assessment –PT tariffs restructuring study	75,000	
Total	**23,785,000**	**830,000**

Social and gender aspects

- Career paths for drivers of (e-) vehicles will be stimulated and women's access to employment as PT drivers will be improved. Partnerships with vocational institutions will be developed to provide training on skills related to e-mobility for all persons, including women.
- The new buses and related infrastructure will comply with international standards regarding inclusiveness, accessible design and improved safety measures that particularly benefit women (better lighting at bus stops, CCTV, public communications campaigns against gender-based violence and harassment) and people with mobility issues (low-floor accessibility).
- The development of new bus routes and the optimisation of the existing ones will be done in line with the gender equality principles and women's needs for PT routing and scheduling.
- The information panels and applications will be developed considering social aspects, such as visual impairments and accessibility.

Smart and digital aspects

- PT use is and will be facilitated by the provision of dynamic digital passenger information through panels and applications, such as real-time schedules and travel times. Additionally, PT networks can be monitored with the use of this data. The renewed PT fleet will be equipped with digital payment options for users and will feature smart diagnostic systems that allow for real-time monitoring of vehicle performance, reducing downtime and optimising fleet management.
- For an optimised operation of PT, the management system will be integrated with the passenger information system, (e)micro-mobility and smart charging system. The passenger information system will be linked with the newly established Mobility Coordination Centre (MCC) and the citywide MaaS app envisaged in *Action 15*.

ACTION 13
Integrated measures for enhanced pedestrian, road, cycling, and public transport infrastructure

TR
Transport

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2030	N\A	12,650,000 EUR

GOAL OF THE ACTION

The action focuses on future-proofing the city's urban mobility network through a structured road rehabilitation and maintenance programme. This programme is designed to create a safer and more accessible environment for all road users, including drivers, cyclists, and pedestrians.

CHALLENGE ADDRESSED

- Residents predominantly rely on private cars for commuting, intense traffic leading to traffic jams, noise and air pollution
- Traffic light system is not synchronised to alleviate heavy traffic
- Insufficient alternative transport infrastructure for pedestrians, bicycles, scooters, etc.
- Road safety for all traffic participants due to crosswalk signalling, parked cars obstructing the view in intersections, ageing private vehicle fleet, illegal occupation of public space (through parking, shop extensions, adjacent equipment)

BENEFITS

- Stimulating modal shift from cars to more sustainable transport modes
- Indirect cost reduction (for example, increased risk of traffic accidents – social costs)
- Maintaining the durability and quality of the infrastructure, reducing journey times, congestion, accidents, emissions, noise pollution and fuel consumption
- Direct cost reduction on the long term (i.e. costs which could be necessary for major reconstructions)

TARGETS

- 2% of the roads rehabilitated per year over a course of 5 years
- 1 km priority bus lane established/year
- Pedestrian and cyclist-friendly infrastructure (separate lanes, shared space) included in the design of each rehabilitation project

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

Context

The roads of Alba Iulia are currently in a moderate to poor physical condition, predominantly designed for car-based use, with insufficient or no dedicated spaces for other road users such as pedestrians and cyclists, and lacking prioritisation for PT. There is a constant need for road maintenance at the city level, and the Municipality is consistently undertaking rehabilitation efforts, guided by a strategic plan that integrates a multimodal investment and maintenance programme.

Recently, the Municipality received a EUR 15 million loan from EBRD in a co-financing arrangement with the EU to rehabilitate the city's transport infrastructure. This investment will enable the rehabilitation of over 15 km of streets, the development of dedicated bus and bicycle lanes, the installation of EV charging stations, enhanced safety and traffic management systems, and the implementation of a new street lighting system. The Municipality will continue this initiative, applying lessons learned and best practices to future transport infrastructure rehabilitation projects, ensuring greater multimodality, sustainability, and improved road safety across the city.

Description

This action comprises several components related to strategic planning, rehabilitation and development of a multimodal transport network.

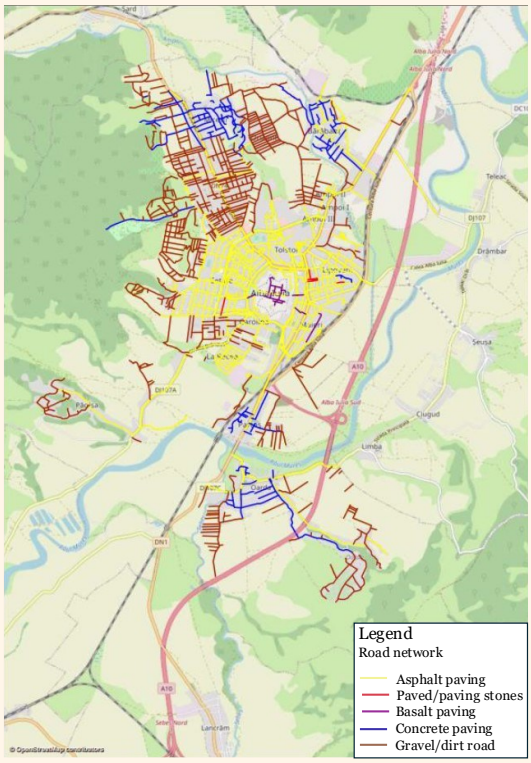


Figure 31 Road infrastructure in Alba Iulia

1. Continuing the implementation of the road rehabilitation and maintenance programme, including the establishment of dedicated PT lanes

Proper planning and coordination of the road works is essential: the works will be adjusted to the necessary works on the drainage system and the implementation of the blue-green network. The use of sustainable techniques and materials will be essential. The programme will also consider the full rehabilitation of the local roads, meaning that besides improvement to the pavements, the rehabilitation will also consider organising parking, installing street furniture, planting trees, etc., making the streets more pleasant for

walking and cycling. Currently, several newly developed neighbourhoods are served by unpaved roads. These areas are a key focus for the Municipality in its modernisation efforts.

Rehabilitation of streets in development areas: Alba Iulia - Micești area, Bărăbanț area, Chip area, Mihail Kogălniceanu area, Lalelelor - Dealul Furcilor area, Ana Ipătescu neighbourhood area, Orizont neighbourhood area, Pâclișa area, Oarda de Sus area. A special attention will be paid to roads that will connect to the North green ring road of the city - Gh. Șincai and Zenit streets – which will be transformed into a green mobility corridor and Zenit.



Figure 32 EBRD-funded rehabilitated road section, with dedicated priority bus lane and safe, parallel cycling paths

Improving pedestrian traffic, bicycle lanes, green areas and road rehabilitation: Gheorghe Pop de Băsești (Macului), Vasile Goldiș, Dr. Aurel Vlad (Jderului), Iederei, Fantanele (Dr. Ioan Pop) and Gladiolelor streets.

To increase the efficiency of PT and reduce travel times, dedicated bus lanes will be introduced along roads with 2 or more lanes. These lanes will also accept taxis. Associated infrastructure upgrades related to the rehabilitation of bus stops are also included in this component. The newly established MCC will enhance the functionality of the priority lanes by smart traffic signal management. These measures will help ensure buses operate with minimal disruptions, making PT a more attractive alternative to private cars.

2. Alleviating incoming traffic from the NW direction on National Road (DN) 74

One of the city's most congested intersections is the main entry road from National Road (DN) 74, due to incoming traffic from the NW, PT and increasing peri-urban development. The Municipality aims to alleviate traffic congestion on this artery, enhancing the quality of life for residents and commuters, by building an underpass from the junction of Calea Moţilor with Republicii and Revoluţiei 1989 Boulevards to the intersection of Calea Moţilor with Detunata Street. The underpass will have a length of approximately 340 m, a cross slope of 2.5% and a longitudinal-progressive slope of 7%. The total surface area of investment is 4,000 sqm. The project area includes the section of Calea Moţilor from the intersection with Bayonne Street to the intersection with Septimiu Severus Street.



Figure 33 Current view of the intersection and plans for the DN74 underpass

The investment will include the following elements:

- The construction of an underpass at the intersection
- The construction of cycling lanes, ensuring continuity with the existing bike lane starting in the Micești neighbourhood, currently interrupted at the Detunata Street – Calea Moţilor intersection, extending to the junction of Calea Moţilor with Republicii and Revoluţiei Boulevards
- Traffic safety enhancements such as roundabouts, guardrails, reflective markings, traffic calming measures
- Development and upgrading of pedestrian infrastructure, vertical pedestrian crossing signals powered by PV
- Upgrading/expansion of the public lightning system serving the project area
- Construction/modernisation of bus stops, including designated lay-bys
- Measures for environmental protection and resilience to climate change

The investment is based on sustainable mobility principles, aligning with the objectives and priorities of the updated SUMP (2022), including traffic flow improvement. The investment aims at reducing traffic congestion in the NW part of the city, increasing road safety in the area, promoting the use of alternative modes of transport, improving air quality and reducing pollution and GHG emissions.

3. Road pavement management system

The Municipality bears legal and administrative accountability for maintaining roads in safe and functional condition. By introducing a road pavement management system, the Municipality will serve as the primary steward of local roads. This will help decision-makers develop maintenance strategies and budgets that prolong pavement and road life and ensure safe, reliable roadways for users. The responsibilities of the Municipality will be the following:

- Data collection and assessment regarding the condition of pavements (e.g. roughness, cracks, potholes) through regular inspections or surveys
- Planning and prioritisation, determining short- and long-term maintenance needs
- Setting priorities for repairs and rehabilitation based on severity of the situation, traffic load and community impact
- Allocating municipal funds or securing external funding for pavement maintenance
- Developing multi-year investment strategies
- Managing, scheduling and executing maintenance activities and rehabilitation projects; coordinating works with contractors, utility companies and other stakeholders
- Monitoring and reporting to demonstrate accountability to officials, residents and other stakeholders
- Informing the public about upcoming road works, project timelines and potential traffic impacts

Implementation steps

Road rehabilitation programme

1. Develop an Integrated Road Rehabilitation Programme.
2. Conduct a network flow analysis and feasibility study for the establishment of bus lanes.
3. Conduct the tender process.
4. Execute road rehabilitation works: improve road marking, street furniture and pedestrian pathways for accessibility; integrate cycling infrastructure and dedicated PT lanes where feasible.
5. Establish the dedicated bus lanes.
6. Establish a monitoring framework and conduct regular inspections to ensure compliance with construction standards.

Alleviating traffic congestion at the NW entry from DN74

1. Develop feasibility studies and engineering designs for the underpass.

2. Obtain necessary urban planning approvals and construction permits.
3. Carry out the tender process.
4. Construct the underpass and associated infrastructure, integrate sustainable transport measures and traffic safety enhancements.
5. Monitor and evaluate, collect user feedback on accessibility.

Road pavement management system

1. Procure technical assistance for developing a road pavement management system.
2. Plan and develop multi-year investment strategies based on a prioritisation of sections of pavements.

Stakeholders

Alba Iulia Municipality, National Road Administration, residents, commuters

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Development of an investment plan for road rehabilitation and maintenance	50,000	
Road rehabilitation – investment foreseen for 5 years, 1,000,000 EUR/year, including establishment of dedicated lanes for PT	5,000,000	150,000
Technical assistance for the pavement management system	100,000	
Construction and supervision of the underpass and associated infrastructure	7,500,000	150,000
Total	**12,650,000**	**300,000**

Social and gender aspects

- Women and community-based organisations will be ensured equal and fair participation in the decision-making process and selection of roads to be rehabilitated.
- Inclusiveness will be ensured during the procurement of road rehabilitation works.
- The action will provide job opportunities in road rehabilitation and maintenance, including underserved groups, as well as digitally skilled personnel for smart management. Job creation will align to inclusive recruitment principles.
- The action will foresee improved safety measures, such as well-lit pedestrian pathways, enhanced crossings, and traffic calming features, benefitting vulnerable groups, including children, the elderly, and persons with disabilities.
- Accessibility enhancements will be integrated into the design of pavements, bus stops, and crossings, making urban mobility more inclusive.

Smart and digital aspects

- Smart traffic management will be implemented through adaptive traffic signals and synchronised lights, improving congestion flow and reducing delays and integrated with the newly established MCC.
- The MaaS app is envisaged to be developed as part of *Action 15*.

ACTION 14
Safe and efficient cycling network

TR
Transport

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2030	344.99 tCO_2eq/year	32,820,000 EUR

GOAL OF THE ACTION

The action aims to establish a safe, continuous and efficient cycling network throughout Alba Iulia, encourage daily bicycle use, reduce traffic congestion, and promote healthier and lower-emission urban mobility. This will be done through linking key neighbourhoods, green spaces, tourist attractions and public amenities.

CHALLENGE ADDRESSED

- Residents predominantly rely on private cars for commuting, intense traffic leading to traffic jams, noise and air pollution
- Insufficient alternative transport infrastructure for pedestrians, bicycles, scooters, etc.

BENEFITS

- Reduced traffic congestion, emissions and noise linked to the decrease in journeys by car
- Increased quality and number of journeys by bicycle / other non-motorised means of transport
- Fast and easy connectivity between points of interest in the city
- Increased safety for all traffic participants
- Improved health and improved community cohesion

TARGETS

- Bike lanes, including rapid transit bike paths (high-speed bike routes, 1 km/year) constructed
- Active mobility (cycling and walking) increased by 10% by 2030
- Smart traffic lights (2 intersections/year) installed
- Traffic safety for cyclists and pedestrians improved

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

SO 4 Enhancing the attractiveness of the city for tourists, by creating adequate infrastructure and diverse offers of sustainable tourism

Context

Well-developed cycling infrastructure and pedestrian lanes encourage citizens to cycle and walk more. Combined with sightseeing in and around Alba Iulia, this can also contribute to bicycle tourism. In combination with cultural tourism, this will increase the number of overnight stays. Currently, there are 16 km of dedicated cycle lanes in Alba Iulia, particularly in urban areas and near tourist sites; 17 km are in their construction phase, and a further 15 km are in the planning/design phase. However, a consistent network of dedicated bike lanes needs to be developed. This is crucial to make the transport network more attractive for pedestrians and non-motorised vehicles.



Figure 34 Parking of the bike-sharing system

Recently, a bike-sharing system has been set up and is currently in its testing phase. A bike-sharing system is a publicly accessible scheme in which users can temporarily use bicycles from dedicated docking stations, typically using a mobile app or an automated kiosk, before returning them to any station across the network. Currently, the system comprises 12 stations for electric bikes and 6 for mechanical bikes. In total, there are 240 electric bikes and 60 mechanical bikes in 18 stations. The price of renting bicycles will be set by a Local Council Decision and will be applied through a digital application.

Description

New areas for cycle parking will be located strategically throughout the city, preferably close to areas where there are significant concentrations of tourists, commuters and students. The development of a comprehensive package of measures for the creation of a cycling network will include:

- Identification of optimal solutions to increase accessibility for cyclists at intersections linked to the cycling networks
- Provision of bicycle parking facilities near public buildings, public spaces, and private buildings
- Integration of cycling paths with PT and mobility hubs—see *Action 15*.
- Planning and construction of the first urban bicycle highway
- Consolidation of existing bike paths with new lanes across central arteries, residential zones, commercial areas and tourist hotspots
- Installation of smart traffic lights for cyclists
- Implementation of safety measures, such as comprehensive signage, improved public lighting and traffic calming designs to protect cyclists and safe integration with road traffic where shared roads are unavoidable
- Integrate the cycling network with tourist activities and locations, in line with *Action 1*.
- Awareness-raising activities in schools, workplaces and community centres, encouraging safe cycling practices.

The Municipality has developed a vision for a sustainable mobility within and around the city and in connection to other regional landmarks situated in the proximity of the city. The fortress's shape inspired the Municipality to develop safe, comfortable transport links and cycling infrastructure, enabling residents and visitors to reach multiple destinations within and around the city.

"Thus, as can be observed in the concept figure below, the Municipality intends to work towards developing the fortress-shaped network of functional (orange coloured, connecting major workplaces and living areas) and recreational cycling routes (connecting the city centre with regional recreational and tourist attractions).



Figure 35 Proposed plans for the urban bicycle highway

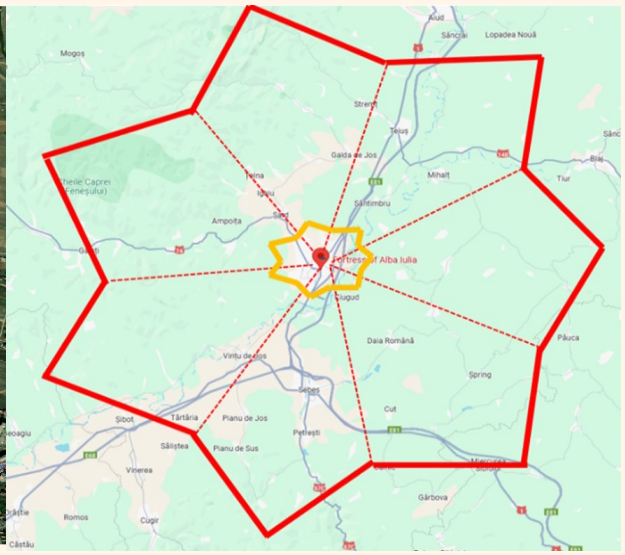


Figure 36 The functional and recreational cycling routes conceived by the Municipality and reflecting the shape of the fortress

The urban bicycle highway is an ongoing initiative, currently in its planning phase and it represents a small section of the orange network presented above. The proposed scheme centres on creating a continuous bicycle highway through the N sector of Alba Iulia, connecting the Micești-Orizont neighbourhood with future recreational areas and the Ampoi river. This project will be developed in two phases, along a drainage canal, minimising disruptions to existing roads, and ensuring a secure and convenient cycling path. Its first segment (1,4 km) will stretch from the southern end of Bayonne Street to the North Park, with its second segment (1 km) extending from the North Park to the Ampoi river.

Introducing an adaptive/smart traffic light system for cyclists is necessary to ensure the safety of bike users. These are designed to detect and prioritise bicycle riders and are best introduced at intersections where cycle routes intersect with main roads or experience significant traffic flow. The adaptive signals will:

- Shorten waiting times for cyclists by sensing oncoming bikes and switching to green more promptly
- Increase safety by giving cyclists an exclusive head start, ensuring they clear intersections before motorised vehicles move
- Collect data on cycling patterns to help city planners optimise future infrastructure & signal timings

In line with international good practice, cycle and walking facilities will be planned, designed and installed based on the principles of visibility, accessibility, safety and security, maintenance and monitoring, availability and capacity, connectivity and attractiveness. Collectively, this action aims to reduce motorised traffic congestion, promote healthier lifestyles and lower emissions. The enhanced network will foster a coherent and appealing cycling culture, making Alba Iulia a more connected and liveable city.

Implementation steps

1. Develop a coherent plan for cycling routes, including missing links and intersections with traffic lights. The primary focus will be on connecting the functional routes between districts, to have at least 5 coherently connected bike routes.
2. Finalise feasibility studies and designs for the Urban Bicycle Highway and prioritise intersections to install smart traffic lights.
3. Conduct the tender process for construction works and smart cyclist dedicated traffic light systems.
4. Construct the urban bicycle highway with associated safety infrastructure.
5. Install smart traffic lights in prioritised intersections.

6. Organise campaigns to promote the use of the network by showing the results and advantages (communication & sensitisation regarding modal shift, reduced impact during working phase).
7. Monitor, maintain and evaluate the updated cycling network.

Stakeholders

Alba Iulia Municipality, NGOs, schools, residents, commuters, visitors

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Strategic Plan for cycling	100,000	
Finalise feasibility studies and designs for the Urban Bicycle Highway and smart traffic lights	100,000	
Construction of high-speed bike lanes (2 phases – 2.2 km in total)	2,000,000	75,000
Installation of smart traffic lights in prioritised intersections, 2 smart traffic lights/year, 60,000 EUR/unit	600,000	25,000
Bike route around the city, 50 km	30,000,000	150,000
Promotion and awareness raising campaigns	20,000	25,000
Total	**32,820,000**	**250,000**

Social and gender aspects

- The feasibility study and technical design for the urban bicycle highway and other bike paths will consider gender-sensitive design elements for cycling infrastructure.
- Beyond direct user support, the project creates opportunities for inclusive employment. Fair and transparent hiring processes in design, construction, and maintenance will seek to attract a diversity of candidates, including women, young people, and underrepresented groups in technical and managerial roles.
- Community-led monitoring and feedback channels can help the cycle network stay responsive to evolving user requirements. Involvement from a broad resident base—especially women and youth—through committees or online forums ensures that future improvements consider practical mobility demands and the unique needs of different genders, ages, and backgrounds.

Smart and digital aspects

- Integrating digital tools into Alba Iulia's enhanced cycle network will improve the user experience and operational efficiency. Real-time journey planning via mobile apps can help cyclists identify the quickest or safest routes, while additional features give riders instant access to bike-sharing options. This will be done in coordination with the development of the MaaS app, a component of *Action 15*.
- Where routes cross major roads, smart traffic lights will use sensors to optimise signal timings, prioritising cyclists when appropriate and collecting data on cycling flow to inform future network upgrades.
- Meanwhile, incorporating interactive digital wayfinding boards at key junctions or parking sites can provide updated route maps, safety advice, and local event information, further boosting the network's appeal. Over time, the municipality can also gather anonymised usage data for analytical insights, guiding maintenance schedules and pinpointing heavily used sections. This application of connected data-driven technologies ensures the city's cycle infrastructure remains safe and convenient, and capable of adapting to evolving travel patterns.

ACTION 15
Construction of a Park&Ride facility and green multimodal mobility corridor

TR
Transport

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2029	5 tCO_2eq/year	6,610,000 EUR

GOAL OF THE ACTION

The aim of the action is to reduce congestion and the environmental impact of transport by encouraging a shift from private car use to more sustainable modes of travel—public transit, walking, and cycling—by establishing a P&R facility in the Partoș district and creating a green mobility corridor in the southwestern part of Alba Iulia. This will foster greater connectivity and efficiency in the transport network, support local economic growth, and enhance the overall quality of life for residents, commuters, and visitors.

CHALLENGE ADDRESSED

- Residents predominantly rely on private cars for commuting, intense traffic leading to traffic jams, noise and pollution
- Insufficient alternative transport infrastructure for pedestrians, bicycles, scooters, etc.

BENEFITS

- Reduced traffic congestion
- Lower emissions, less polluted and quieter urban environment
- Reducing the demand for parking spaces in the city centres
- Better accessibility and connectivity of the southeastern part of the city

TARGETS

- Overall daily occupancy rate of 30% of the P&R in a year after implementation
- 2.6 km of new arterial road with dedicated bus lanes and safe bicycle lanes within 5 years
- The use of PT increased by 15% within a year after project completion
- Mobility-as-a-Service (MaaS) app developed

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

SO 4 Enhancing the attractiveness of the city for tourists, by creating adequate infrastructure and diverse offers of sustainable tourism

Context

Recognising the impact of the transport sector on air quality and overall accessibility, the strategic plans of the Municipality emphasise the importance of measures such as P&R facilities and green mobility corridors. A P&R is a facility where drivers park their cars on the outskirts of a city or near transit hubs and then continue their journey into urban areas using alternative mobility options such as PT or cycling, significantly reducing inner-city traffic and parking pressures.

Description

1. Construction of a Park & Ride facility

The Municipality recently approved a Detailed Urban Plan to establish a P&R in the Partoș district. The establishment of the P&R is envisaged to provide parking space and charging infrastructure for local PT and private cars, intended to serve commuters and visitors. It is a crucial element of the Municipality's broader strategy to reduce reliance on private vehicles through a comprehensive parking policy, which is included in the long-term actions of the sector. By alleviating congestion in the historic centre and along primary routes, this shift will reduce harmful emissions and noise, contributing to cleaner air and an enhanced quality of life for residents. The facility will entail the following:

- Covered platform for 40 e-buses, each with a slow charging station
- Outdoor parking space for 20 buses, 8 of them equipped with fast charging stations
- A minimum of 52 parking lots will be created for private cars, out of which 4 for people with mobility issues, equipped with 24 charging stations for vehicles
- Parking space for 20 bikes and a bike rental system
- Vehicle-cleaning space, workshop/technical space and storage area
- Administrative area
- Ticketing machines, real-time information screens and barrier systems
- Fencing with controlled gates, CCTV surveillance and energy-efficient light-emitting diode (LED) fixtures to ensure safety and visibility
- Roundabout for vehicle access



Figure 37 Proposed plans/render for the Park & Ride facility

2. Green mobility corridor on the SW side of the city

This corridor will link Revoluției 1989 Boulevard with a junction near the Sebeș–Turda motorway exit (around Rogozului Street), traversing parts of Ion Lăncrănjan and Izvorului streets. This initiative aims to divert heavy traffic and commuters' cars from central, western and southwestern parts of the city, supporting efficient through-traffic flow and safer neighbourhood roads for pedestrians and cyclists. The corridor will decrease traffic bottlenecks, noise and pollution levels. The project includes the following sub-components:

- 2.6 km four-lane arterial road, with dedicated lanes for PT

- Separate cycling lanes and pedestrian walkways along the full length of the corridor
- Green buffer zones for traffic separation and landscape integration
- EV charging stations, stormwater management and public lighting
- Connections to adjacent streets, utility upgrades and traffic safety infrastructure
- Level crossing over the technical railroad and partial undergrounding of power lines



Figure 38 Location and plans for the green mobility corridor

These improvements encourage a broader uptake of eco-friendly transport options, bolstering Alba Iulia's tourism appeal and long-term urban sustainability.

3. Development of the Mobility-as-a-Service (MaaS) app

A user-friendly app with in-car notification feature provides real-time information about traffic jams, parking availability, PT schedules, and alternative routes. The action will be initiated as an overarching measure that integrates various transportation services into a single, user-friendly application. The goal is to provide seamless, efficient, and flexible mobility solutions by combining multiple modes of transport—such as buses, trains, ride-hailing, bike-sharing, car-sharing, and scooters—into one system. The MaaS users can access different transport options (PT, taxis, bike rentals, etc.) through a single app, obtain real-time information on PT routes, schedules, and availability, can book and pay for multiple transport modes in one transaction and can plan their routes via the city, finding the fastest, cheapest, or most eco-friendly travel options.

The planned app will be actively promoted through partnerships with tourism agencies and strategically placed advertisements. These will include clear and highly visible posters and billboards positioned around key tourist attractions, hotel districts, and major entry points into the city.

Implementation steps

Park & Ride facility

1. Obtain necessary environmental and planning permits.
2. Prepare final engineering blueprints, detailed design and technical documentation for the P&R.
3. Conduct tender and procurement procedure.
4. Build the P&R and accomplish associated site works.
5. Officially open the P&R, accompanied by awareness campaigns on sustainable mobility options.
6. Monitor and evaluate the results of the investment.

Green mobility corridor in the southwestern part of the city

1. Conduct traffic analysis, feasibility assessments and initial architectural/engineering surveys.
2. Obtain necessary environmental and planning permits.
3. Prepare final engineering blueprints, including road alignment, station layouts and architectural concepts for cycling lanes, pedestrian pathways and green landscaping elements.
4. Conduct tender and procurement procedure.
5. Construct the new roadway, cycle lanes, pedestrian pathways and associated drainage, lighting and signage; install landscaping features and noise-reducing green buffers.
6. Officially open the green corridor to travellers, accompanied by awareness campaigns on sustainable mobility options.
7. Monitor and evaluate the results of the investment.

Development of the MaaS app

1. Develop a feasibility study and engage with key stakeholders that could develop such app.
2. Tender the app development.
3. Set up a task force to oversee implementation and monitor progress of app development.
4. Pilot, refine, and scale the MaaS system citywide.

Stakeholders

Alba Iulia Municipality, AIDA-TL, STP Alba Iulia, National Road Administration, private bus service companies, residents, commuters, visitors

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Final design and technical documentation for P&R, including tendering and procurement procedure	100,000	
Construction of P&R and associated site works	2,000,000	150,000
Prepare baseline studies, detailed design and technical documentation for the green mobility corridor, including tendering and procurement procedure	250,000	
Construct the green mobility corridor and associated public infrastructure	4,000,000	300,000
Awareness-raising campaign on sustainable mobility options	10,000	20,000
MaaS app development	250,000	20,000
Total	**6,610,000**	**490,000**

Social and gender aspects

- The action fosters social inclusion by offering more equitable mobility options, accessible buses, safe pavements, and protected cycle paths that benefit those without private vehicles (including the elderly, youth, and persons with disabilities).
- The action entails safe public spaces around transport hubs, well-lit walkways and enhanced safety for women and other vulnerable groups.
- The action will ensure equal employment opportunities in hiring operations, ensuring that all genders can access construction, maintenance, and management jobs on fair terms. Employment opportunities will align to inclusive recruitment principles.
- The MaaS app will be designed with inputs from diverse users, including considerations for technology accessibility.

Smart and digital aspects

- The action will integrate real-time passenger information through electronic displays at the P&R facility and key stops along the green corridor, enabling travellers to see up-to-date bus arrival times, route changes, and station occupancy. Contactless ticketing and payment options—via automated kiosks or mobile applications—speed up boarding processes while helping operators gather valuable data on passenger flows and transport demand.
- In terms of infrastructure, energy-efficient LED lighting fixtures in roadways, walkways, and cycle paths will be connected to a central management system, allowing brightness levels to be adjusted based on ambient conditions, thereby enhancing both safety and energy conservation. These corridors are further equipped with remote monitoring capabilities for surveillance, maintenance alerts, and environmental parameters such as air quality.
- The MaaS app will integrate information on bus schedules, bike-sharing options, and other services into one cohesive digital platform. Such an approach simplifies multimodal journeys, helping users plan and pay for varied modes of travel in a single, user-friendly interface, and thereby demonstrating Alba Iulia's commitment to forward-thinking urban mobility solutions.

Waste


VIITORUL
SE FACE AZI.
RECICLEAZĂ.
PENNY.
Economisim bani, nu responsabilitate.

Sector overview

The municipal solid waste (MSW) management system in Alba Iulia is already well-organised. The waste management operator RER Vest manages 64 above-ground and 43 underground Waste Collection Islands (WCIs) located around apartment blocks, in the city centre and peri-urban areas. All WCIs offer the possibility to separate household-generated waste in 4 fractions, namely paper/cardboard, plastic/metal, glass and residual, while the newly established WCIs have additional separate receptacles for organic waste.

As per the latest data, the city generated 22,753 tons of waste in 2023—about 305 kg per capita, which is below the national average. Source separation, however, remains weak—86 % of kerbside flow still consists of mixed residuals, with only 14 % captured as recyclables. Additionally, biowaste (~57 % of the generated waste) and textiles (~ 1 %) are not yet collected separately in the entire city. Waste composition in municipal and similar waste is represented in the figures below.

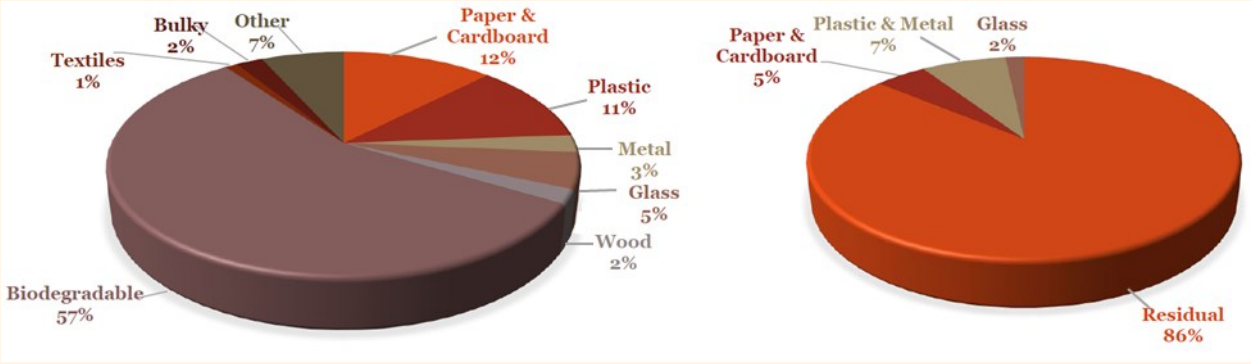


Figure 39 Municipal and similar waste composition in urban settlements, 2019, Alba County Waste Management Plan; Right: Share and type of separately collected MSW, 2023, ADI Salubris Report

The collected waste is transported by RER Vest to the regional Integrated Waste Management Centre (IWMC) at Galda de Jos. The waste collection fleet includes vehicles which have been manufactured between 2013 and 2023. RER Vest is making frequent modifications to the collection routes to increase efficiency.

Other waste fractions are managed as follows:

- The street waste and the illegally dumped waste are collected by POLARIS M HOLDING and delivered to the IWMC.
- Green waste from public and private green spaces is collected by SC Sport Turism, the company contracted to manage the public green spaces. The green waste is delivered to a composting station managed by the same company located in Alba County, but not at the IWMC. Additionally, Polaris is performing seasonal green waste collection from citizens, which is also delivered to the composting station.

The previously mentioned WCIs are generally functional and cover most of the city, yet the smart card locks on most units are out of service, and littering is a common phenomenon around the WCIs. Alongside the network of WCIs, the Municipality is developing its first bring-in centre for recyclable and special waste streams under the National Recovery and Resilience Plan (NRRP). The facility, costing approximately EUR 1 million, is being built on a disused industrial plot on Gheorghe Şincai Street and will accept waste streams that cannot be collected through the doorstep service. Residents will be able to drop off dry recyclables, bulky items, waste from electrical and electronic equipment (WEEE), batteries (including car batteries), waste oil, paints and solvents, expired medicines and other hazardous waste, tyres, construction and demolition waste (CDW), garden & green waste, textiles, as well as small pet carcasses.

At the regional level, and especially in rural areas, the operator and representatives of local authorities have distributed home composting units to reduce the total quantities of organic waste collected. In 2015, approximately 16,000 home composting units were distributed in rural areas of Alba County.

Waste collection service tariffs for households are flat-rate, at approximately EUR 3.5 per household per month and EUR 20 for small businesses, with only marginal discounts for good sorting, so citizens lack a price incentive to reduce or segregate waste. The tariffs show a small modularity based on the quantity of materials recycled, as reflected in the annual tariff calculations. In 2023, recovery and recycling activities resulted in a monthly tariff reduction of less than approximately 0.2 EUR per capita.

100 % of households are ensured weekly collection service, and all loads are hauled to the county IWMC at Galda de Jos. The IWMC is part of the county-wide system that forms Alba County's waste infrastructure. Although the city's waste company is managing the IWMC, it was designed and sized to handle all waste collected across the entire county. Therefore, no specific action is related to these facilities. The IWMC includes a mechanical-biological treatment facility (MBT), with an overall processing capacity of 85,500 t/y. In addition, the IWMC has a twin manual-sorting line for source-separated waste, processing an amount of 43,213 t/y. The MBT and the recyclable sorting flow are presented in the pictures below.

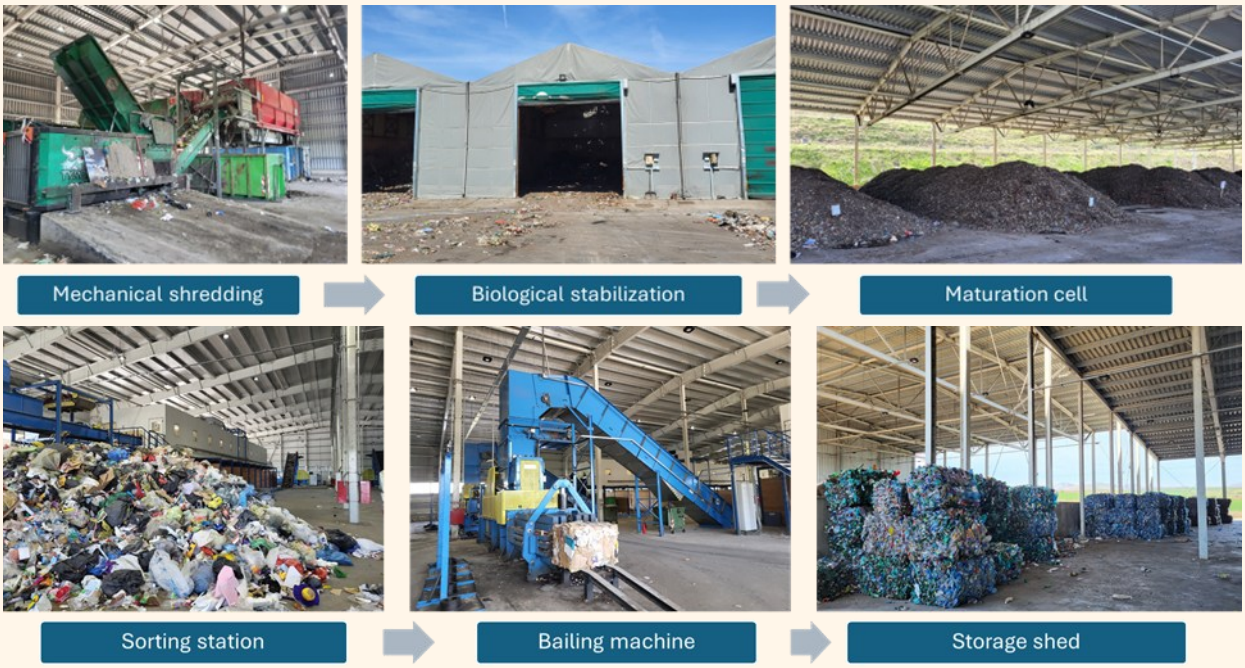


Figure 40 MBT and recyclable sorting flow at Alba IWMC

The IWMC receives approx. 30-35t/day (higher during the summer period) from across Alba County, out of which a recyclable fraction of 25% is diverted from the landfill. Residual material that leaves the MBT is landfilled on-site. The first sanitary cell was opened in 2021 and still has approximately 4 years of capacity, while Cell 2 is designed and permitted, but not yet under construction. The MBT facility and the landfill plots are not under the jurisdiction of the Municipality; they are managed by the Intercommunity Development Association Salubris – Alba (ADI Salubris Alba).

Main pressures therefore revolve around underperforming source separation that drags recycling rates and inflates landfill use, illegal dumping near marginalised and vulnerable settlements, a tariff model that doesn't reward waste prevention, and an imminent need for Cell 2 construction at the landfill. Yet, because the essential infrastructure is largely in place, the emphasis now shifts to smarter operations and behaviour change rather than CAPEX-intensive measures.

The GCAP addresses sector challenges with targeted measures: digitalisation and expansion of the WCI network, citywide Pay-As-You-Throw (PAYT) and circular economy roll-out, the introduction of a separate collection system for textiles and expansion of the separate collection system for organics, paired with the promotion of home-composting. Intensive awareness-raising programmes are backing up all sector actions.

Figure 41 Challenges, short- and long-term actions in the Waste sector

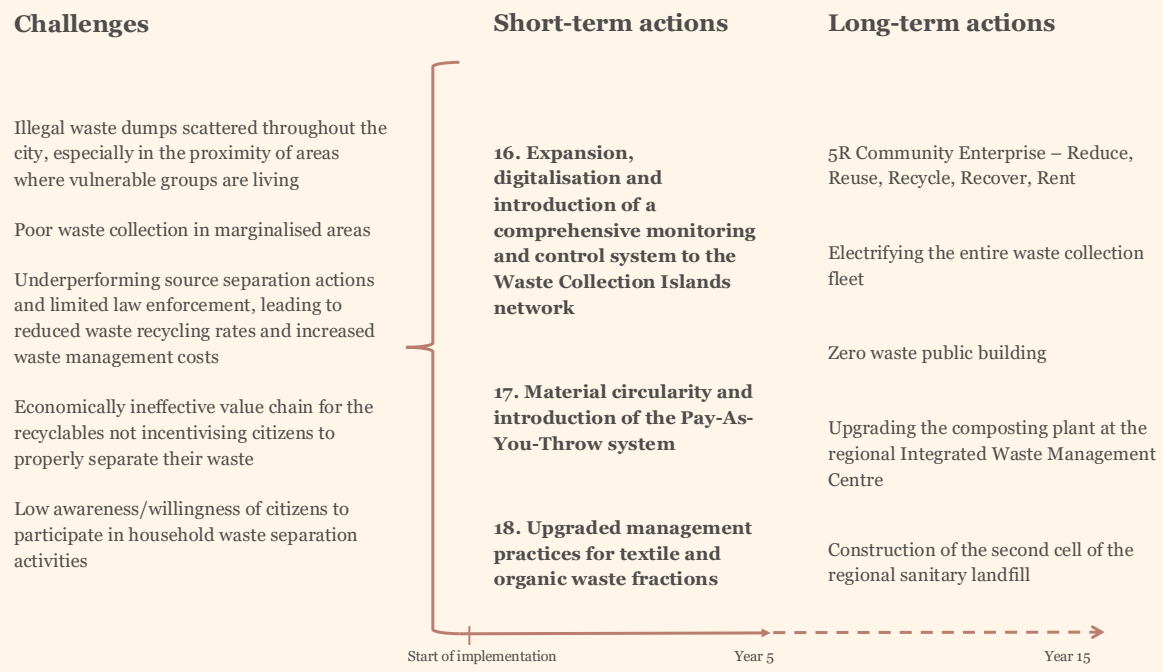


Table 11 Contribution of Waste sector actions to SDGs

Action	Contributing to SGDs
ACTION 16. Expansion, digitalisation and introduction of a comprehensive monitoring and control system to the Waste Collection Islands network	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE; 12 RESPONSIBLE CONSUMPTION AND PRODUCTION; 10 REDUCED INEQUALITIES; 4 QUALITY EDUCATION
ACTION 17. Material circularity and introduction of Pay-As-You-Throw system	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE; 12 RESPONSIBLE CONSUMPTION AND PRODUCTION; 10 REDUCED INEQUALITIES; 4 QUALITY EDUCATION
ACTION 18 Upgraded management practices for textile and organic waste fractions	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE; 12 RESPONSIBLE CONSUMPTION AND PRODUCTION; 10 REDUCED INEQUALITIES; 4 QUALITY EDUCATION

ACTION 16
Expansion, digitalisation and introduction of a comprehensive monitoring and control system to the Waste Collection Islands network

WS
Waste

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2027	N\A	3,000,000 EUR

GOAL OF THE ACTION

The implementation of digitally connected Waste Collection Islands (WCIs) was a significant initiative in Alba Iulia. However, without proper functionality, the benefits of this innovative approach remain limited. Therefore, the primary objective of this action is to expand and optimise the utilisation of digitised WCIs throughout the city, ensuring their efficient and effective operation. Additionally, this action aims to develop a comprehensive monitoring and control system for WCIs, incorporating a clearly defined, recurring control strategy to guarantee long-term efficiency and sustainability.

CHALLENGE ADDRESSED

- Illegal waste dumps scattered throughout the city, especially in the proximity of areas where vulnerable groups are living
- Poor waste collection in marginalised areas
- Underperforming source separation actions leading to low waste recycling rates and increased waste management costs
- Insufficient support from the enforcement authorities to ensure proper source separation
- Low awareness/willingness of citizens to participate in household waste separation activities

BENEFITS

- Decreased GHG emissions produced by collection trucks
- Fostering better and more responsible waste segregation and recycling
- Route planning solution enhancing collection efficiency, time management, and reducing operational costs

TARGETS

- Full functionality of all 163 WCIs
- All 120 aboveground WCI and 43 underground WCI fully integrated into a digital platform
- 80% of the collected recyclable waste properly sorted and recycled
- A centralised oversight mechanism in place for all WCIs

STRATEGIC OBJECTIVES AIMED AT

SO 1 — Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 — Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 — Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

Context

The Municipality plans to expand the number of aboveground WCIs to 100 through an EU-funded project, and an additional 20 aboveground WCIs are needed to fully cover the residential areas. The collection points are designed with a locking mechanism, which is not working properly. Other issues identified across the city include the poor condition of the collection points, many of them being affected by improper manoeuvrability, misuse, or inappropriate user behaviour, along with non-compliant waste segregation. To maximise convenience and capture rates, the Municipality intends to replicate the bring-in centre model by constructing two further ones in strategic locations of the city during the following planning period.





Figure 42 Aboveground (left) and underground (right) waste collection islands in Alba Iulia for selective waste collection

Description

This activity aims to set up a comprehensive waste separation system that enables citizens to dispose of their waste accordingly, using a card-locking mechanism. This system facilitates tracking the frequency of use, estimating the volume of disposed waste, and supporting the implementation of the PAYT scheme, addressed in *Action 17*. The action proposes a set of measures, which include, but are not limited to:

- Up-to-date comprehensive assessment of the actual technical condition of each WCI across the city
- Upgrade and necessary maintenance and additional investments to existing WCIs to be fully digitally operational
- Installation of 20 additional aboveground WCIs to cover the high-rise building areas across the city.
- PV solar panels for each unit (minimum 200W/unit)
- Implementing a reliable Card Access System: distribution of access cards to every citizen/ apartment/ household/ family, with the possibility of issuing additional cards if needed.
- Digital components to provide access control to the WCIs, develop a track usage pattern, incorporate fill-level sensors to monitor capacity, and optimise collection schedule/ frequency.
- Enhance accessibility and ease of use by making the system intuitive and user-friendly for all citizens, regardless of age or digital literacy, including clear instructions and multilingual support.

The action also proposes the introduction of a supervisory mechanism that will ensure the proper functioning of the collection points. The mechanism will involve periodic inspections carried out by the public authorities and waste operators, complemented by full-time surveillance cameras (CCTV).

In the newly established bring-in centres, residents will be able to drop off dry recyclables, bulky items, WEEE, batteries (including car batteries), garden and green waste, textiles, waste oil (vegetal), pesticide/insecticide containers, waste paint, varnish and solvent packaging, pharmaceutical waste, tyres, CDW, neon tubes and even small pet carcasses. The plans include a 16-container covered platform, a drive-through weighbridge, secure bays for hazardous fractions, a refrigerated unit for animal remains, a rainwater collection system and CCTV-equipped perimeter fencing.

Implementation steps

1. Construct 20 WCIs.

2. Ensure digital integration through:
    a. Monitoring sensors
    b. Digital platform used by local authorities and waste operators, which is integrated with a mobile application targeted at citizens
    c. Guideline for service operators
3. Implement the Card Access System and distribute the cards.
4. Construct 2 bring-in centres for recyclables and special waste streams.
5. Establish an oversight mechanism by:
    a. Assigning responsibility and establishing inspection frequency, and
    b. Procuring CCTVs for each WCI.

Stakeholders

Waste management operators; Local Police; Department for Public and Private Domain Administration; local NGOs – compliance with the waste segregation; citizens/residents

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Up-to-date technical condition assessment of the WCIs and investment in their renovation, including PV panels	200,000	20,000
Construction of 20 aboveground WCIs, including PV panels	400,000	20,000
Digital monitoring sensors and a digital platform for local authorities and waste operators, integrated with a mobile application targeted at citizens	150,000	10,000
Construction of 2 bring-in centres for recyclables and special waste streams	2,000,000	50,000
Card access system implementation and distribution of cards	85,000	8,000
Establishment of an oversight mechanism through investment in surveillance cameras and policy adoption	165,000	2,000
Total	**3,000,000**	**110,000**

Social and gender aspects

- Community engagement and awareness raising will be ensured through campaigns that promote proper waste segregation.
- The action promotes social security by ensuring fair access to improved waste collection infrastructure for all social groups, including vulnerable populations and gender-responsive physical design and accessibility (height, lighting, etc.) will be ensured for the new WCIs.
- The monitoring system for the WCIs will include usage patterns, satisfaction levels, and challenges faced by different user groups, with data disaggregated by gender, age, and socioeconomic status.
- Reduced public health risks, especially in the marginalised areas, due to increased urban cleanliness.
- Job opportunities will be created, particularly during the operation of the bring-in centre and in highly skilled smart management. Job creation will align to inclusive recruitment principles.

Smart and digital aspects

- Smart sensors will be incorporated in collection points, measuring fill levels in bins and monitoring any type of waste (mixed waste, paper, plastics, glass, clothing, bio-waste, liquids, electronics, metal) in bins and containers of various types and sizes.
- Remote digital management of access to bins will be ensured, allowing access to the bins only for authorised people.

ACTION 17
Material circularity and introduction of the Pay-As-You-Throw system

WS
Waste

TIMEFRAME	GHG SAVINGS	CAPEX
2027–2028	3,839.43 tCO_2eq/year	1,500,000 EUR

GOAL OF THE ACTION

The action aims to implement the Municipality's CEAP, where waste is properly considered as a valuable resource and to create a sustainable economic system by minimising waste, maximising resource efficiency, and extending the life cycle of products and materials. This action is also focused on the introduction of a new payment system for waste collection, by adopting the PAYT system.

CHALLENGE ADDRESSED

- Underperforming source separation actions leading to low waste recycling rates and increased waste management costs
- Economically ineffective value chain for the recyclables not incentivising citizens to properly separate their waste
- Low awareness/willingness of citizens to participate in household waste separation activities

BENEFITS

- Closing the circularity loop for more waste streams
- Reduced service costs for waste management
- Increased resource efficiency and recycling rates
- Decreased quantity of landfilled waste, associated savings in GHG emissions

TARGETS

- 60% of total municipal waste prepared for re-use and recycling by 2030; 65% of total municipal waste reached by 2035
- Municipal waste quantities destined to landfill reduced to a maximum of 10% of the total amount by 2035
- PAYT system implemented citywide by 2028

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

Context

Alba Iulia is a city where the tourism sector is the main driver of the local economy. Still, certain industrial sectors are active in the region, and the Municipality is aware of the regional industrial development potential. The newly proposed green industrial park (see *Action 3*) and the developments in waste management guided the Municipality towards considering the development and adoption of a circular economy strategy. This aligns with the vision of this GCAP and with the CEAP of Alba Iulia 2023-2033. It will also provide a framework to adopt a circular economy approach across the city while promoting local economic growth through synergies between multiple recycling activities, multi-level stakeholders, including cooperation between public and private entities, and new policy and incentive measures.

Description

By embedding circular principles in urban planning, waste management, and economic policies, cities can lead the transition to a greener, more sustainable future. Thus, Alba Iulia has developed its CEAP to complement the efforts made at the regional level and correlate this with the future Solid Waste Management Action Plan, which should be developed at the regional level. Alba Iulia's CEAP includes several potential actions that are to be implemented in the next years by the Municipality and other key stakeholders.

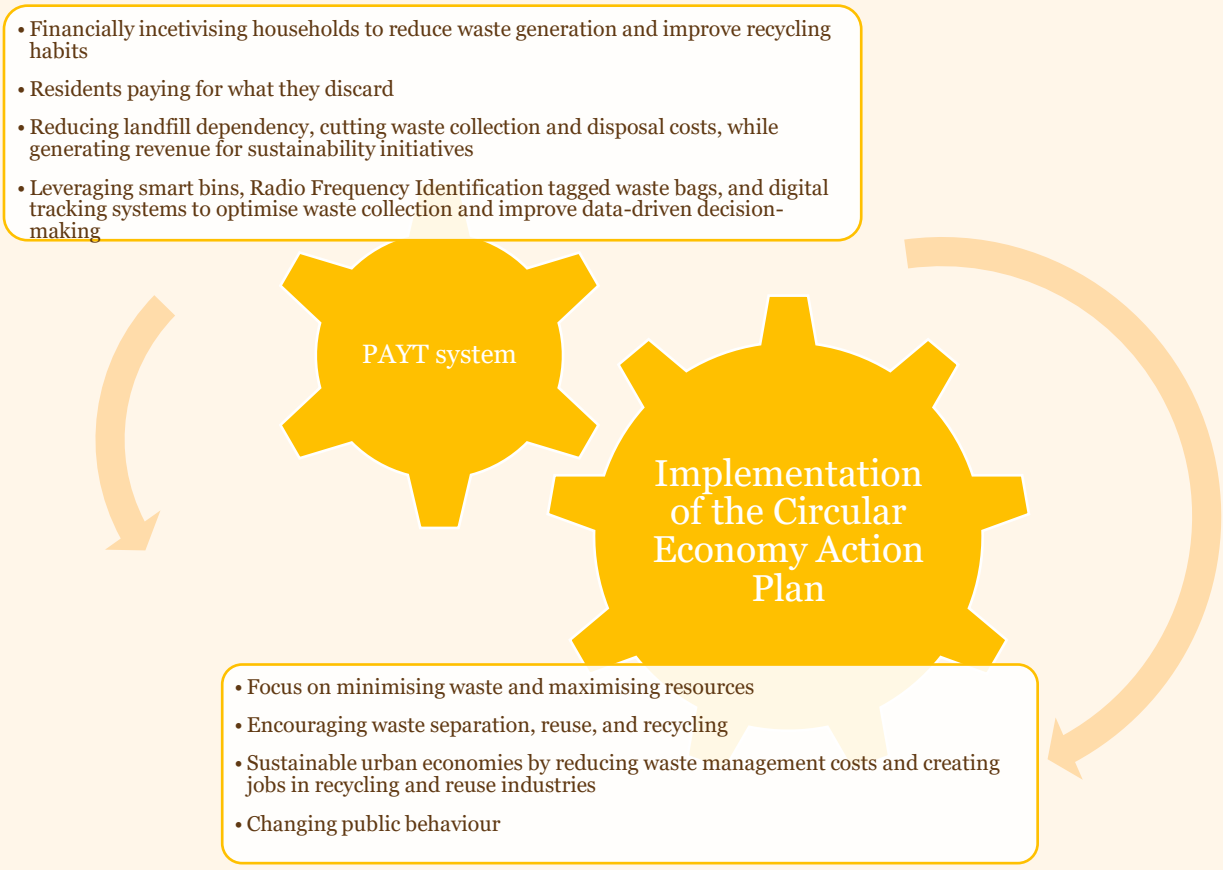


Figure 43 The PAYT system and the CEAP, two mutually reinforcing concepts

The implementation of the CEAP will be correlated with the introduction of a PAYT system, as both aim to reduce waste, improve resource efficiency, and promote sustainable resource management. Introducing a PAYT system aligns perfectly with a city's circular economy strategy by making waste management financially sustainable, environmentally responsible, and socially fair.

The PAYT system will be defined based on an opportunity study, which will determine how to best link the waste fees with the quantity of waste generated, creating a financial incentive for individuals and businesses

to reduce waste quantities and increase the amount of waste separately collected and sent to recycling. The "frequency-based schemes" model is proposed to be piloted across the city of Alba Iulia, particularly in areas with high-rise buildings. It is also supported by the implementation of *Action 16*, with digital integration playing a crucial role in the success of this action. In areas with individual houses, waste will be collected using the door-to-door method, with fees calculated according to a bag-based system. Households will be charged according to the number of prepaid waste bags they use.

This action is also complementary to *Action 3,* focused on new green industrial practices. The city's circular economy strategy will define new and innovative ways of integrating waste processing facilities, recycling plants and synergies between different waste streams, as well as applicable incentives for new start-ups or local businesses to operate within the waste recycling loop.

Implementation steps

1. Develop a waste characterisation study together with an analysis of options for the future development of waste management systems and for the possibilities of future industrial symbiosis between different actors.
2. Implement specific actions from the CEAP: development of repair shops, textile trade shops and development of solutions and projects for reducing food waste.
3. Support and implement the PAYT model across Alba Iulia, including the tender process, software development, training for administrative staff and public awareness campaign.

Stakeholders

Service providers, local authorities, local community and businesses

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Waste characterisation study	100,000	
Implementation of specific actions from the CEAP	1,000,000	10,000
Technical assistance for the introduction of a PAYT system	80,000	
Supporting infrastructure for the introduction of a PAYT system, including software development	300,000	15,000
Delivery of public awareness campaigns on the PAYT system	20,000	20,000
Total	**1,500,000**	**45,000**

Social and gender aspects

- This action aims at equity in waste fee structures.
- A subsidy scheme for low-income families and individuals will be designed and implemented in order to familiarise them with the PAYT system.
- Community engagement and education of the citizens will be gender-mainstreamed and will also consider the needs of the most vulnerable persons in terms of access to information and awareness raising.
- Women entrepreneurship in the textile recycling business will be promoted. Entrepreneurship will also be promoted among other groups (such as youth groups).
- While taking into account different skills requirements, inclusive employment opportunities will also be promoted in the waste analysis and management sector.

Smart and digital aspects

- The introduction of a PAYT system will have a direct impact on the digital invoicing system, which will need to be adjusted accordingly.

ACTION 18
Upgraded management practices for textile and organic waste fractions

WS
Waste

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2027	91.24 tCO_2eq/year	1,620,000 EUR

GOAL OF THE ACTION

The action aims to introduce a system for source separation and collection of textile and extensions for biodegradable waste. Even though considerable investments in the waste management system have been made, especially in the waste collection infrastructure, the separate collection for textiles and biodegradables is not yet fully established in Alba Iulia. This action will ensure citywide coverage by a five-stream collection system – residual waste, biodegradable waste, paper / cardboard, plastic / metal and glass –, and a separate collection system for textiles.

CHALLENGE ADDRESSED

- Lack of future-proof waste management planning considering new tariffing systems, such as PAYT
- New legal requirements regarding textile and biodegradable waste fraction
- Low awareness/willingness of citizens to participate in household waste separation activities
- Non-existence of a dedicated textile and biodegradable waste fraction infrastructure
- Very low composting rates
- Very low recycling rates for textiles

BENEFITS

- Reduction of landfilled waste by diverting the textiles and organic waste
- GHG emission reduction
- New circular economy business models
- Supporting the circular economy

TARGETS

- 60% of biodegradable waste collected separately by 2030
- 25% of textile waste collected separately by 2030
- Municipal waste disposed of at landfills reduced to 10% of the total municipal waste generated by 2035

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

Context

Biodegradable waste is collected separately only at recently installed WCIs, and this approach needs to be integrated within the previously installed WCIs (both above-ground and underground) as well. The same situation applies to textile waste, where only some limited initiatives for collection organised by local NGOs have been identified. Although the textile waste fraction accounts for only 1% of the total municipal waste, its separate collection became mandatory as of the 1st of January 2025, thus creating an urgent need for investment in new infrastructure.

The textile waste is currently collected in certain containers that are privately owned by different NGOs and are located in certain areas of the city. Currently, there are 10 such collection points[7] within the city.



Figure 44 Collection point for textiles, managed by an NGO

Description

The existing practices and the legal requirements create the premises for developing a system for the separate collection of biodegradable and textile waste at city level. This action is envisaged to precede and support the activities foreseen in *Action 16,* and to correlate with measures envisaged in *Action 3* and *Action 17*, related to initiating textile recycling businesses.

The biodegradable waste fraction will be collected and treated in home composting units in areas with detached houses, respectively collected in separate bins in newly developed neighbourhoods. The measures can then be expanded to areas with blocks of flats where the existing above-ground WCIs could be adapted to support the 5-fraction waste collection. The biodegradable fraction will be integrated into the existing infrastructure by gradually repurposing one of the residual waste containers.

To this extent, the action proposes two sets of measures, one focusing on biodegradable waste collection and one on textile waste collection. For biodegradable waste collection, the following measures are foreseen:

1. Determine the number of home-composting units needed for individual houses across the city.
2. Acquisition and distribution of home composting units
3. Citywide extension of the biodegradable waste collection system; in already existing 4-fraction WCIs, a separate waste bin will be allocated for this fraction.
4. Awareness-raising campaign for the population to acknowledge the difference between residual waste and biodegradable waste. (Biodegradable waste consists of organic materials that can naturally break down into carbon dioxide, methane, or simple organic molecules. Examples include green

[7] Source: https://containeretextile.ro/lista-containtere/

waste, food scraps, and food-soiled paper. On the other hand, residual waste refers to the remaining waste after recyclable materials have been separated, such as certain non-recyclable plastics, hygiene products, composite materials, etc. The campaign will also provide a guide on composting practices and how to produce fertiliser in and for the garden.)

As the separate collection of biodegradable waste has been introduced recently and is gradually extended, the treatment of this fraction has not yet been foreseen. The first planning task is therefore to project future increases (tonnage, seasonality, capture-rate) over a 10- to 15-year horizon. High-level assessment indicates that upgrades to the MBT line at the regional IWMC could cover the new stream: the plant already has basic stabilisation boxes and maturation cells, and would additionally need covered reception bunkers, forced-aeration floors and odour control. From an economies of scale perspective, it would be beneficial to consider separately collected biodegradable waste from other cities in Alba County as well. For this, the responsible entity for the management of waste services in the region, ADI Salubris, should commission a feasibility study to:

- Confirm tonnage forecasts and calculation of transport costs;
- Compare technology options (static, containerised, in-vessel or windrow composting, anaerobic digestion, etc.) against CAPEX/OPEX and market demand for compost, biogas and bioslurry;
- Define the exact upgrade package if the MBT route is preferred; and
- Align the timetable with the implementation of the GCAP.

Once the study is completed and endorsed by the ADI Salubris and IWMC operator, detailed design and financing schedules can follow, ensuring treatment capacity increases in line with collection expansion.

Note: As this initiative would fall mainly under the jurisdiction of county-level stakeholders, this study was not budgeted in the GCAP.

The separate collection of textiles is intended to facilitate their integration into the circular economy system. The collected textile waste will be further processed and repurposed within the newly established industrial area dedicated to recycling activities, which is envisaged in *Action 3*. The specific measures foreseen for the introduction of the textile waste collection are:

1. Identification of the most effective system configuration, capacity, and operational model
2. Establishment of dedicated textile waste collection points in strategic locations – 1 central collection point for each neighbourhood
3. Securing location for the textile recycling warehouse within the new industrial park
4. Establishment of the recycling business model and investments in recycling equipment
5. Monitoring progress and adjustment of the system in order to reach targets

Implementation steps

Biodegradable waste integration

1. Carry out acquisition and distribution of home composting units to individual houses.
2. Extend citywide the collection system on 5 fractions with separate bins for biodegradable waste.
3. Set up the logistics to enable the separate collection and treatment of biodegradable waste at the MBT station within the IWMC.
4. Conduct awareness raising campaign regarding the new waste separation fraction of the biodegradable waste.

Textile waste integration

1. Conduct an opportunity study to assess the best options for the separate collection of the textile waste fraction, including system configuration, containers' location, sizing, and operator model.
2. Secure the location within the new industrial area and establish the business.

3. Carry out the procurement of containers, collection vehicle and, if needed, recycling equipment (pending on the business model chosen for textile waste treatment).
4. Conduct awareness-raising campaign to promote the source separation of textile waste.

Stakeholders

Local authorities; service operators; local community; ADI Salubris Alba; NGOs

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Acquisition and distribution of home composting units to individual houses	1,000,000	10,000
Extension of the biodegradable waste collection system in newly developed neighbourhoods	300,000	3,000
Opportunity study for textile waste collection system	60,000	
Investment in equipment for textile waste collection (20 containers, 1 collection vehicle, equipment needed for textile recycling/ processing)	250,000	20,000
Awareness-raising campaigns to promote the source separation of biodegradable and textile waste	10,000	5,000
Total	**1,620,000**	**38,000**

Social and gender aspects

- Proper organic waste management implies improved sanitation and prevents odours, especially in high-traffic areas.
- Community-based composting initiatives will lead to saving costs for households and access to resources.
- Collection of textile waste will offer opportunities for recycling and development of recycling businesses where women entrepreneurs and other groups (such as youth groups) can be promoted, in direct correlation with measures envisaged in *Action 17*.

Smart and digital aspects

- This action allows for digital integration by using the fill-level sensors and card access mechanisms at waste collection points – covered in *Action 16*.
- AI-Powered Chatbot can be used to answer common questions on composting and waste separation via WhatsApp, Messenger, or a dedicated app.
- The mobile app & web platform can provide educational materials, video tutorials, and interactive guides on home composting and proper waste sorting.
- The action entails opportunities for gamification & incentives, namely a digital rewards system (points, discounts, vouchers) to encourage proper participation.

Energy and Buildings



Sector overview

The Municipality of Alba Iulia is now positioning its Energy & Buildings sector as a pillar of its low-carbon future. The following overview presents the baseline, challenges and flagship actions that will steer the city toward its climate neutrality targets.

The total final energy demand in the city edged up to 808,660 MWh in 2021, just 1% above the 2008 baseline. This consumption generated 227,677 t CO_2eq in the same year, again about 1% higher than 2008. Despite the uptick, Alba Iulia is already the only city in Romania procuring over 70% of its grid electricity from renewables, a feat that earned the city a place on the 100%-renewable cities leaderboard of the Carbon Disclosure Project. Also, the local prosumer wave is growing in a fast manner, as 636 rooftop-PV producers are now feeding 31.3 MWp into the low-voltage distribution network.

Alba Iulia's building stock comprises roughly 35,400 properties—about 10,000 single-family houses, 24,000 apartments and 420 public buildings—adding up to almost 2 million m^2 of floor area. Yet fewer than one in ten apartment blocks has undergone a deep energy retrofit in the past decade. At the same time, many historical buildings outside the UNESCO-listed citadel still await renovation but face heritage-protection hurdles.



Figure 45 Public building in Alba Iulia with PVs on the rooftop

Thermal energy supply relies overwhelmingly on natural gas, as around 98% of space-heat demand is met by individual gas boilers, with a modest 3,185 t/y of biomass used in peri-urban areas. The low voltage/medium voltage grid is ranked as weak, with technical losses already presenting at up to 7%, and midday PV injections trigger over-voltage outages. As for public lighting, through recent EU projects, the Municipality replaced 4,114 units with LED fixtures, lifting coverage to 90% of the 288 km network.

Policy-wise, the Municipality's SECAP commits to a 40% GHG cut by 2030 as compared to 2008, while the 2015 Energy-Efficiency Improvement Programme targets a 16% decrease in specific use in municipal buildings and a tripling of local RES output. The pending GUP revision already embeds nZEB mandates and micro-grid readiness.

Key pressures of the sector(s) are: leaky post-1960 blocks and post-1990 sprawl, ageing PV-stressed grid, utility bills that deepen energy poverty, heritage-retrofit constraints, limited building energy audit coverage and near-total reliance on natural gas.

Against these backdrops, the Municipality proposes several key interventions to halve emissions in the building sector by 2030, while turning citizens from passive consumers into prosumers, hard-wiring resilience into the local grid and completing the city's leap to smart, efficient lighting.

Figure 46 Challenges, short- and long-term actions in the Energy & Buildings sector

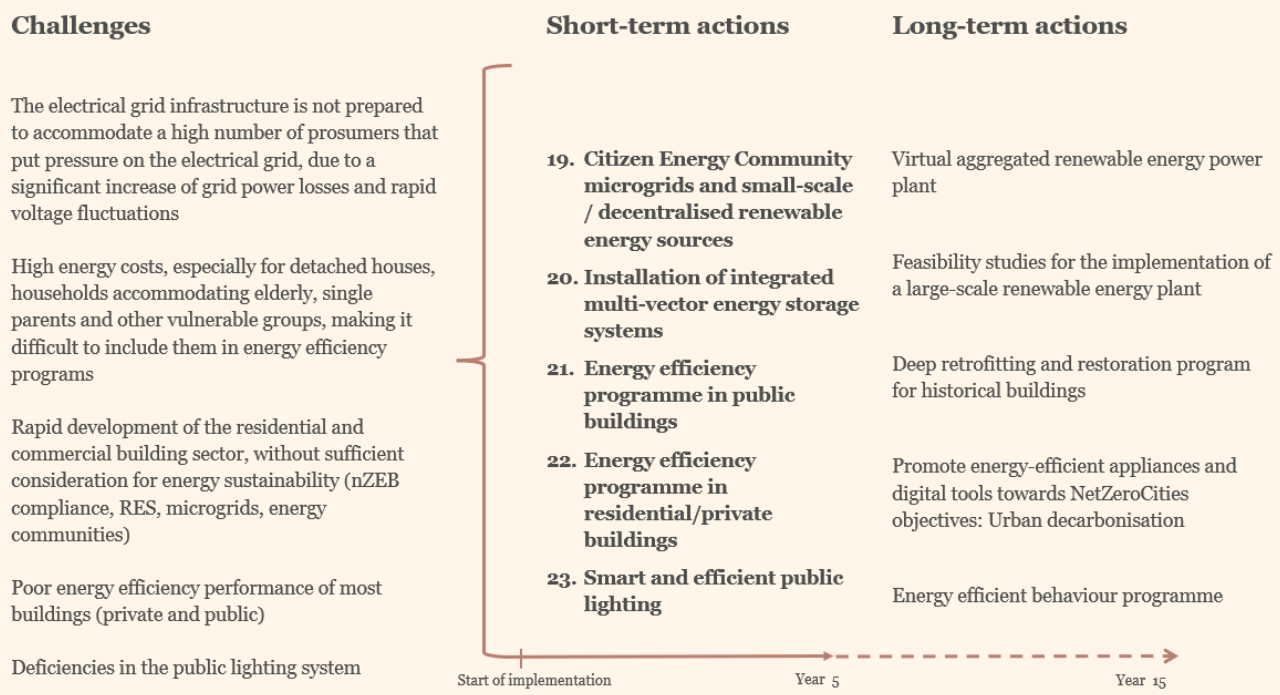


Table 12 Contribution of Energy & Buildings sector actions to SDGs

Action	Contributing to SGDs
ACTION 19 Citizen Energy Community microgrids and small scale / decentralised RES	7 AFFORDABLE AND CLEAN ENERGY; 8 DECENT WORK AND ECONOMIC GROWTH; 10 REDUCED INEQUALITIES; 3 GOOD HEALTH AND WELL-BEING; 4 QUALITY EDUCATION
ACTION 20 Increase multi-vector energy storage capacity	7 AFFORDABLE AND CLEAN ENERGY; 8 DECENT WORK AND ECONOMIC GROWTH; 10 REDUCED INEQUALITIES; 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
ACTION 21 Energy efficiency in public buildings	7 AFFORDABLE AND CLEAN ENERGY; 8 DECENT WORK AND ECONOMIC GROWTH; 10 REDUCED INEQUALITIES; 4 QUALITY EDUCATION
ACTION 22 Energy efficiency programme in residential/private buildings	7 AFFORDABLE AND CLEAN ENERGY; 8 DECENT WORK AND ECONOMIC GROWTH; 10 REDUCED INEQUALITIES; 3 GOOD HEALTH AND WELL-BEING; 4 QUALITY EDUCATION
ACTION 23 Smart and efficient public lighting	7 AFFORDABLE AND CLEAN ENERGY; 8 DECENT WORK AND ECONOMIC GROWTH; 10 REDUCED INEQUALITIES

ACTION 19
Citizen Energy Community microgrids and small scale / decentralised renewable energy sources

EN Energy

BD Buildings

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2030	1,949.36 tCO_2eq/year	7,500,000 EUR

GOAL OF THE ACTION

The goal of this action is to enable energy efficiency and local renewable energy generation, sharing, and consumption within a federation of energy communities. These systems enhance energy autonomy, resilience, and sustainability by integrating RES (e.g., solar, wind), energy storage, and smart grid technologies to optimise energy use.

CHALLENGE ADDRESSED

- The electrical grid infrastructure is not prepared to accommodate a high number of prosumers that put pressure on electrical grid, due to significant increase of grid power losses and rapid voltage fluctuation
- High energy costs, especially for detached houses, blocks of apartments not yet renovated, the elderly, single-headed households and other vulnerable groups making it difficult to include them in energy efficiency programmes or even if included without an integrated approach and focus on them
- Rapid development of residential and commercial building sector, without sufficient consideration for energy sustainability (nZEB compliance, SRI preparation, green labelling, RES sufficient coverage, microgrids, energy communities)

BENEFITS

- Direct supply from local distributed renewable own energy sources, coupled with storage systems
- Prevention of voltage fluctuations and power failures
- Increased energy efficiency as a trigger due to the direct supply of own consumption from green electricity
- Triggered electrification of EV mobility and heating with heat pumps at household level, in the energy community due to the supply of green electricity
- Carbon dioxide emissions reduction
- Lower energy bills

TARGETS

- Local renewable energy generation capacity increased by 7 MWp
- At least 1,000 households involved in microgrid systems (households located in the same area, including underserved/single headed households)
- CO_2 emissions reduced by 20% for the participants in the federative energy communities
- Electricity costs reduced by 20% for participants

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

Context

The development of Renewable and/or Citizen Energy Community (REC/CEC) microgrids, the implementation of a local policy incentive system for small scale energy production from local RES, the development of storage capacities, the development of energy efficiency measures, the electrification of heating and mobility, and the digitisation of energy metering will position Alba Iulia as one of the pioneering municipalities in Romania with such developments in the energy sector in the benefit of citizens, for the mitigation of energy poverty, through the involvement of small/medium-sized enterprises.

Alba Iulia faces challenges related to energy security and dependence on fossil fuels as all other Romanian and European cities. Implementing microgrids as physical infrastructures for REC/CEC will enable decentralised, renewable energy generation, aligning with local and national sustainability targets. This initiative is critical for triggering and improving energy efficiency and electrification and fostering local benefits, including economic development contribution from the local suppliers, PV, Battery Energy Storage System (BESS), heat pumps (HP), and EV installation companies.

On one hand, through two recently signed Local Green Deals, the Municipality has already prepared the background for the launch of a Positive Energy District to act as a REC, gathering a group of public educational buildings and two blocks of apartments. On the other hand, through the second Local Green Deal the Municipality intends to implement a municipal energy dispatch system comprising all public assets to integrate these into a larger REC in which the locally generated energy is shared, thus the energy needs of the assets are covered (buildings, street lighting, electric buses, charging stations, etc.).

In addition, a recently implemented Norwegian project called EMERGE contributed to the setup of a CEC at a multi-residential household level, and a feasibility study is available to be used in funding applications.

Description

Community microgrids are localised energy networks that can operate independently from the national power grid. More importantly, these can monitor and control the internal assets, both regarding energy consumption and local generation. Thus, energy efficiency reduces energy consumption. In addition, the use of local storage systems can increase energy use from the local renewable generation, and control of the load curve from the power grid demand side management, thus ensuring grid flexibility. These systems increase the durability, resilience and energy efficiency of local communities.

The action involves deploying community microgrids with solar panels (PV, solar-thermal), energy storage systems, HP, EV chargers, smart meters, and advanced network management technologies in residential areas and apartment blocks of buildings on one side and public assets on the other side. Technical assistance and incentive systems will be introduced through local policies to encourage citizen participation in joining REC/CEC and renewable energy production and consumption.

The microgrid will be managed by two newly established energy communities, one operating around a pool of residential buildings and the other around buildings owned by the Municipality. The mode of operation is yet to be decided, as there are two variants considered, one being direct operation by the Municipality and the other being the delegation to an authorised company that will maintain the system's operation. The solution that will eventually be implemented will be decided after the elaboration of a feasibility study.

The Municipality will act as a facilitator in the launching of the energy community, through public policy, de minimis grants and technical assistance, although final decisions will be taken by the citizens involved.

The citizens are sometimes sceptical about participating in such REC/CEC, and they do not often understand all the benefits such microgrids bring. Addressing resident scepticism towards microgrid projects requires transparent communication, fair financing, and community engagement. Educating residents, showcasing

success stories, and offering subsidies or shared ownership will build trust among Alba Iulia citizens to actively engage in the development of the REC/CEC.

Implementation steps

1. Select pilot locations.
2. Develop a feasibility study and policy framework using already available studies. Specific new cases will be defined both on a Positive Energy District, gathering public assets and residential households, and on a larger number of residential blocks of apartments. The existing FS will be used to apply for the upcoming calls and new ones in the following period.
3. Install renewable energy and storage systems and configure microgrid systems.
4. Develop and implement a plan for stakeholder engagement, based on lessons learned from previous projects related to PV systems installed on public buildings.

Stakeholders

Alba Iulia Municipality with all its public institutions (schools, social assistance, medical etc.); local residential communities, especially household associations; PV, HP, BESS, EV system installers.

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Feasibility studies	50,000	–
Technical assistance contracted by the Municipality to support the citizens	150,000	–
Microgrid installation (1000 households) including digital solutions Estimated costs for 1 kWp of PV is EUR 600 – EUR 700 and for 1 kWh of BESS is EUR 180 per kWh, thus for an estimation of a total installed power of 7 MWp PV and associated BESS of 15 MWh capacity. The CAPEX includes advanced network management technologies as SaaS, which are starting to be available on the market, and they are included in the OPEX estimation.	7,300,000	50,000
Total	**7,500,000**	

Social and gender aspects

- Equal access to energy benefits all citizens and local and small businesses.
- The equal participation of women and underserved groups in decision making within energy communities will be ensured.
- Training programmes specifically targeting women for technical roles in renewable energy will be developed and promoted in partnership with local educational institutions.
- Job opportunities in the energy transition sector will be created, in accordance with inclusive recruitment principles.

Smart and digital aspects

- This action includes the development of an automated energy management systems in order to monitor, control, and optimise energy use in buildings.
- All users will be connected to a digital app for monitoring energy consumption; the use of such app will be promoted in order to optimise energy consumption, reduce energy bills and promote sustainable living. One such example of a digital app is RENERGIA app – www.renergia.ro.

ACTION 20
Installation of integrated multi-vector energy storage systems

EN Energy

BD Buildings

TIMEFRAME	GHG SAVINGS	CAPEX
2027–2030	N\A	2,000,000 EUR

GOAL OF THE ACTION

The aim of the action is to enhance the energy storage capacity of Alba Iulia, both in the public and residential sector. This measure is induced by the increasingly large-scale deployment of PV systems and distributed generation. The excess of electricity during mid-day and the need for electricity during evening and morning peak-power periods also underlines the need for increased energy storage.

CHALLENGE ADDRESSED

- The electrical grid infrastructure is not prepared to accommodate a high number of prosumers that put pressure on the electrical grid, due to a significant increase of grid power losses and rapid voltage fluctuations
- High energy costs in both public and residential buildings, although at present day compensated by the Government
- Rapid development of the residential and commercial building sector, without sufficient consideration for energy sustainability (nZEB compliance, RES, microgrids, energy communities)

BENEFITS

- Balancing supply and demand at the local level
- Better renewable energy integration and coverage of own energy use from renewables
- Reduced pressure on the electrical grid during peak demand and avoidance of PV disconnection

TARGETS

- At least 10 MW / 10 MWh of storage capacities installed by 2030
- Fossil fuel emissions reduced by 55% by 2030 (Fit for 55 target), in combination with RES, at local level

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

Context

Alba Iulia is increasingly focused on sustainability and smart energy solutions. Given the increasing share of renewables in the energy mix such as solar, ensuring a stable and efficient energy supply is crucial. The Municipality of Alba Iulia has recently installed a total of 1 MWp of distributed PV systems on public buildings' roofs (300 kWp) and on ground with direct grid injection (700 kWp). Another 3 MWp system is contracted and will be installed this year (2025). Thus, the total installed power of 4 MWp will be several times higher than the average daily power consumption of all aggregated assets—public buildings, EV charging stations in public parking, EV charging stations for the electric buses, etc.

At this moment, there is still in place a compensation procedure, through which the excess electricity injected into the power grid can cover the consumption from the grid at parity up to 200 kWp, then in a fiscal way above, but at a significant lower price, as related to the electric energy purchased from the grid, which is from the very beginning a disadvantageous deal for the Municipality.

This is why local energy storage capacities have to be added, starting from the consumers' level (buildings, EV charging systems) and up to the larger on-ground PV systems belonging to the Municipality. Thus, the electric energy demand can be covered long after sunset as well. The excess electricity, instead of being injected into the power grid, could be stored as thermal energy as well as hydrogen as an option on a longer-term basis.

For the residential and commercial sectors, the approach should be the same. The following figure shows the dynamics and current statistics of the county-level installed power capacities:

Table 13 Comparative table of installed power capacities in the 6 counties of the Centre Development Region

Installed power per county and per energy source in MW							
	Alba	**Sibiu**	**Brașov**	**Covasna**	**Harghita**	**Mureș**	**TOTAL**
Coal	-	-	-	-	4	-	**4.00**
Natural gas	-	4.049	60.785	2.26	-	306	**373.09**
Hydropower	359.55	174.83	49.419	-	11.912	7.236	**602.95**
PV	8.51	40.789	101.403	6.357	8.814	28.275	**194.15**
Wind	11.50	-	-	-	-	-	**11.50**
Biomass	11.27	-	-	15	-	-	**26.27**
Prosumers	30.07	34.73	36.63	14.58	31.47	45.42	**192.90**

Description

The aim of this initiative is to establish a multi-vector energy storage system (MVESS), integrating battery storage, thermal energy storage, and hydrogen solutions. These systems allow conversion between different energy carriers. For instance, excess electricity might be stored as heat or hydrogen and later converted back to electricity when needed. They can provide flexibility in energy storage and grid services such as frequency regulation, load balancing, and peak shaving. This process can enhance the efficiency of the energy system by reducing transmission losses and improving access to energy. Such systems play a key role in integrating intermittent RES, such as solar and wind into the grid. Surplus energy from these sources can be stored and used when generation is low or demand is high. Benefits of MVESS:

- Increased energy security: By diversifying energy storage across multiple vectors, these systems provide a backup for power outages and disruptions, enhancing energy security.
- Optimised use of renewable energy: MVESS help manage the variability of renewable sources like wind and solar by storing excess energy and making it available when generation is low.

- Grid stability and flexibility: They provide grid services such as frequency regulation, load levelling, and voltage support, which help maintain grid stability, especially when large quantities of renewable energy are integrated.
- Economic benefits: By improving the efficiency of energy use and reducing the need for peaking power plants, MVESS can lower operational costs and improve the economics of energy systems.
- Environmental benefits: By enabling better integration of renewable energy, MVESS help reduce reliance on fossil fuels, contributing to a decrease in GHG emissions.

This will stabilise the energy supply by storing excess renewable energy and optimising distribution, even within public energy communities at the level of groups of public buildings comprising schools, kindergartens and other public buildings.

This action is complementary to *Action 19*. For the public buildings, an estimation of a total capacity of 10 MWh is required to be associated with the already existing and scheduled PV systems to be installed, which amounts to a total CAPEX of EUR 2 million in a range of technologies: BESS, thermal storage, hydrogen production and storage tanks.

Implementation steps

1. Develop feasibility studies connected with the blocks of public buildings and with the on-ground PV parks.
2. Develop and submit for approval a regulatory framework related to asset management.
3. Design and procure storage technology, as a first step, BESS and thermal storage associated with individual HP at building level.
4. Install and integrate the technology with RES.

Stakeholders

Alba Iulia Municipality; local business ecosystem; residential sector

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Feasibility studies and approval process	100,000	–
Installation of BESS	1,900,000	30,000
Total	**2,000,000**	**30,000**

Social and gender aspects

- The action allows for job creation in the renewable energy and energy storage sectors. Equal opportunities for men and women to access such jobs will be ensured, in accordance with inclusive recruitment principles.
- Targeted training programmes for women in energy technology will be deployed.
- The action will improve energy access and affordability for vulnerable consumers.

Smart and digital aspects

- Demand-response technology can be used to optimise energy consumption emergence from the local and national business eco-system for the energy management of the new installed technologies and aggregated involvement of the prosumers in the energy market.

ACTION 21
Energy efficiency in public buildings

EN Energy | BD Buildings

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2030	202.66 tCO_2eq/year	20,250,000

GOAL OF THE ACTION

This energy efficiency programme in public buildings will focus on reducing energy consumption, optimising operational costs, and decreasing the carbon footprint of this sector. Key measures will include upgrading insulation, retrofitting heating, ventilation & air conditioning (HVAC) systems, transitioning to energy-efficient lighting, and integrating RES where feasible. The initiative aims to set an example of sustainability for the community and improve the comfort and functionality of public spaces.

CHALLENGE ADDRESSED

- Poor energy efficiency performance of the majority of buildings (private and public)
- High energy costs for public buildings

BENEFITS

- Reduction of energy consumption and associated costs
- Improvement of indoor air quality and comfort
- CO_2 emissions reduction
- Transformation from passive energy user to buildings as active utility nodes

TARGETS

- Thermal rehabilitation of 14 public buildings by 2030
- 30% reduction in energy consumption in rehabilitated buildings
- 55% reduction in CO_2 emissions in buildings targeted for renovation
- 30% increase in the share of RES of the total consumption in rehabilitated buildings

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

SO 4 Enhancing the attractiveness of the city for tourists, by creating adequate infrastructure and diverse offers of sustainable tourism

Context

Many public buildings in Alba Iulia were built before the implementation of modern building energy performance standards, having insufficient thermal insulation and high energy consumption. This leads to high operational costs and a negative environmental impact. The Municipality has recognised the need for an energy efficiency programme to address these issues and improve the sustainability of public buildings, both for not yet modernised buildings and for already renovated ones, which include a range of technical systems (HVAC, LED lighting, PV, HP, EV chargers and BEMS). Overall, the present action aims to address challenges, such as: high energy costs for public buildings, rapidly deteriorating buildings that create safety issues, a considerable no. of public buildings with asbestos roofing tiles, a high no. of abandoned buildings in the city centre and lack of clear guidelines for the rehabilitation of historic buildings with high tourist value.

Within the framework of the Energy Efficiency Programme, using EU and Norwegian funds, out of a total number of 58 public buildings belonging to the Municipality, several have been renovated in the last 10 years. During the most recent renovations within the NRRP programme, the RES component was included. In addition, PV systems were installed on several other buildings through separate funding schemes. This is why 14 public buildings were identified to be in need of deep renovation by 2030.

Description

The action foresees the thermal rehabilitation of 14 public buildings covering a surface area of approximately 8,500 m². The energy efficiency solutions planned consist of refurbishing building envelopes, upgrading heating and lighting systems, implementing mechanical ventilation, adopting building energy management systems (BEMS), and electrification of heating using HP. Additionally, the use of small-scale RES, such as PV panels, will be encouraged in order to cover the current electrical energy demand as much as possible and to cover EV charging and heating needs (when using HP). Priority will be given to educational institutions, hospitals, and other public buildings with a central role in the community.

The public buildings covered by this action are the following:

- Dionisie Pop Martian Economic College – Octavian Goga street;
- Regina Maria Art School – Călăraşilor street;
- Ion Agarbiceanu Elementary School – Vasile Goldiş street;
- Barabant Elementary School – Streiului street;
- Micesti Elementary School – Scărişoara street;
- Kindergarten no 1 – Rubin Patiţia street;
- Kindergarten no 2 – Traian street;
- Kindergarten no 8– Mihai Viteazul street;
- Kindergarten no 9– Vasile Goldiş street;
- Paclisa Kindergarten – Carpenului street;
- Micesti Kindergarten;
- Oarda de Jos Cultural Centre – Biruinţei street;
- Micesti Cultural Centre;
- Barabant Cultural Centre.

According to the revised Energy Performance of Buildings Directive, which is due to be transposed into Romanian legislation, all new buildings should be zero-emission buildings by 2030, and existing buildings should be transformed into zero-emission buildings by 2050. The directive defines a zero-emission building as a building with a very high energy performance calculated according to a common general framework and where the nearly zero or very low amount of energy required is covered to a significant extent by energy from renewable sources and with zero on-site carbon emissions.

In consequence, the proposed energy efficiency programme in this action sets out to prepare the transition towards the ZEB standard for the public buildings covered by this programme.

NBS in building renovations are already suggested in the current Terms of References for Feasibility Studies for building rehabilitation. These include, but are not limited to the, adoption of blue/green roofs, the incorporation of the indoor courtyards of the schools and kindergartens for public use in the neighbourhood and for the local community, and provisions towards green building certification from the Authorisation Documentation for Intervention Works phase.

Implementation steps

1. Develop feasibility study - 5 Documentation for the permitting (Authorisation Documentation for Intervention Works).
2. Implement rehabilitation measures (integrated package of energy efficiency and RES solutions).
3. Implement an energy management programme to be applied during the life cycle of the building.
4. Conduct a behavioural change and energy efficiency (EE) instruction programme among the users of the buildings.

Stakeholders

Alba Iulia Municipality; beneficiary public institutions; local community using the public services; contractors and service providers in construction and energy

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
DALI documentation	250,000	–
Behavioural change and EE instruction programme	–	10,000
Design and renovation work for 14 public buildings	20,000,000	200,000
Total	**20,250,000**	**210,000**

Social and gender aspects

- The action allows for job creation due to construction and rehabilitation projects. The job opportunity announcements will be gender mainstreamed, and equal opportunities for accessing these jobs will be provided.
- Inclusive procurement in construction and gender-responsive approaches in behavioural change programmes/communications will be adopted.
- Accessibility elements that will provide safe and easy access to vulnerable groups will be included in the technical design for public building rehabilitation.
- Local jobs will be created in the buildings' facility management and behavioural change programmes, in accordance with inclusive recruitment principles.

Smart and digital aspects

- Implementation of intelligent BEMS.
- Integration of smart meters for real-time energy consumption monitoring and facilitating the transformation of existing buildings from passive energy consumers to Buildings as Active Utility Nodes.
- The renovation of the HVAC system is an opportunity to deploy an automated heating and cooling system.
- Digital platforms can be used to track energy efficiency improvements.

ACTION 22
Energy efficiency programme in residential/private buildings

EN Energy | BD Buildings

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2030	3,933.67 tCO_2eq/year	28,800,000 EUR

GOAL OF THE ACTION

The goal of this action is to enhance the energy efficiency of residential buildings through targeted investments in insulation, electrification of heating using HP, individual mechanical ventilation systems, modern indoor lighting systems, efficiency appliances, and other energy-efficient technologies. The programme aims to reduce energy consumption, lower utility costs, and minimise the environmental impact of residential properties. The target is to retrofit a significant number of buildings, improving the comfort for residents while contributing to the sustainability goals of the Municipality. This action also includes the removal of non-compliant roofs made with asbestos cement sheets.

CHALLENGE ADDRESSED

- Poor energy efficiency performance of the majority buildings (private and public)
- High energy costs, especially for detached houses, the elderly, single-headed households and other vulnerable groups making it difficult to include them in energy efficiency programmes
- Rapid development of the residential and commercial building sector, without sufficient consideration for energy sustainability (nZEB compliance, RES, microgrids, energy communities)

BENEFITS

- Improved energy efficiency
- Reduction of energy poverty
- Increased comfort for residents
- Increased property value
- Active energy users
- Decarbonisation
- Increasing citizen safety by decommissioning and replacing asbestos roofs

TARGETS

- At least 16 residential buildings (blocks of apartments) renovated to improve energy efficiency
- The renovation of at least 200 individual houses supported
- Overall residential energy consumption reduced by 30%
- 8,000 m² of green roofs and walls deployed, current asbestos roofs replaced
- The number of households experiencing energy poverty reduced by 20%

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 3 Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to housing, leisure, digitalisation and innovation needs are incorporated in an organic manner

Context

At present, the city of Alba Iulia is confronted with significant energy inefficiency in residential buildings, both regarding blocks of apartments and individual households, with high heating demands due to inadequate insulation and outdated heating systems. Additionally, according to recent internal studies developed by the Municipality, a considerable portion of the population struggles with energy poverty, leading to discomfort and financial burdens. To address these issues, the Municipality aims to promote energy-efficient solutions and renewable energy integration through targeted investments and policy measures and to facilitate the absorption of EU funding both by the Municipality and by individual applicants. Additionally, this action aims to address the lack of clear dissemination of rehabilitation programmes addressed to companies and citizens.

There are over 35,000 households in Alba Iulia with a total useful surface area of over 2 M sqm, most of this area belonging to the population. Out of it, less than 20% was renovated in the last 10 years using EU grants and proper technical documentation. Around 27,000 individual households are in blocks of apartments and around 7,900 are individual houses. There are also over 50 residential buildings with non-compliant roofs made of asbestos cement sheets. Considering that these are toxic and dangerous for the residents, their replacement is necessary. The replacement of non-compliant roofs offers the opportunity to rebuild these areas using NBS, such as green roofs.

In terms of annual energy use of the residential sector, 46 GWh of electricity is supplied. For heating purposes, 257 GWh of natural gas is supplied through individual gas boilers, which need to be decarbonised in the future. Within the framework of two EU funding programmes for buildings renovation (2007-2013 and 2014-2021), an estimated number of 2,700 apartments were renovated, with a focus on envelope insulation.

Description

The aim of this programme is to enhance energy efficiency in private residential buildings by implementing a mix of passive and active energy efficiency measures. Key components include:

- Promoting small-scale RES (PV systems, HP, EV chargers)
- Encouraging the installation of energy-efficient lighting, insulation, and smart thermostats
- Providing financial incentives, such as tax reductions and subsidies, to encourage homeowners to invest in energy-saving technologies
- Developing a public awareness campaign to educate citizens on energy conservation practices
- Establishing a support mechanism for energy-poor households to ensure deep renovation projects are accessible and affordable

According to the revised Energy Performance of Buildings Directive, which is due to be transposed into Romanian legislation, all new buildings should be zero-emission buildings by 2030, and existing buildings should be transformed into zero-emission buildings by 2050. The directive defines a zero-emission building as a building with a very high energy performance calculated according to a common general framework, and where the nearly zero or very low amount of energy required is covered to a very significant extent by energy from renewable sources, and with zero on-site carbon emissions.

In consequence, the proposed energy efficiency programme in this action sets out to prepare the transition towards the ZEB standard for the residential buildings covered by this programme. There are a total of 76 owners' associations that have formally requested that their apartment blocks be renovated, with a total useful surface of 65,000 m^2.

Homeowners will be stimulated to invest in energy-efficient technologies using de minimis financing schemes up to the maximum of EUR 200,000 per year. NBS, such as green roofs, are already considered in the current Terms of References for the renovation of residential buildings.

Implementation steps

1. Identify the buildings targeted for intervention, and sign partnerships with the property owners. Additionally, establish a One-Stop-Shop.
2. Conduct energy audits and prepare the documentation required for permitting (DALI) for targeted residential buildings.
3. Launch technical assistance for the renovation programme.
4. Carry out procurement procedures and manage the execution of energy rehabilitation works.
5. Deploy renewable energy systems in residential buildings.
6. Track energy savings and GHG reductions.
7. Conduct regular impact assessments and adapt the programme as needed.

Stakeholders

Alba Iulia Municipality, homeowners and residential associations, energy service companies

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Preparing the DALI	400,000	-
Census of all asbestos roofs and their assessment	200,000	
Technical assistance to the renovation of the blocks of apartments and individual houses	200,000	-
Energy efficiency campaign and incentives for EE investments, including the establishment of a one-stop-shop	-	250,000
Buildings renovation – blocks of apartments	24,500,000	25,000
Buildings renovation – individual households	3,500,000	15,000
Total	**28,800,000**	**290,000**

Social and gender aspects

- The action will ensure that households affected by energy poverty receive priority support.
- Specific criteria will be applied to prioritise certain buildings to be rehabilitated, such as the number of single-parent households present in the building, the presence of vulnerable persons, etc.
- Women's participation and employment will be promoted in the implementation of EE measures and supported by technical training in EE and green and digital skills. The creation of job opportunities will align to inclusive recruitment principles.
- Gender-responsive awareness and education campaigns will be conducted.

Smart and digital aspects

- The renovation of both individual homes and apartment buildings should incorporate the integration of RES and energy storage systems, closely aligned with initiatives to establish and support energy communities. To accomplish this, a transformation is required from the status of passive energy users, in relation to the power grid, to the status of active energy users.
- The goal of this action is to improve the energy efficiency of residential buildings through a combination of thermal and energy rehabilitation measures, integrating smart and digital technologies. This will involve the installation of advanced insulation, energy-efficient systems, and smart meters to monitor and optimise energy use. The inclusion of digital tools will facilitate better energy management and allow real-time tracking of energy savings and performance.

ACTION 23
Smart and efficient public lighting

EN Energy | BD Buildings

TIMEFRAME	GHG SAVINGS	CAPEX
2026–2028	537.89 tCO_2eq/year	1,050,000 EUR

GOAL OF THE ACTION

The goal of this action is to upgrade the public lighting system with energy-efficient solutions such as LED lights, along with integrating smart technologies for improved control and monitoring. Smart lighting systems will allow for adaptive dimming based on traffic patterns, weather conditions, and time of the day, reducing energy consumption while maintaining safety and visibility. Additionally, the integration of sensors and real-time data collection will help optimise maintenance schedules and detect faults, reducing both operational costs and environmental impact.

CHALLENGE ADDRESSED

- Higher energy consumption of traditional public lighting systems
- Limited adaptability of conventional lighting
- Need for improved public safety and urban aesthetics
- Need for an emergency centralised control shutdown system

BENEFITS

- Decreased GHG emissions, contributing to sustainability goals
- Enhanced public safety through improved visibility
- Increased lifespan and reduced maintenance of lighting infrastructure
- Real-time monitoring and adaptability based on user needs

TARGETS

- Energy consumption reduced by at least 60% compared to conventional lighting solutions
- Faults identified within 24 hours due to the tele-management system
- Daytime lighting operation reduced by 99% due to the tele-management system

STRATEGIC OBJECTIVES AIMED AT

SO 1 Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level

SO 2 Increasing the efficiency of local resources for integrated and climate neutral development

SO 4 Enhancing the attractiveness of the city for tourists, by creating adequate infrastructure and diverse offers of sustainable tourism

Context

A significant portion of the city's street lighting has relied on outdated technology, leading to high maintenance costs and excessive energy use. To address these challenges, the city prioritised the modernisation of its public lighting through smart and energy-efficient solutions using EU funding. Thus, through 3 recently implemented projects, 90% of the total street lighting system has already been retrofitted. Investments in LED technology and intelligent lighting control systems will contribute to long-term sustainability and cost-effectiveness.

According to an already prepared feasibility study to be submitted within a financing programme launched by the Romanian authorities, the modernisation degree will reach 97% of the public lighting system.

However, the lighting grids need to be extended in newly developed neighbourhoods, and all lighting fixtures have to be integrated into a centralised tele-management system. This action aims to address the challenges of higher energy consumption of traditional public lighting systems, limited adaptability of conventional lighting, the need for improved public safety and urban aesthetics and the need for a centralised emergency shutdown system.

Description

The action aims at replacing conventional streetlights with energy-efficient LED technology to reduce energy consumption and therefore CO_2 emissions, and to improve lighting quality, given the fact that LED lighting has a luminous efficacy of approximately 172 lm/W compared to 100 lm/W for sodium-vapour lighting systems. Additionally, the installation of smart lighting systems equipped with sensors will allow for the adjustment of brightness based on pedestrian and vehicle movement. In order to further increase operational efficiency, this action includes the introduction of a centralised monitoring and control system to optimise lighting efficiency and reduce maintenance efforts.

A total of 231 lighting poles will be modernised.

The proposed streets for this action, along with the number of fixtures are the following:

Ion Alexandru street – 14 , Vanatorilor street – 6 , Liviu Rebreanu street – 13, Nichita Stanescu street – 13, Marin Sorescu street – 10, Dr Aurel Vlad street – 10, Nazareth Ilith street – 20, Nada Florilor street – 6, Mihail Sadoveanu street – 1, Varese street – 12, Constantin Brancusi street – 6, Cornel Medrea street – 9, Sliven street – 9, Viadana street – 7, Valea Argintului street – 13, Padurii street – 3, Abrudului street – 10, Calistrat Hogas street – 10, Stefan Luchian street – 3, Ion Andreescu street – 5, Nicolae Tonita street – 4, Afrodita street – 3, Laleleor street – 25, Fantanele street – 6, Ion Lancranjan street – 13.

Along with the above-mentioned streets where lighting is proposed to be retrofitted, the municipal street lighting network will be expanded to the following streets: Pinului, Molidului, Ienuparului, Gheorghe Tatarescu, Spiru Haret, Sesuri, Raului, Minerva, Albinelor, Iris, Rasaritului, Cutina, Nemesis, Violetelor.

Establishing a PPP is potentially beneficial for the Municipality. This solution will be assessed in an opportunity study, but only for maintenance operations. In the past, EU financing calls for street lighting were not deemed eligible if an investment PPP was in place.

Implementation steps

1. Develop a feasibility study for the extension of the street lighting system.
2. Develop technical project and related documentation.
3. Procure the products, contract installation and configuration.
4. Carry out luminotechnical checks.

5. Install a tele-management system monitoring during exploitation, embed it in the existing public lighting control system.

Stakeholders

Local service providers, Alba Iulia Municipality

Estimated costs

Item	CAPEX (EUR)	OPEX (EUR/year)
Feasibility Study	50,000	-
Project implementation (500 EUR/per lighting element)	1,000,000	50,000
Total	**1,050,000**	**50,000**

Social and gender aspects

- The action will ensure that lighting is equally distributed in all neighbourhoods, especially in underserved areas.
- Prioritising areas where safety concerns are the highest (safety audits with women's groups to identify priority areas) will be considered. All public spaces have to be well-lit to enhance safety for women, children, and other vulnerable groups, reducing the risk of gender-based violence or harassment at night.
- Women's access to job opportunities will be promoted, especially in installation and maintenance works. Job creation will align to inclusive recruitment principles.

Smart and digital aspects

- In public street lighting, smart lighting systems equipped with sensors can automatically dim lights when there is little or no traffic or can increase brightness during peak hours or in response to weather changes. A tele-management system would allow operators to remotely adjust lighting schedules or fix malfunctions without having to physically inspect every light pole.
- Streetlights can also be used as a 'communication hub' for IoT devices. The public street lighting system can also deploy air quality sensors and traffic monitoring devices.
- In short, smart and digital aspects transform traditional systems into intelligent, connected systems that can adapt to changes, provide insights, and improve operational efficiency.

Summary of GCAP actions and financial details

Total investment needs established by the GCAP for the 2026–2030 period are estimated at the amount of EUR 228.8 million. Transport, Energy and Buildings and Water Sectors are the ones where most of this budget will be directed. The chart below shows the division of the overall GCAP budget per sector.

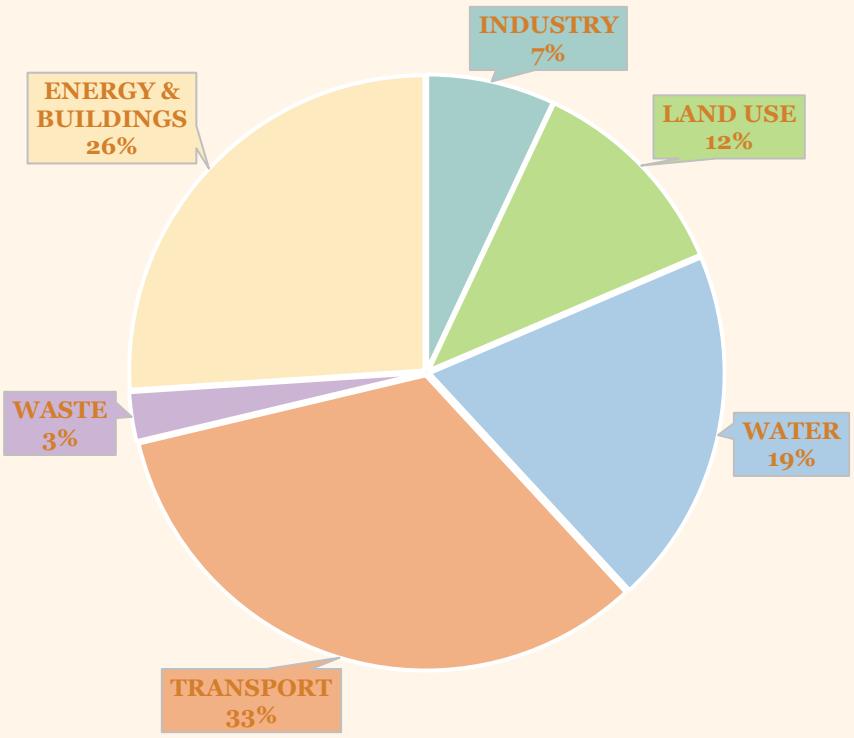


Figure 47 The division of GCAP budget per sector

As indicated in the introduction to Section 2 of the GCAP, all the proposed investments gravitate around the **Industry** sector actions. Still, the total CAPEX for the Industry sector is low since the Municipality can only steer the development in this sector, guiding the private investments and providing support via the other sectors.

A significant portion of the GCAP budget estimate is allocated to investments in the **Transport** sector. The Municipality of Alba Iulia has initiated two major projects and remains committed to further rehabilitating and expanding its road infrastructure, as well as upgrading the PT system. The planned actions in the transport sector also emphasise the promotion of greener, alternative modes of transportation, alongside the development of supporting infrastructure for cycling and pedestrian mobility.

The Alba Iulia Fortress — the city's iconic landmark — has inspired the creation of a cycling network that originates from the fortress and connects the fortress with various natural landscapes and cultural sites beyond the city. This initiative offers both residents and tourists a sustainable way to explore the area while discovering its scenic beauty and rich cultural heritage.

Another key area of investment for Alba Iulia over the next five years will be the **Energy and Buildings** sectors. The city is already recognised as a frontrunner in testing and adopting innovative solutions in the energy field, supported by a team of highly qualified professionals and passionate experts. Their efforts are directed toward developing smart energy communities, advancing multi-vector energy storage solutions, and implementing intelligent and efficient public lighting systems. Simultaneously, programmes focused on the rehabilitation of public and residential buildings will continue, contributing to improved energy efficiency and sustainability across the urban fabric.

The **Land Use** sector is identified as a critical area for urban development investments aimed at enhancing the overall liveability and comfort of the city for both residents and visitors. Key initiatives include the adoption of NBS, the rehabilitation of riverbanks to support slow mobility and recreational activities, and the introduction of new regulations to promote the integration of blue and green infrastructure into the design of emerging neighbourhoods. Together, these efforts will contribute to shaping a greener, more climate-resilient future for Alba Iulia.

Opportunities to secure finance for GCAP actions are many, including green bonds, power purchase agreements, EU-funded programmes, including grant schemes, national and local budget allocation and International Financing Institutions (IFIs) Climate Funds and loans. The Municipality of Alba Iulia monitors the progress of implemented projects since 2007 through the website: https://proiecte.apulum.ro/. A total of 157 projects, with a combined grant funding of approximately 300 million EUR, have been recorded.

Municipal financing for development projects in Romania prioritises access to grant funding, either through EU programmes, mainly the NRRP and the Regional Programme (PR), but also through national grant funds, such as the National Investment Programme Anghel Saligny (PNI), the Modernisation Fund or Environmental Fund budget lines. These financing opportunities are grant-funded up to 98% to 100 % of eligible cost categories. However, since the ineligible components of projects are high, there are components of supporting infrastructure that are not financed, and due to cost overruns, these projects are usually co-financed up to 15 to 30% from repayable financing or own funds. For revenue generating projects financed by the Regional Programme for the Centre Region, state-aid rules apply and grant funding for Alba County is available up to about 50-70% of the project, depending on the financing gap of each project, the location of the project (county) and the type of the beneficiary enterprise (micro, small, mid-sized, large). In the case of Alba County, the intensity of the regional state aid is 50-70%, and public entities are assimilated to large enterprises and qualify for 50% financing of the eligible investments.

For priority projects that are not funded by grant programmes or that are funded by highly competitive non-reimbursable funding programmes, and for which Alba Iulia Municipality may not be able to access funding, it will likely seek repayable financing, typically a multi-objective credit line or, in the case of revenue-generating projects, it will seek private sector partners. It is common practice for municipalities to finance their project portfolio and not each project separately, as this is more flexible for them and they can draw down funds and use them for their priorities.

The Municipality has also experience in issuing municipal bonds. In 2005, it initiated the issuance of four series of municipal bonds, guaranteed through its own revenues, with a maturity period of 20 years, financed through a ‘bridge loan’ from a domestic commercial bank. The four series of bonds were issued over three years (2005-2007, and later in 2018), with a total nominal value of 56.5 million RON (about 10 million EUR) for the period of the first three consecutive years and 100 million RON (about 20 million EUR) in 2018. The purpose of the raised funds was to finance investments in public infrastructure. As such, the Municipality is capable of further pursuing a green agenda by issuing green municipal bonds for financing GCAP investments.

The following table provides a sector-based summary of financing mechanisms Alba Iulia will likely use for financing GCAP actions.

Table 14 Opportunities to obtain financing for actions per Green City sectors

Sector	Potential financing mechanisms
Industry	Industrial parks and incubators are revenue-generating investments that may be co-financed from grant funding if the appropriate calls are available, through IFIs, commercial loans and PPPs.
Land use	Land use projects focus on blue-green infrastructure, public green spaces and recreation. Urban regeneration grant funding options are the first line of funding for these projects. These projects, if they do not receive grant funding, are de-prioritised, on the other hand significant parts of the projects are suitable for crowdfunding, an option that Alba Iulia may explore.
Water	Water and wastewater network rehabilitation and extension has limited grant funding opportunities. Since these are high priority investments, it is likely that IFIs or commercial loans will be sought for these projects. The loans can be accessed by the Municipality or the Public Utility Company. Stormwater projects can be part of urban regeneration projects proposed for grant funding.
Transport	For PT, micro-mobility projects and projects favouring environmentally friendly transport modes, as well as parts of electric mobility projects, grant funding is available and is sought as a first order of priority. Supporting infrastructure is often not eligible, i.e. road infrastructure is rather financed through loans. Other supporting infrastructure such as developments in the electric network and substations needed for electric mobility (private and public), utility works are typically not eligible and may be financed through IFI loans or commercial loans. Parking houses and bike sharing solutions are revenue generating, so can be financed by loans and operated by private partners, alternatively can be implemented through PPPs.
Waste	Waste sector investments are funded to a limited extent by grants, for example, collection centres are eligible for grant funding. Upgrading and extending the collection, integrating a PAYT system and enhancing the collection of source-separated waste on additional fractions will be delegated to the operator through service agreements. The costs implied by such investments can be covered by setting higher tariffs for the service. EPR schemes come to aid the financing of such projects through the contracts with the Municipality.
Energy and Buildings	Building retrofit projects will seek grant funding as a first priority. Cost overruns on these projects are very common, and many of the measures are not eligible, i.e. investments into structure, amenities, sanitary equipment, change of functions, extensions, connecting infrastructure. These projects may seek loan financing typically for up to 40-50% of the investment amounts. Public lighting modernisation may be funded through ESCO-type contracts and access funds from the Environmental Fund. Developing micro-grids, while desirable, are not yet eligible for grant funding, a mix of crowdfunding, loans or green bonds would be suitable to finance these projects.

The table below provides an overview of the foreseen investment and operational costs for each action, along with the estimated capital expenditures (CAPEX) distributed over the next five years.

Table 15 Overview table of investments and operational costs required by GCAP actions

SECTOR	ACTION	CAPEX (EUR)	Timeline					OPEX (EUR/YEAR)
			2026	2027	2028	2029	2030	
INDUSTRY	1. Alba Iulia – more visitors and longer, sustainable stays	11,500,000	1,500,000	2,500,000	2,500,000	2,500,000	2,500,000	170,000
	2. Incentivise green technologies and sustainable industrial practices	500,000	200,000	300,000				40,000
	3. Partnerships with the private sector for new green industrial areas	4,000,000	500,000	1,000,000	1,500,000	1,000,000		400,000
LAND USE	4. From street and district-level nature-based solutions to city-scale climate resilience	13,400,000	400,000	2,500,000	3,500,000	3,500,000	3,500,000	260,000
	5. Rehabilitate riverbanks for slow mobility and leisure	4,150,000	150,000	1,000,000	1,000,000	1,000,000	1,000,000	105,000
	6. Nature and blue small infrastructure for thriving communities	1,700,000	150,000	300,000	250,000			110,000
	7. Test and adopt regulations for blended green and social infrastructure design	7,300,000	1,300,000	1,500,000	2,500,000	1,000,000	1,000,000	225,000
WATER	8. City-wide implementation of smart water network management and metering	2,500,000	1,200,000	1,300,000				200,000
	9. Energy efficiency measures and integration of renewable energy sources in the water sector	6,100,000	300,000	1,000,000	1,500,000	1,500,000	1,800,000	300,000
	10. Water stewardship and cultural heritage-led urban regeneration	4,150,000			600,000	2,000,000	1,550,000	220,000
	11. Rehabilitation and extension of the water and wastewater network	32,000,000	3,000,000	7,000,000	7,000,000	7,000,000	8,000,000	500,000
TRANSPORT	12. Enhancing public transport sustainability with bus upgrades, network expansion, and tariff reform	23,785,000	4,000,000	10,000,000	9,785,000			830,000

SECTOR	ACTION	CAPEX (EUR)	Timeline					OPEX (EUR/YEAR)
			2026	2027	2028	2029	2030	
	13. Integrated measures for enhanced pedestrian, road, cycling, and public transport infrastructure	12,650,000	1,650,000	2,500,000	3,000,000	3,000,000	2,500,000	300,000
	14. Safe and efficient cycling network	32,820,000	2,000,000	3,000,000	7,000,000	10,000,000	10,820,000	275,000
	15. Construction of a Park&Ride facility and green multimodal mobility corridor	6,610,000	500,000	2,000,000	2,000,000	2,110,000		490,000
WASTE	16. Expansion, digitalisation and introduction of a comprehensive monitoring and control system to the Waste Collection Islands network	3,000,000	1,000,000	2,000,000				110,000
	17. Material circularity and introduction of Pay-As-You-Throw system	1,500,000		750,000	750,000			45,000
	18. Upgraded management practices for textile and organic waste fractions	1,620,000	500,000	1,120,000				38,000
ENERGY & BUILDINGS	19. Citizen Energy Community microgrids and small scale / decentralised RES	7,500,000	200,000	2,500,000	2,000,000	2,000,000	800,000	50,000
	20. Installation of integrated multi-vector energy storage systems	2,000,000		100,000	500,000	700,000	700,000	30,000
	21. Energy efficiency in public buildings	20,250,000	2,000,000	4,500,000	4,250,000	5,000,000	4,500,000	210,000
	22. Energy efficiency programme in residential/private buildings	28,800,000	800,000	3,000,000	5,000,000	10,000,000	10,000,000	290,000
	23. Smart and efficient public lighting	1,050,000	300,000	500,000	250,000			50,000
	TOTAL COSTS	**228,885,000**	**21,650,000**	**50,370,000**	**55,135,000**	**52,810,000**	**48,920,000**	**5,248,000**

Monitoring framework, evaluation and reporting

03

Monitoring framework

Monitoring and evaluation of the GCAP implementation are envisaged to track and assess the results and outcomes of implementing the plan. The process highlights the most effective actions and guides the implementation team on how to adjust the ones that are not bringing sufficient results. Its core purpose is to measure the impact GCAP actions have on the quality of environmental factors in Alba Iulia, while also gauging progress toward the targets established for each action. Thus, both the progress and the impact of implementation are monitored. The monitoring process is structured on the following principles:

- Indicators have been structured to reflect the overarching vision of the GCAP and its four SOs, ensuring that the monitoring process captures both the implementation status of individual actions and their cumulative contribution to city-wide sustainability goals. Monitoring indicators with measurable targets have been assigned to each SO to better reflect the achievement of the set objectives.
- Every action from each sector addressed by the GCAP has been assigned tailored indicators, with specified data format and measurement unit to be used in collection and processing, that reflect both sector-specific aspects and their interactions with broader urban environmental systems.
- The tool addresses both the progress of implementation (e.g. planning stages, procurement, execution, completion) and the impact of the actions, using environmental and performance indicators that allow comparison with baseline conditions and targets (several action-specific targets for all 23 actions).
- The monitoring and evaluation process is based on annual data collection and review, enabling the Municipality to amend its efforts, reallocate resources and optimise implementation strategies based on evolving evidence.

This structured monitoring tool is designed in an MS Office Excel file (see Annex 1). A total of 117 action-specific indicators have been set up to monitor the fulfilment of the GCAP vision and its four strategic objectives, in addition to the selected 45 environmental indicators already listed in the GCAP database. The framework facilitates clear and structured reporting of results, enhancing transparency.



Figure 48 GCAP monitoring framework

This monitoring and evaluation framework is a dynamic tool that tracks progress on every action and its related measures. Furthermore, the tool includes several indicators that will be monitored to determine the progress in reaching the strategic objectives of the GCAP. The table below presents these specific indicators for each Strategic Objective.

Table 16 Indicators for monitoring GCAP implementation

Strategic Objective	Monitoring indicators
SO 1. Development of the municipal infrastructure and public services in line with the needs of citizens, while reducing GHG emissions at city level	• Km of dedicated lanes for PT (km) • Km of dedicated bike lanes (km) • No of rehabilitated/retrofitted public/private buildings per year (#/year) • Connection rate to the drinking water supply/wastewater collection system (%)
SO2 Increasing the efficiency of local resources for integrated and climate-neutral development	• Local renewable energy generation capacity (MWp) • Energy consumption in public buildings and facilities (kWh, kWh/m²) • Share of recyclables from total collected MSW/Share of MSW treated in sorting, processing and treatment plants (%)
SO3. Creating a sustainable urban ecosystem in which the development of youth career paths, and solutions to needs regarding housing, leisure, digitalisation and innovation are incorporated in an organic manner	• Sqm of quality green space/inhabitant • Users' satisfaction of the provided municipal services • No and type of youth groups/NGOs actively involved in decision-making progresses (#, type, level of involvement)
SO4: Enhancing the attractiveness of the city for tourists, by creating adequate infrastructure and diverse offers of sustainable tourism	• No of overnight stays per year in the city (#/year) • No of users per year of dedicated digital applications for tourism (#/year) • Users' satisfaction of city experience through digital app (%)

Evaluation and reporting

The evaluation of GCAP implementation will operate on two oversight levels: a **Steering Committee** (SC) will provide high-level supervision and periodic evaluation; at the same time, the **Green City Officer** (GCO) will manage the day-to-day monitoring and reporting. The GCO will compile all the data received from the working group and sectoral departments and will produce an annual progress report during the GCAP implementation period. The monitoring and evaluation of the GCAP implementation process require well-trained and skilled personnel. The SC and GCO will benefit from trainings and technical support during the first monitoring exercise. 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 targets established at the level of the Municipality have been reached.
- External audit – after every 5 years. This will focus on conducting a full assessment of the GCAP implementation process, taking into consideration all elements, such as technical, financial aspects and utilisation of resources.

Green City Action Plan Alba Iulia

Alba Iulia Municipality

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