Interreg CENTRAL EUROPE
Co-funded by the European Union
MISSION CE CLIMATE

COMBATING URBAN HEAT ISLANDS

NATURE-BASED COOLING OF URBAN BUS STOPS SUPPORTED BY IOT MONITORING AND CITIZEN ENGAGEMENT

INNOVATIVENESS

The innovativeness of the solution lies in its integrated, micro-scale approach that combines:

- Nature-based solutions (green roofs on bus shelters and additional greenery in planters) implemented directly at places of everyday exposure to heat,
- Digital innovation, through the installation of IoT sensors measuring temperature, humidity, air quality, solar radiation, wind, and precipitation,
- Open data and transparency, by integrating collected data into the municipal data platform for further analysis and public use,
- Citizen participation, through pre- and post-intervention surveys capturing perceived comfort, heat stress, and acceptance of the measures,
- Awareness-raising and communication activities, including city-wide visual campaigns (city lights), informational leaflets explaining the pilot and resident-planted greenery, and branded bags distributed during surveys to increase public engagement and visibility of the initiative.

The pilot demonstrates how small-scale interventions at strategically selected locations can deliver tangible climate adaptation benefits while overcoming regulatory, institutional, and spatial constraints typical for dense historic city centres.

OBJECTIVE

The objective of the solution is to reduce heat stress and improve thermal comfort at highly exposed urban micro-locations by implementing nature-based solutions (NBS) at public transport stops. The solution aims to improve the well-being of public transport users, especially vulnerable groups, while generating measurable climate data to support evidence-based urban planning, awareness raising, and replication of the approach across the city and other Central European communities.

GEOGRAPHICAL COVERAGE:

CITY OF MARIBOR (SLOVENIA), WITH IMPLEMENTATION AT SELECTED BUS STOPS IN THE CITY CENTRE, INCLUDING THE MAIN PILOT LOCATION AND SEVERAL ALTERNATIVE BUS SHELTERS USED FOR INTERIM IMPLEMENTATION.

CLIMATE RESILIENCE SOLUTION IN MUNICIPALITY OF MARIBOR

The Maribor pilot implements a climate resilience solution focused on combating urban heat islands at public transport stops. Selected bus shelters were upgraded with green roofs and additional vegetation in planter boxes, providing shade, evapotranspiration cooling, and improved microclimatic conditions. All urban equipment installed within the pilot is newly procured and was selected in accordance with the specifications defined in the municipal Catalogue of Urban Equipment.

The intervention is supported by the installation of IoT sensor systems that continuously monitor key climate and environmental indicators, such as air temperature, humidity, particulate matter, selected gases, solar radiation, wind speed and direction, and rainfall. Data collected through the sensors are integrated into the existing municipal data infrastructure and prepared for open access and further analysis.

In parallel, citizen surveys were conducted before and after the intervention to assess perceived heat stress, comfort, and acceptance of nature-based solutions. The solution serves as a demonstrator for scalable, data-driven urban heat mitigation that can be replicated at other bus stops and public spaces.

Installation of green roof on bus stop

Vegetation installation next to bus stop for improved microclimatic conditions

IMPLEMENTATION STEPS

1. ANALYTICAL AND PREPARATORY PHASE

- Identification of urban heat challenges and priority micro-locations based on local strategic documents and stakeholder consultations
- Selection of suitable bus stop locations considering heat exposure, passenger frequency, spatial constraints, and regulatory conditions

2. DESIGN AND PLANNING PHASE

- Definition of appropriate nature-based solutions (green roofs, planters, plant species selection)
- Preparation of conceptual design, technical specifications, and cost estimations
- Coordination with municipal departments, concessionaires, and heritage protection authorities

3. PROCUREMENT AND IMPLEMENTATION PHASE

- Public procurement of urban equipment, greenery, and IoT sensor systems
- Installation of green roofs and additional greenery at selected bus shelters
- Preparation of pilot sites and integration of NBS into existing urban infrastructure

4. MONITORING AND DATA MANAGEMENT PHASE

- Installation of IoT sensors at selected bus stops
- Continuous measurement and collection of climate and environmental data
- Integration of data into the municipal platform and preparation for open access

5. CITIZEN ENGAGEMENT AND EVALUATION PHASE

- Implementation of surveys among public transport users before and after the intervention
- Collection of feedback on thermal comfort, well-being, and perception of greening measures
- Use of combined sensor data and citizen feedback to evaluate effectiveness and support replication

Anketiranje potnikov javnega avtobusnega mestnega prometa na postajališču Glavni trg -Elektro

Spoštovani potniki,

Mestna občina Maribor načrtuje prenovo avtobusnega postajališča Glavni trg - Elektro. Postajališče je v poletnih mesecih zelo **toplotno obremenjeno**, zato želimo v prihodnosti potnikom omogočiti **boljšo potovalno izkušnjo**. V okviru pilotnega projekta Mission CE Climate bomo, v sodelovanju s pristojnimi uradi, **ozelenili strehe novih avtobusnih nadstrešnic in namestili novo urbano opremo z dodatno ozelenitvijo.** Ozelenitev avtobusnih nadstrešnic izboljšuje kakovost zraka, saj rastline absorbirajo prašne delce, skladiščijo deževnico in zmanjšujejo učinek toplotnega otoka s hlajenjem okolice. Poleg tega zelene strehe spodbujajo biotsko raznovrstnost, privabljajo opraševalce, kot so čebele in metulji, ter prispevajo k trajnostnemu urbanemu okolju.
Prosimo vas, da odgovorite na nekaj vprašanj, ki nam bodo v pomoč pri načrtovanju aktivnosti. Prosimo upoštevajte, da se raziskava nanaša zgolj na omenjeno tematiko večjih toplotnih obremenitev, s katerimi se v zadnjih letih soočamo.

Zahvaljujemo se vam za sodelovanje! S pomočjo vaših odgovorov bomo ustvarili **prijetnejši in bolj zelen Maribor!**

1. Prosimo, zaupajte nam koliko ste stari?

Izberite vse primerne odgovore.

- od 10 - 25 let
- od 25 - 65 let
- več kot 65 let
- ne želim povedati

◀ Survey prepared for citizen feedback gathering and evaluation of intervention

Citizen engagement activity ▶

PILOT SUMMARY

The Maribor solution contributes to climate resilience by demonstrating a practical and replicable approach to mitigating urban heat at highly frequented public spaces. By combining nature-based solutions with digital monitoring and citizen participation, the pilot improves microclimatic conditions, supports evidence-based decision-making, raises awareness of climate adaptation measures, and provides a tested model that can be scaled up across the city and transferred to other Central European communities.