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PilotInnCities

Summary of Agile Pilot

Company name	**Envirosense Hungary Ltd.**
Company location	**Debrecen, Hungary**
Domain	**Digital services and communication**
Municipality	Debrecen, Hungary
Project period	September 2025 – May 2026 (9 months)
Solution	Within the framework of the INTERREG Danube Region project DRP0200367 "PilotInnCities", Envirosense Hungary Ltd. implemented the agile pilot project "Heat Stress and Heat Risk Mapping to Support Climate Adaptation in Debrecen" between September 2025 and March 2026. The pilot developed a high-resolution urban heat stress and heat risk assessment methodology based on satellite remote sensing data. Using thermal imagery from Landsat 8 and Landsat 9, combined with Sentinel-2 multispectral data, the project produced a 10-metre-resolution heat stress map covering the administrative area of Debrecen. The solution enables municipalities to: • identify critical heat-stressed public spaces and buildings, • classify urban areas according to a five-level heat risk scale, • estimate the population exposed to different heat stress levels, • support climate adaptation planning and green infrastructure investments, • prioritize interventions in public spaces and municipal facilities, • monitor urban heat island effects over time. The methodology combines satellite-derived land surface temperature (LST) analysis, GIS-based spatial processing, population data integration, and municipal asset databases into a scalable decision-support framework.
Stakeholders	Involved stakeholders and users: • Municipality of Debrecen and its relevant departments, • Municipal companies and public institutions, • EDC Debrecen Nonprofit Ltd. (urban development team), • Climate adaptation and urban planning experts, • Envirosense Hungary Ltd. (solution provider).
Lessons learned	• The agile pilot successfully validated a real market demand for urban heat stress assessment services. • The methodology proved to be scalable and transferable to other cities. • Data availability and quality strongly influence the level of detail and usefulness of the analysis. • Population exposure assessment can only be performed where sufficiently detailed demographic data are available. • The involvement of EDC Debrecen as an intermediary organization significantly improved communication between municipal stakeholders and the development team. • Early stakeholder engagement is essential for defining relevant indicators and ensuring practical applicability of the results.
KPI 1 Development of a satellite-based heat stress risk assessment methodology	Measurement: Development and validation of a methodology capable of identifying urban heat stress patterns and producing heat risk maps from thermal satellite imagery. Expected target value: 1 validated methodology. Achieved value: 1 methodology successfully developed and tested.

	Summary and analysis of the results achieved in relation to the indicator:A transferable methodology was developed using Landsat thermal imagery, Sentinel-2 downscaling techniques and GIS analysis. During implementation, the originally planned WHO-based classification approach was replaced by a percentile-based classification system, providing greater differentiation between urban heat stress categories and improving the analytical value of the outputs. Comments / factors influencing the results: The methodology was intentionally designed to be scalable and applicable to other municipalities with minimal adaptation requirements.
KPI 2 Identification of critical public spaces and buildings	Measurement: Identification and ranking of heat-stressed public spaces and buildings. Expected target value: At least 20 critical public spaces and 60 critical buildings identified. Achieved value: Target met – at least 20 critical public spaces and 60 critical buildings (including schools, healthcare, and social facilities) successfully identified and ranked. Summary and analysis of the results achieved in relation to the indicator: The analysis identified critical public spaces and buildings throughout Debrecen. Dense urban areas were consistently classified within the highest heat stress categories. The project produced a prioritised list of public spaces and buildings requiring intervention. Comments / factors influencing the results: The availability and quality of municipal asset databases significantly affected the filtering and ranking process. Additional data processing was required to distinguish municipal assets and sensitive public facilities such as schools, healthcare institutions and social service buildings.
KPI 3 Identification of population exposed to critical heat stress	Measurement: Estimation of population affected by critical heat stress zones. Expected target value: Identification of at least 10,000 residents. Achieved value: More than 98,000 residents identified within the highest-risk category. Summary and analysis of the results achieved in relation to the indicator: Using address-level population data, the project successfully linked demographic information to the building database. Analysis showed that approximately 51.1% of Debrecen's population falls within the most critical heat stress category. Comments / factors influencing the results: The availability of detailed demographic datasets was a key prerequisite for conducting population exposure analysis.
KPI 4 User involvement and needs assessment	Measurement: Number of workshops and stakeholder engagement activities. Expected target value: Minimum 2 workshops. Achieved value: 3 workshops conducted and documented (exceeding the minimum target of 2). Summary and analysis of the results achieved in relation to the indicator: Multiple workshops were conducted during the pilot period. The first focused on identifying municipal user needs, while subsequent workshops reviewed interim results and validated outputs. Feedback collected during these events was incorporated into the development process. Comments / factors influencing the results: The active involvement of EDC Debrecen facilitated stakeholder identification, workshop organisation and communication with municipal experts.
Evaluation of the business model focusing on its	Envirosense Hungary Ltd. develops and operates geospatial analytics and remote sensing solutions for municipalities, agriculture, waste management and environmental

viability and potential for growth	applications. Its business model combines project-based consulting services, licensed geospatial data products and subscription-based operational services. • Validated strengths of the business model • Development driven by validated user needs • Strong scalability and transferability of the methodology • Broad applicability across municipalities and climate adaptation projects • Ability to integrate multiple spatial datasets into decision-support products Identified barriers or potential weaknesses • Service quality depends heavily on the availability and quality of local datasets • Pricing strategy requires further refinement according to different service levels • Access to demographic and municipal asset data may vary significantly between municipalities Implemented / planned adjustments • Service packages will be differentiated according to available datasets and analytical depth • Data availability assessments will become part of the pre-sales process • Greater emphasis will be placed on stakeholder identification and user training • Project objectives and indicators will be more explicitly defined at project initiation Identified potential areas requiring external support • Networking support and access to municipal decision-makers • Local intermediary organisations similar to EDC Debrecen that can facilitate stakeholder engagement Priority needs for further scaling • Development of a pricing and scaling strategy • Marketing and dissemination activities targeting municipalities • Implementation of the methodology in additional pilot cities • Development of monitoring services to assess intervention impacts over time
Impacts	The pilot successfully demonstrated the feasibility of satellite-based heat stress mapping as a practical decision-support tool for municipalities. Key impacts include: • Creation of a city-wide 10-metre-resolution heat stress map for Debrecen • Identification of priority public spaces and buildings requiring climate adaptation measures • Estimation of population exposure to urban heat stress • Validation of a scalable methodology applicable to other municipalities • Increased awareness of urban heat island effects among municipal stakeholders • Improved evidence base for climate adaptation and sustainable urban development strategies
Suggestions for future actions, especially focusing on sustainability and replication	• Introduce the methodology in additional Hungarian and international municipalities. • Develop standardised service packages adapted to different levels of data availability. • Establish periodic monitoring to evaluate the effectiveness of climate adaptation investments. • Expand the methodology to support additional climate resilience indicators. • Strengthen stakeholder engagement and user training during implementation.
Next steps	• Finalise the pricing and commercialisation strategy. • Implement the methodology in 2–3 additional municipalities. • Develop a dedicated marketing campaign targeting local governments and urban development agencies.

	• Explore additional use cases beyond heat stress assessment. • Prepare for international market expansion from 2027 onwards.
Provider's Reflection	The agile piloting provided an excellent opportunity to validate both the technical feasibility and market relevance of the proposed solution. The project confirmed that urban heat stress assessment is an increasingly important topic for municipalities addressing climate adaptation challenges. The pilot also highlighted the importance of high-quality local datasets and strong stakeholder engagement. Cooperation with EDC Debrecen significantly improved implementation efficiency and communication with municipal users.
Municipality's Reflection	The municipality considers the heat stress map a valuable decision-support tool that can improve investment planning, climate adaptation measures and resource allocation. The solution helps identify priority locations requiring intervention and supports long-term monitoring of urban climate conditions. Municipal stakeholders emphasised that agile piloting enables early validation of innovative solutions while incorporating end-user needs through continuous feedback.
Expert's Reflection	The mentoring process provided continuous support throughout the pilot, helping to connect the technology provider, municipal stakeholders and city-development organisations. Mentoring contributed to methodological refinement, stakeholder engagement and the development of a scalable service framework. A key lesson was that climate adaptation solutions become truly valuable when technical analyses are translated into practical decision-support tools that respond to local needs and municipal planning priorities. The pilot demonstrated the importance of combining scientific methodology, local data and active stakeholder involvement to achieve meaningful and transferable results.