

„PNRR: Fonduri pentru România modernă și reformată!”

# National Competence Centre and solutions for the development of Climate Neutral and Smart Cities



## Deliverables - Project 5

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# Deliverables - Project 5

## **P5.D1.1. Use-Cases & KPIs for a NetZero Smart Campus – document**

The report presents the main use cases and measurable performance indicators associated with the implementation of a NetZero Smart Campus. It includes scenarios related to the Smart Campus laboratory and Digital Twin platform, sustainable energy and environment, sustainable buildings, and smart and sustainable mobility. The report highlights system requirements, indicative implementation elements, estimated investment aspects, and exploitation perspectives. The reported content may support competencies in use-case definition, KPI mapping, smart campus planning, and structured analysis of NetZero transition scenarios.

## **P5.D1.2. Data infrastructure – physical infrastructure**

The deliverable presents the design choices and the analysis of the physical data infrastructure for the NetZero Smart Campus. It reports the evolution of infrastructure planning, including requirements, data collection and management strategies, communication technologies, storage, security, and links with Digital Twin, simulation, and AI-oriented components. The document describes how collected data may contribute to monitoring, analysis, prediction, and decision-support activities in NetZero scenarios. The reported content may support competencies in data-driven Smart Campus development, infrastructure updating, Digital Twin integration, and scenario-oriented technical analysis.

## **P5.D1.3. Communication infrastructure – physical infrastructure**

This deliverable presents the physical communication infrastructure associated with the NetZero Smart Campus and related component projects. It reports communication solutions such as private LoRaWAN, smart building communication systems, commercial and private 5G, and LoRaWAN connectivity for specific project scenarios. These technologies are positioned as enablers for data collection, monitoring, and IoT-based services. The reported work may support competencies in communication infrastructure planning, 5G and LoRaWAN deployment analysis, and connectivity design for smart and climate-

neutral campus applications.

#### **P5.D1.4. Internet of Everything Infrastructure – physical infrastructure**

This deliverable presents the IoT and Internet of Everything infrastructure associated with the NetZero Smart Campus. It reports the general IoT architecture, local systems, and sensor infrastructures for sustainable energy and environment, sustainable buildings, smart mobility, and the Smart Campus laboratory. The document includes references to energy monitoring, smart building sensors, vehicle and air quality sensors, traffic cameras, GPS and acceleration sensors, parking sensors, weather sensors, indoor people monitoring, and smart lighting pole sensors. The reported content may support competencies in IoT infrastructure mapping, sensor integration, and smart city data collection.

#### **P5.D1.5. Climate neutral plan for Smart Campus – document**

This report presents a climate neutrality action plan for smart campuses, with a focus on the National University of Science and Technology POLITEHNICA Bucharest campus context. It reports the methodological approach, asset and energy flow inventories, greenhouse gas emissions estimation, mitigation measures for buildings, technical systems, mobility, waste management, education, awareness, research, innovation, dissemination, stakeholder involvement, and funding opportunities. The report also includes examples of demonstrative pilot projects and annexes related to emissions estimates. The reported work may support competencies in climate neutrality planning, emissions inventory development, and campus-level sustainability assessment.

#### **P5.D2.1. Architecture of the NetZero Open Data platform – Document**

We present an architectural proposal for the NetZeroCities Open Data platform. The architecture includes data sources related to energy and environment, smart buildings, mobility, and infrastructure, as well as functional and non-functional requirements for the platform. It includes a central system with data acquisition, Big Data processing, testing and validation, database, and export components, together with local systems hosted by project partners. The reported content

may support competencies in open data platform design, data source modelling, system architecture, Big Data integration, and Digital Twin-oriented platform planning.

### **P5.D2.3. Platform interaction and data curation mechanism – Software**

The deliverable presents the platform interaction and data curation mechanism for the NetZeRoCities Open Data context. It reports requirements for the data export component, qualitative design principles, SOLID principles, data integration from multiple sources, transformation into a unified format, API requirements, data formats, and open data standards. The document also presents the architecture of the export component, cloud-based simulation and testing elements, and a case study on data collection from an IoT smart switch. The reported content may support competencies in data curation, API-oriented design, cloud testing, and embedded IoT data collection.

### **P5.D4.1. Testing and Validation methodology**

This deliverable presents the testing and validation methodology for the Smart Campus and Digital Twin solutions developed within the project. It reports the Smart Campus architecture, the communication and IoT infrastructures used, and a set of implementation scenarios covering air pollution monitoring, energy measurements, sustainable and intelligent buildings, smart lighting, and intelligent traffic. The document also includes descriptions of tests, reported results, conclusions, and a framework for testing and validating solutions with external stakeholders. The reported content may support competencies in validation planning, pilot scenario assessment, IoT testing, and evidence-based evaluation of smart campus solutions.

### **P5.D4.2. Smart energy grids**

This deliverable presents the interoperability methodology for the Smart Campus ecosystem. It reports the integration of mobile communication components, 5G and LoRaWAN networks, IoT applications, monitoring and control components, V2X elements, embedded systems, and the central Digital Twin platform. The document also describes interactions between the central system and partner or third-party platforms through APIs, gateways, secured communication

mechanisms, connectors, data models, and unified visualization approaches. The reported content may support competencies in interoperability design, API-based integration, IoT platform alignment, and secure data exchange for Smart Campus applications.

### **P5.D4.3. Piloting solutions**

The deliverable presents the piloting activities carried out for Smart Campus and Digital Twin-related solutions. It reports the evaluation methodology for piloted solutions, including connectivity and data transmission testing, and describes pilots developed with public authorities, campus environments, and partner infrastructures. The document covers scenarios related to traffic monitoring, air quality monitoring, fall detection, abandoned waste detection, citizen notification analysis, building and utility efficiency, smart public lighting, and campus-based deployments. The reported content may support competencies in pilot planning, urban data analysis, solution evaluation, stakeholder interaction, and practical validation of smart city technologies.

### **P5.D5.1. Exploitation plan**

The deliverable presents the exploitation plan for the NetZeRoCities Smart Campus and Digital Twin results. It reports the context for exploiting project outcomes, the state of the art, and a structured technology transfer process covering local needs, exploitable results, feasibility, standardization, interoperability, intellectual property, licensing, and the “Smart City in a Box” operational model. The document also includes a possible exploitation scenario, with implementation, testing, preliminary results, and scaling or replication considerations. The reported content may support competencies in exploitation planning, technology transfer, sustainability assessment, and the preparation of smart city solutions for broader use.

### **P5.D5.2. Education and training documents**

This deliverable presents the education and training plan associated with the NetZeRoCities Smart Campus and Digital Twin activities. It reports a proposed curriculum and introductory smart city activities, including a general programme structure and an IoT module focused on architectures, connectivity, and security in Smart Campus contexts. The document also includes training elements

specific to NetZero solutions and the “Smart City in a box” concept. The reported content may support competencies in curriculum design, smart city education, IoT-oriented training, and the transfer of project knowledge toward learners and stakeholders.

### **P5.D5.3. Awareness and dissemination activities**

The deliverable presents the awareness, dissemination, and communication activities associated with the project. It reports elements such as the project visual identity, website, social media presence, workshops, events, collaborations, public presentations, media appearances, and activities connected to local communities and related initiatives. The document also indicates that dissemination relies on several communication channels and includes materials presenting Smart Campus, Digital Twin, and climate-neutral city solutions. The reported content may support competencies in project communication, public awareness, stakeholder engagement, knowledge transfer, and dissemination planning for research and innovation projects.