6G-VERtical Trials for SUStainability
Key outcomes from the 1st Phase Trials

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Agenda

1. Project Overview
2. How 6G verticals create sustainability impact
3. How sustainability impact was assessed
4. Results from 1st Phase Trials
5. Lessons Learnt

Co-funded by the European Union

UCY/KIOS CoE at a glance

- Established as a Research Unit in **2008** and upgraded to a Center of Excellence (CoE) in **2017** – Collaborates strategically with Imperial College, London
- Operates within the University of Cyprus (at the level of Faculty)
  - More than **235** people at KIOS CoE
- Develops **research infrastructures** (Testbeds)
  - Test technologies under realistic operating conditions
- Creates **synergies**
  - National and international with industrial and governmental organizations

The name "KIOS" was inspired from the Greek Mythology, where KIOS was the titan of "Intelligence"

6G-VERSUS: 6G VERtical trials for SUStainability

Web site: http://6G-versus.eu

Linkedin 6g-versus

x.com @6G_VERSUS

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Duration: 36 months 1.1.2025 – 31.12.2027

Call: HORIZON-JU-SNS-2024-STREAM-D-01-01 - SNS Large Scale Trials and Pilots (LST&Ps) with Verticals

Type of action: HORIZON-JU-IA HORIZON JU Innovation Actions

Funding: 12,1 M€, total budget 14,5 M€

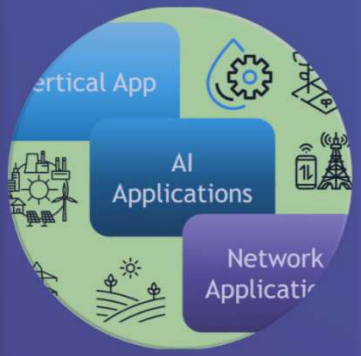
Coordinator: UOULU / Sanna Tuomela

Partners: 34 from 10 countries, 13 academic and/or research organizations, 10 industrial partners, 9 SMEs and 2 NGOs

Co-funded by the European Union

Objectives

6G-VERSUS



6G-Enabled Application Framework for the triplet of V-app, AI-app and N-app

6G Trials to assess performance with the principles of "sustainable 6G"

Integration of 6G Applications across 6 Testbeds

Societal and environmental impact assessment and new business models

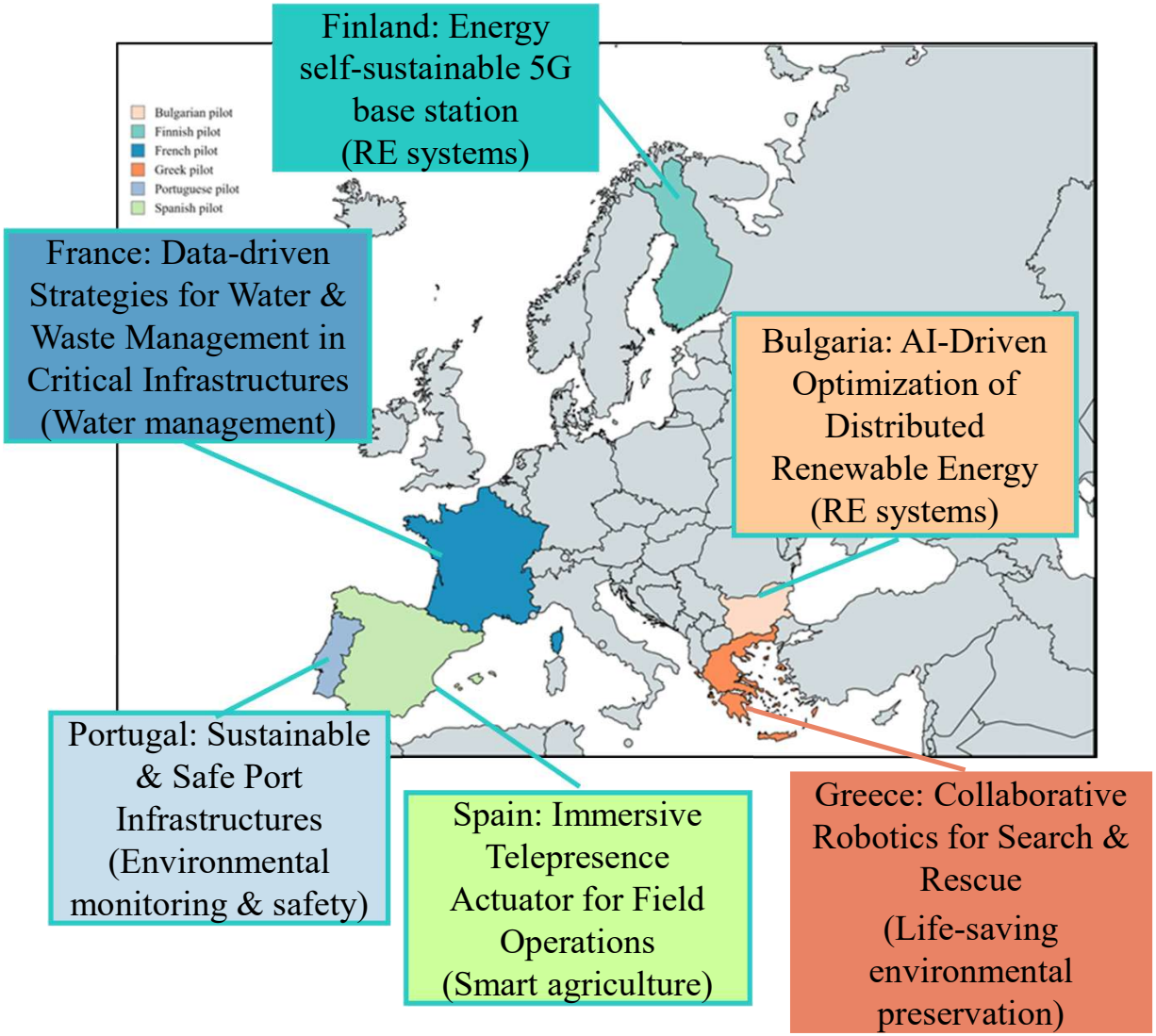
Maximize the impact and adoption

Sustainability

Co-funded by the European Union

6GSNS

Pilot clusters



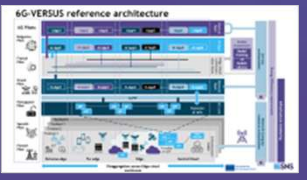
- 6 large-scale E2E pilots for 5 verticals
- Real-life sustainability use cases: 7 UCs
- Integration with B5G/6G testbeds

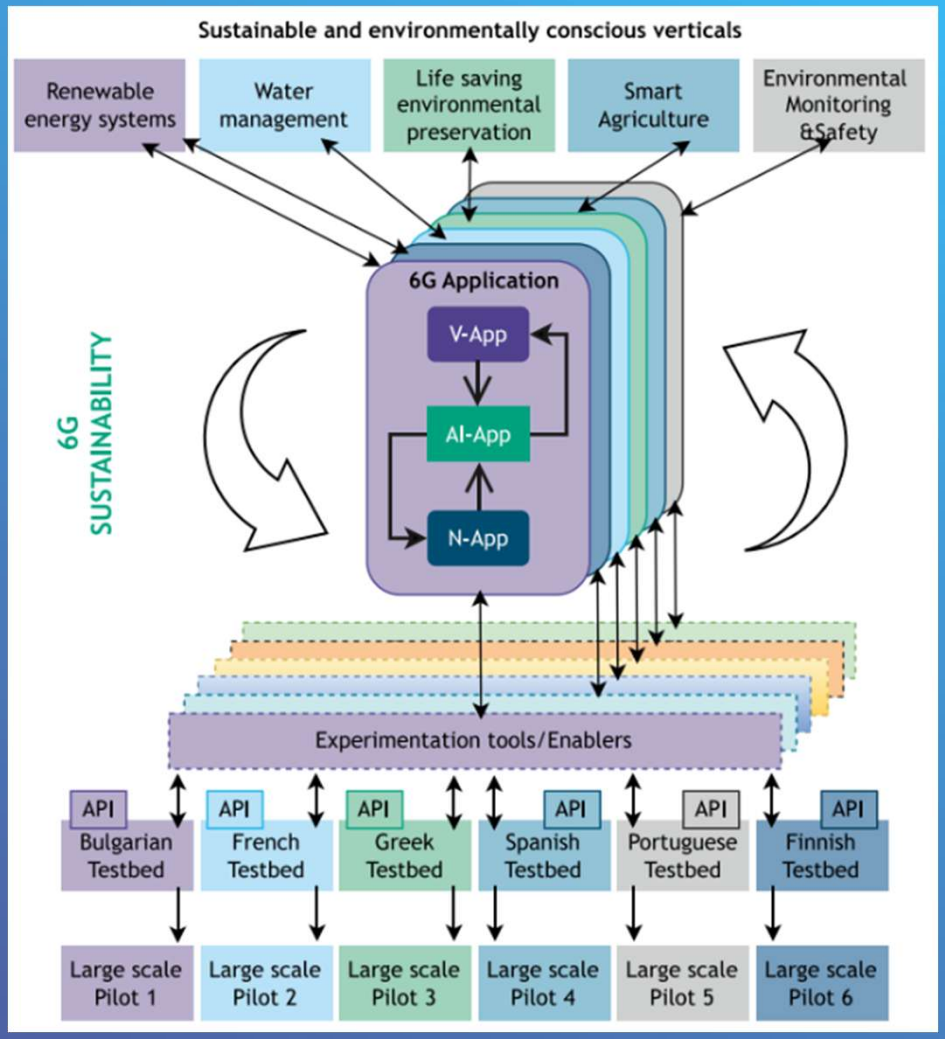
6G-Application: *the main differentiator*

6G-VERSUS

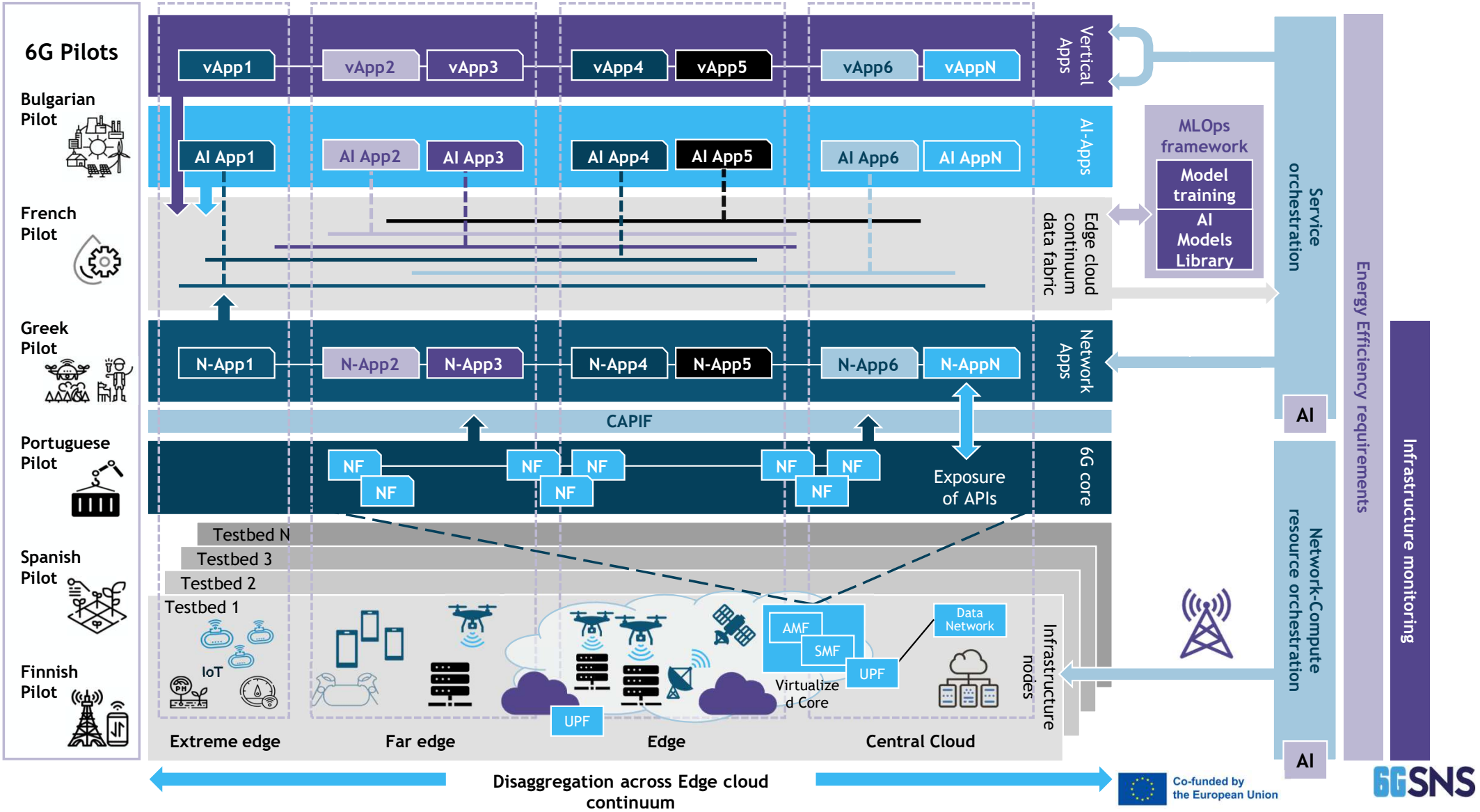
An application triplet

- **N-App (Network Application):** Boundary component between the network and the 6G application. It uses native 5G/6G APIs & Functions (for example, NEF and NWDAF).
  - Exposes business APIs and ***mediates V-App-AI-App*** interaction for optimised decision-making.
- **V-App (Vertical Application):** Domain-specific user interface. It provides **context awareness**. It presents real-time operational data to the vertical.
- **AI-App (AI Application):** ML and analytics component. It transforms raw data into **actionable intelligence** for either/or both verticals and the underlying network





6G-VERSUS reference architecture



How 6G verticals create sustainability impact

6G-VERSUS

Minimise

the negative environmental and social

Energy intensity of base stations, embodied carbon in equipment, rare-earth resource use, e-waste, lifecycle emissions - and exclusion risks if deployment skips rural, peripheral or under-served communities.

Maximise

the positive contribution of 6G to vertical sustainability goals

Energy-efficient agriculture, precision irrigation, efficient water and waste management, smart-grid integration, mission-critical emergency response, port safety and envrironment monitoring - verticals where 6G is the enabler, not the consumer.

FOOTPRINT −

- Energy consumed by the network
- Embodied carbon in equipment
- Resource use & e-waste
- Adverse social effects

+

HANDPRINT +

- Emissions avoided in verticals
- Water, fertiliser, fuel saved
- Lives reached, inclusion gained
- Processes decarbonised

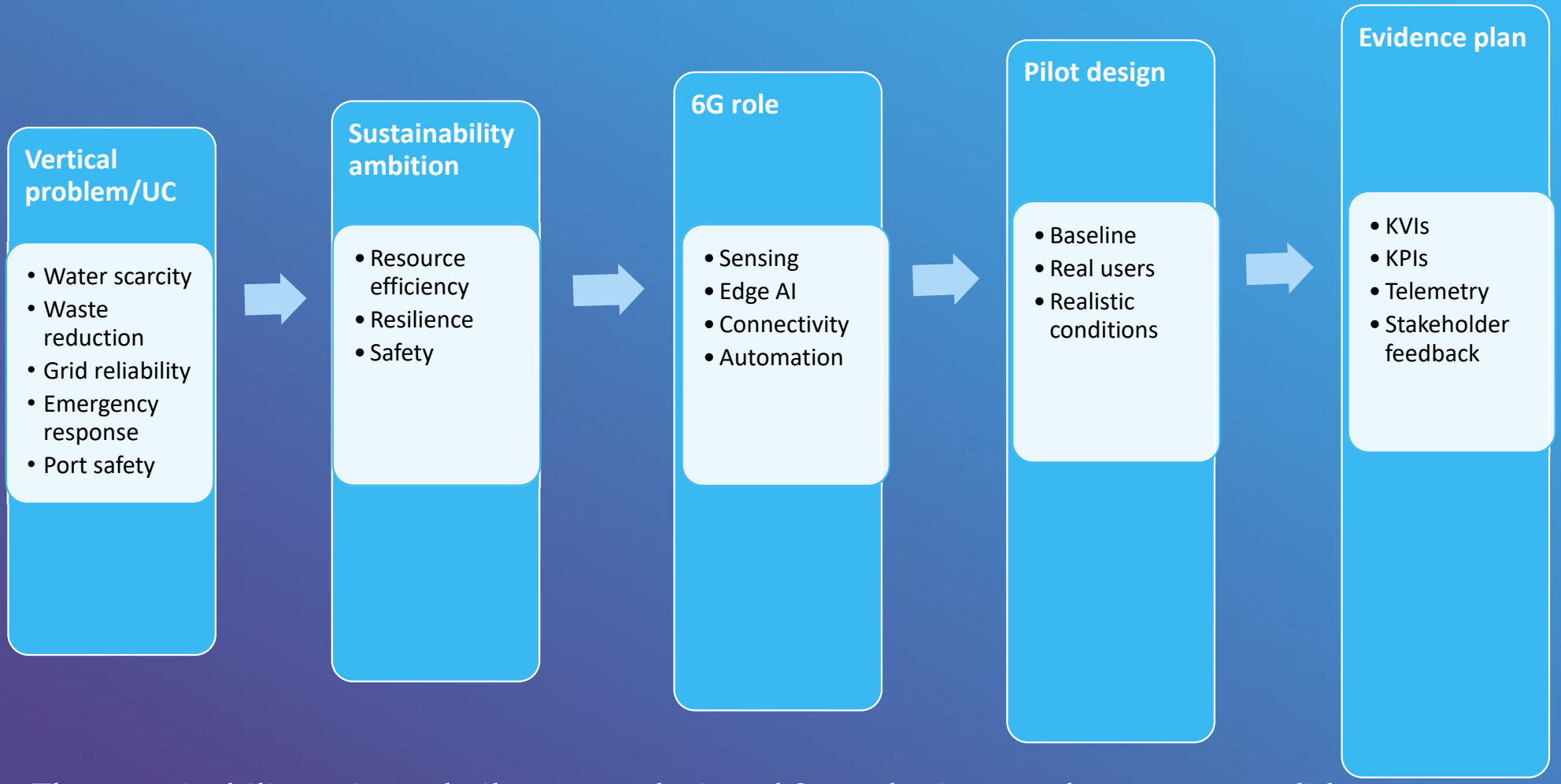
=

NET IMPACT

- What the deployment actually does for sustainability
- Must be positive — and verifiable
- Direction-of-design rule for 6G
- Auditable against the SDGs

How sustainability impact was assessed in Trials (1st Phase)

6G-VERSUS



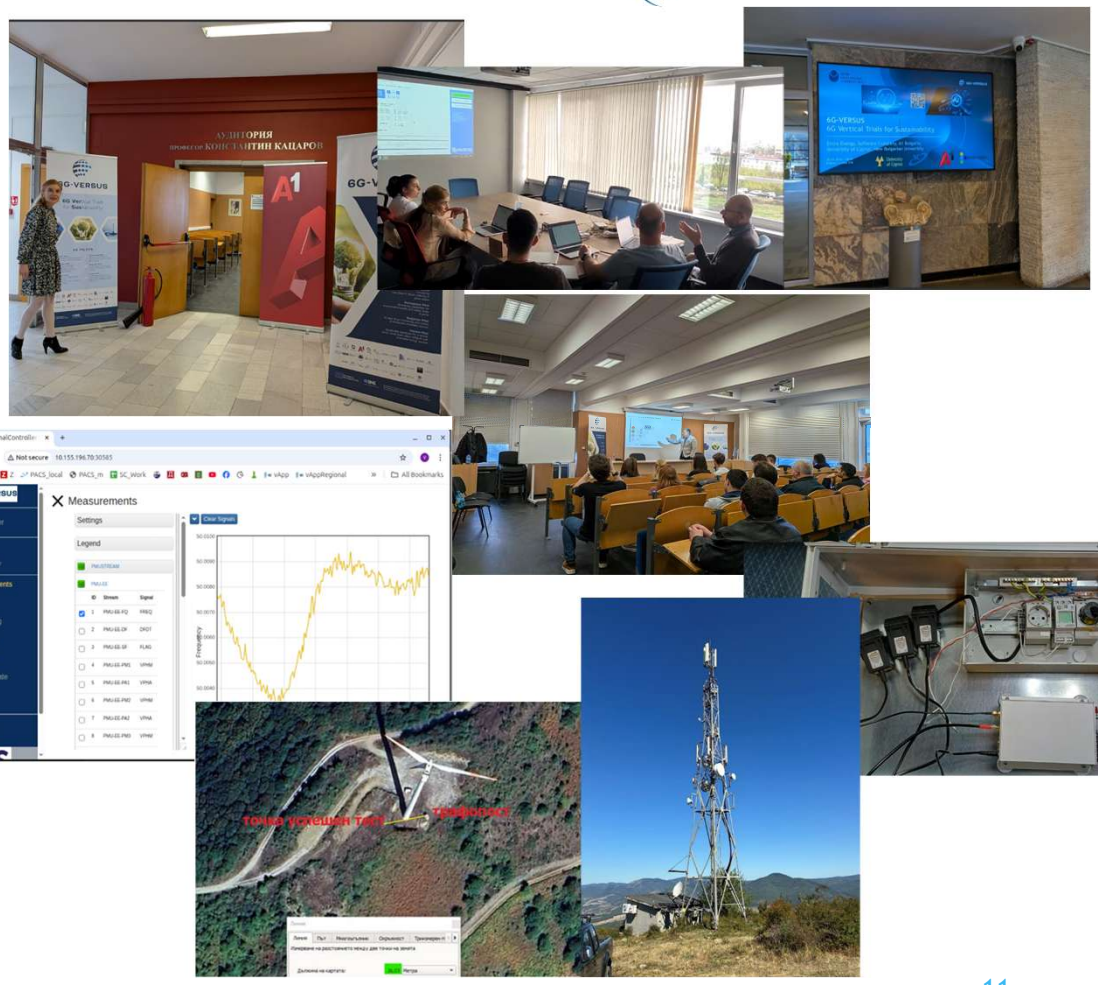
The sustainability-oriented pilots were designed from the impact they want to validate.

Bulgarian Pilot – 1st Phase Trials

Trial 1 Sofia, Bulgaria

Trial #1	
Date	26/03/2026
Location	New Bulgarian University Sofia, Bulgaria
Name	
Partners	EE, A1, SCBG & UCY*

Summary of participants	
End-users	0
Research	25
Industry (SME)	5
Gov. Bodies	0
Other	0



Goals and Objectives

- The trial focused on the initial validation of the Bulgarian use-case, AI-driven Wide Area Monitoring and Control (WAMC) of Distributed Energy Resources (DERs) for smart and resilient energy systems.

Results

- Collection and analysis of initial KVs and KVIs:
  - KVI001: Env/Increase in utilisation of RES
  - KVI002:Env/Increase in use of RES for energy generation
  - KVI004: Soc/Increase in the grid stability (Reduced risk of blackouts)
  - KVI006: Soc/Increase in affordable and stable Renewable Energy supply
  - KVI007: Soc/Increased participation in energy generation. (Wind, Solar and Microgrids)
  - KVI008: Ec/ Optimizing revenue management of RES Owners

Bulgarian Pilot – 1st Phase Trials
Trial 2 UCY, Nicosia Cyprus

Trial #2	
Date	11/06/2026
Location	University of Cypris, Nicosia, Cyprus
Name	
Partners	UCY, EE, A1*, SCBG*

Summary of participants (number of participants)	
End-users	2
Research	12
Industry	4/20
Gov. Bodies	0
Other	0

Goals and Objectives

This trial validated the e2e control loop between power system sensors and the actuators of DERs via b5G technology. It also focused on the validation of the full stack of the 6G-triplet (alpha version) using a TRL6 pre-piloting env.

Results

- Collection and analysis of initial KVs and KVIs via questionnaires and interviews after a live demo:
  - KVI001: Env/Increase in utilisation of RES
  - KVI002:Env/Increase in use of RES for energy generation
  - KVI004: Soc/Increase in the grid stability (Reduced risk of blackouts)
  - KVI006: Soc/Increase in affordable and stable Renewable Energy supply
  - KVI007: Soc/Increased participation in energy generation. (Wind, Solar and Microgrids)
  - KVI008: Ec/ Optimizing revenue management of RES Owners

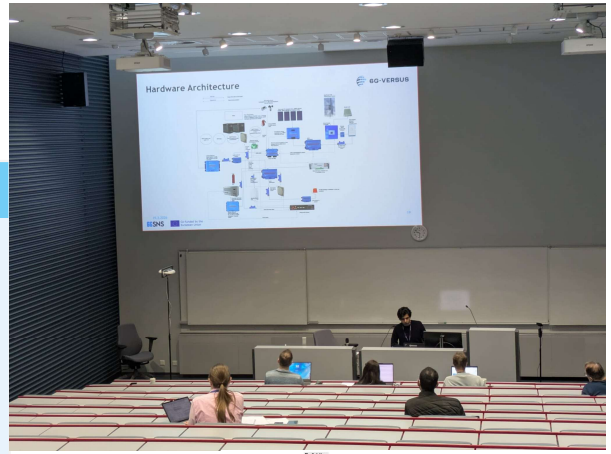
Results Expected	
# of T&Ps	2 (Trial 1 &2)
# of UEs per T&P	1/6
# of Stakeholders/End-users per T&P	0/6
# of questionnaires per T&P	30/32
# of interviews/focus-groups per T&P	0/4
# of Datasets (collected/shared)	0/3* (collected)

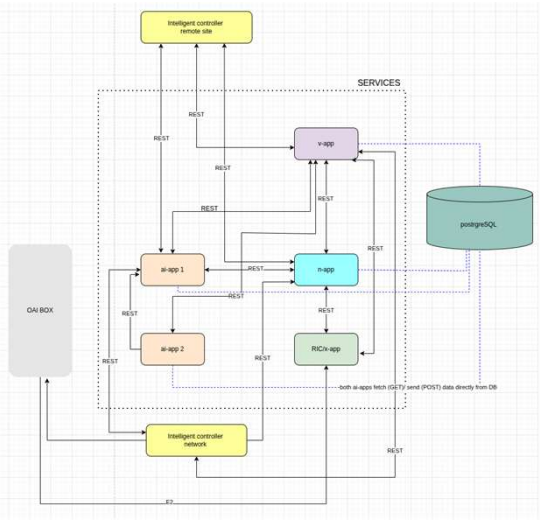
Finish Pilot - Trial 1

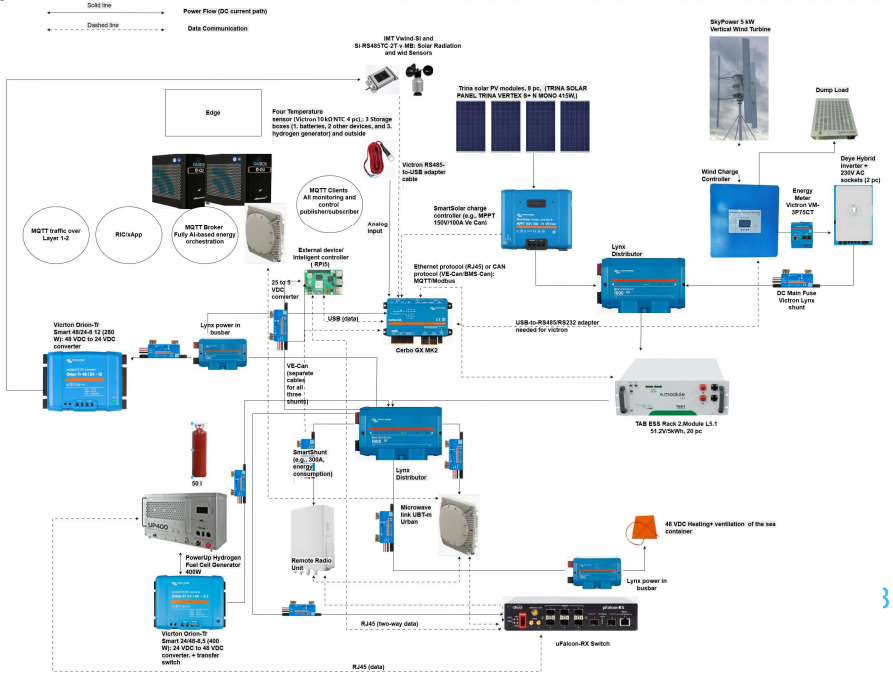
Focus on targets, architecture and simulations

Goals and Objectives

- **Assess stakeholder perception:** Evaluate how clearly the 6G off-grid base station concept communicates its value and the problems it solves.
- **Measure impact expectations:** Capture stakeholder views on the solution's social, economic, and environmental benefits for remote and underserved communities.
- **Identify adoption priorities and barriers:** Understand which sustainability metrics, economic drivers, and technical or commercial obstacles matter most to key stakeholders.







DRAFT RESULTS:

- **100%** – Concept clear and understandable
- **100%** – Renewable energy seen as key benefit
- **89%** – Reduced environmental impact highlighted
- **89%** – Improved safety in remote areas recognized
- **89%** – Strong value for communities and businesses
- **78%** – Better connectivity and wellbeing in Arctic/remote regions
- **78%** – Strong business and market potential identified
- **67%** – Improved digital inclusion recognized
- **50%** – Energy resilience and reduced fossil fuel dependency prioritized

French Pilot - Trial 1

Trial #1	
Date	00/00/2026
Location	Sophia Antipolis (EUR) & Marseille (GREEN)
Name	French Cluster 1st Trial
Partners	EUR/GREEN/TSGF

Summary of participants (number of participants)	
End-users	-
Research	5
Industry	8
Gov. Bodies	14
Other	-

Goals and Objectives

- Validate 5G/B5G capabilities for sustainable environmental monitoring and smart urban watering UC2: Smart watering in green space.
- Integrate multi-layer architecture, testing control-plane (CAPIF), access, data-plane, and AI-application layers using an OpenAirInterface (OAI) 5G Standalone (SA) Extreme-edge-to-cloud.
- Optimize resource consumption by testing 2-step RACH mechanisms for latency reductions and deploying AI-driven MLOps to maximize IoT battery life.

Results

- Substantial Resource Savings: Achieved 499 m^3 in total water savings (35.5% reduction), saved 349 kWh in energy, and avoided 150 kg of CO_2 emissions.
- Enhanced Network Latency: 2-step RACH over-the-air (OTA) USRP achieved a low latency of ~8.94 ms, significantly outperforming the 13.94 ms achieved by 4-step RACH.
- Drastic Battery Optimization: The Thales AI-App (utilizing XGBoost) achieved up to a 104% increase in IoT device battery life compared to non-DRX baseline operations.

Result of the training job in the ML-Ops platform

"In Martigues, approximately 60 hectares are managed, spread across more than 300 areas, and the water used is exclusively potable water. Before the solution was implemented, water consumption was approximately 300,000 cubic meters per year, and it has been reduced by nearly half."

Sylvain Chauvet Smart City Development Officer at the City of Martigues

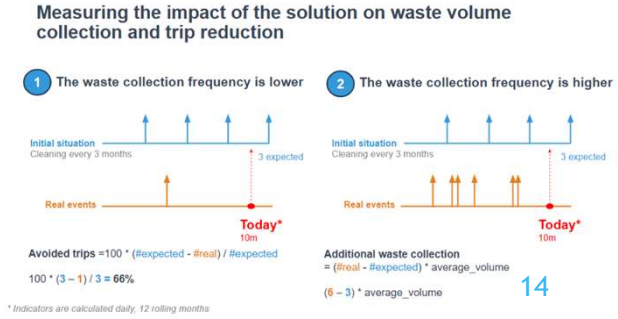
Map of the Two Soil Sensors Deployed in the Testbed

"In addition to water savings, other benefits include energy savings, reduced travel, lower plant mortality, and an improved image for the city. A simulation conducted in Marseille indicates that an investment of €260,000 to equip 40 hectares, with 60% water savings, could generate a net profit of €900,000 over three years. In addition, the system saves staff approximately three months of labor time during the seasonal startup, as they no longer need to physically access each controller to replace the batteries."

Jeremy Curt, Coordinator of the Tree Plan - Urban Nature Department - City of Marseille

Results Expected

# of T&Ps	1
# of UEs per T&P	5
# of Stakeholders/End-users per T&P	31/0
# of questionnaires per T&P	0
# of interviews/focus-groups per T&P	0/2
# of Datasets (collected/shared)	1/1



Greek Pilot Trial 1

Trial #1	
Date	06/03/2026
Location	NCSRD Campus
Partners	NCSRD, ICCS, OTE, INF, HRTA

Summary of participants (Academia focus in the first trial)	
End-users	-
Research	15
Industry	-
Gov. Bodies	-

Results Expected	
# of T&Ps	P2-T1
# of UEs per T&P	5
# of Stakeholders/End-users per T&P	15
# of questionnaires per T&P	1/1
# of interviews/focus-groups per T&P	n/a
# of Datasets (collected/shared)	n/a

Goals and Objectives

- PoC –integration and interconnection of the components with a static approach
- **Technical Goals:** Validate part of 6G-App interfaces (N-App, AI-App and V App wildfire monitoring)
  Business Goals: Demonstrate the logic of the early wildfire detection scenario

Results

- **Successful PoC validation** of the initial functionalities, application interoperability and a subset of the use case on the Athens B5G testbed, excluding the operational logic.
- **Identification of improvement opportunities**, focusing on the design and integration of the operational logic of the scenario alongside the technical implementation

Components and apps under test

- Amarisoft RAN
- N-App for location (single cell)
- Open5GS-OpenCAPIF
- AI-App for location
- AI-App wildfire monitoring
- V-App wildfire monitoring (camera & dashboard)
- V-App INUS Management system (robotic dog, m_drone)
- EEaaS-coarse-grained metrics to generate a software model (EESM) for power estimation

Greek Pilot Trial 2

Trial #2	
Date	07/05/2026
Location	NCSRD Campus
Partners	NCSRD, ICCS, OTE, INF,

Summary of participants	
End-users	n/a
Research	16
Industry	4 SMEs
Gov. Bodies	1 (Public Body)

Results Expected	
# of T&Ps	2P-1T
# of UEs per T&P	
# of Stakeholders/End-users per T&P	17
# of questionnaires per T&P	1
# of interviews/focus-groups per T&P	1
# of Datasets (collected/shared)	4

Goals and Objectives

- The second trial showcased an “operational” approach as there was mobility of the Robotic dog connected with the drone providing relay link.
- **Technical Goals:** Validate additional 6G-App interfaces (N-App, AI-App and V App wildfire monitoring integration), validate Inus V-App (drone) in terms of relay connectivity and object recognition (streaming video) from the robotic dog including mobility.
  Business Goals: Demonstrate early wildfire detection and incident verification along with ground assessment (through robotic dog).

Results

- Successful validation of the relay link (PC5) between robotic dog and rUAV
- N-App location with support of two cells and integration with AI-App location
- Successful end to end validation of 6G Application (triplet) (V-App->AI-App->N-App)
- Fined grained power estimation model 89.8% reduction in percentage error and 89.6% reduction in error

Technologies and apps under test

- Amarisoft RAN (two cells)
- N-App for location (enhanced MonitoringEvent API-Location reporting event supporting two cells)
- Open5GS-OpenCAPIF
- AI-App for location (mobility pattern between two cells)
- AI-App wildfire monitoring
- V-App wildfire monitoring (camera & dashboard)
- V-App INUS Management system
- Static rUAV with active side-link relaying (robotic dog, rUAV)
- mobility of the Robotic Dog
- EEaaS fine-grained telemetry system and testing a calibrated EESM power estimation model (v-App, N-App)

Portuguese Pilot Trial 1

Goals and Objectives

- Demonstrate 6G-App triadic interfaces and logic in the context of Environmental monitoring
- Showcase value of key B5G/6G features for energy-efficient Port environmental monitoring

Key Technologies:

- 5G NR RedCap smart Buoys and OpenCAPIF-enabled QoS (N-App)
- Event-driven QoS (N-App) activation for AI-based maritime trash detection using RC boats (Mobitrust AI-App)

Stakeholder's feedback

- **Continuous sensing** is valued for building reliable environmental baselines and detecting abnormal events faster.
- **Adaptive monitoring** is needed: low-frequency routine sensing, high-frequency transmission during incidents.
- Broader coverage should target port basins, inland port areas, navigation channels, and estuary-sensitive zones.
- Priority **data sources**: water-quality sensors, buoys, drones, AI visual detection, and potentially fixed cameras.
- **IoT autonomy** is important to reduce maintenance effort, data gaps, energy use, and field intervention needs.
- Main adoption concerns: **deployment cost, data reliability, sensor maintenance, battery life, and long-term trust**.

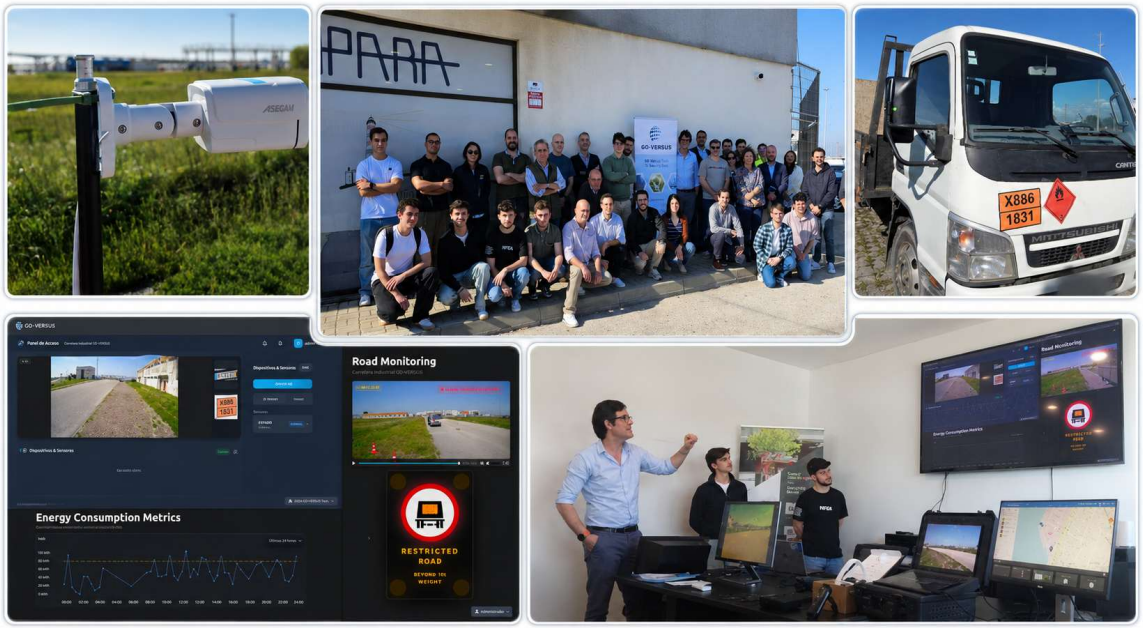
Results Expected

# of T&Ps	1
# of UEs per T&P	3
# of Stakeholders/End-users per T&P	13
# of questionnaires per T&P	10
# of interviews/focus-groups per T&P	5/0
# of Datasets (collected/shared)	0/0

Portuguese Pilot Trial 2

Goals and Objectives

- Showcase value of key B5G/6G features for Port safety and logistics (scenario 2)
- Present approach and benefits to Port Campus infrastructure energy optimization (scenario 3)



Key Technologies:

- OpenCAPIF-enabled dynamic network slice activation (N-App)
- Object Detection & HazMat Detection AI-Apps and OpenCAPIF-enabled dynamic network slice activation (Network Operations N-App) for energy efficiency

Stakeholder's feedback

- Safety monitoring-related
  - Perceived operational value in system supporting prevention and logistics such as truck pre-validation or gate preparation, reducing unnecessary vehicle movements.
  - Potential deployment barriers include legal constraints, data protection or camera reuse limitations.
- Infrastructure energy management-related
  - 5G/6G can add value by improving real-time visibility of renewable energy use
  - Stakeholders value energy optimisation but perceive the concept as still early-stage

Results Expected

# of T&Ps	1
# of UEs per T&P	3
# of Stakeholders/End-users per T&P	13
# of questionnaires per T&P	8
# of interviews/focus-groups per T&P	5/0
# of Datasets (collected/shared)	0/0

Spanish Pilot Trial 1 - Ada Byron

Trial #1 - scenario 3	
Date	02/02/2026
Location	Ada Byron (University of Malaga)
Partners	UMA/KEYS/HPE

Summary of participants	
End-users	5
Research	3
Other	5

Goals and Objectives

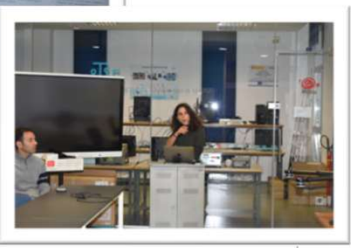
- Demonstrate key 6G-VERSUS technologies in a laboratory environment.
  - 5GC and UE energy consumption
  - P4 UPF, ISAC and multi-connectivity
- Obtain early feedback on the project objectives and methodology

Results

- 6G-VERSUS **technologies successfully demonstrated**, including 5GC energy profiling reults, live UE energy consumption demo, real P4 UPF implementation, ISAC capabilities, multi-connectivity for drone control (emulated) and robotic arm integration with the drone
- **Positive feedback** received from ~20 participants
  - Interest in affordable sensors for wide deployment
  - Alignment on the potential of unmanned vehicles for agriculture
  - Need to study drought impact on soils and crops
  - Identification of synergies across research groups

Lessons learnt

- Although it was asked whether everyone completed the questionnaire, some people did not



Results Expected	
# of T&Ps	1
# of UEs per T&P	6
# of Stakeholders/End-users per T&P	13/5
# of questionnaires per T&P	13
# of interviews/focus-groups per T&P	0/0
# of Datasets (collected/shared)	1/0

Spanish Pilot Trial 2 – La Mayora

Trial #1 – scenario 1	
Date	02/06/2026
Location	La Mayora
Partners	UMA/NOKIA/CET

Summary of participants	
End-users	-
Research	20
Industry	4

Goals and Objectives

- Smart Agriculture use case visit from EuCNC 2026
- Identify synergies and collect valuable inputs of potential interest for later project phases
- Co-Location and Cross-pollination with 6G-PATH
- Feedback from wide international audience

Results

- Collaboration between projects to organize events of this type has multiple benefits
- Successful integration of the Unitree Go 2 and the D1 arm. Furthermore, it has been validated in the field

Lessons learnt

- Even with a large number of people (50) registered to attend and several emails sent reconfirming attendance, the final number was significantly reduced
- As it was organized as part of the EuCNC 2026 social program, some people encountered last-minute issues (flights, visas, the stand)

Results Expected	
# of T&Ps	1
# of UEs per T&P	2
# of Stakeholders/End-users per T&P	24/0
# of questionnaires per T&P	~20
# of interviews/focus-groups per T&P	0/0
# of Datasets (collected/shared)	0/0

Lessons Learnt

6G-VERSUS

01

Sustainability is two-sided

Verticals require both a smaller footprint and a larger handprint. Collaboration and Know-how sharing from AMAZING-6G frames it; 6G-PATH and 6G-VERSUS show how this becomes concrete in farming, environmental or energy contexts.

02

Method matters as much as metric

Numbers alone are not evidence. 6G-PATH's iterative using mixed-methods design integrated to technical performance with stakeholder judgement - the same approach was followed across verticals in 6G-VERSUS.

03

Vertical co-design unlocks the gains

6G-VERSUS shows that the biggest sustainability gains appear when energy and communication systems are co-designed. The same is true for water, waste, ports or first respond verticals.

SDG alignment: SDG 6 (water) · SDG 7 (clean energy) · SDG 9 (industry, innovation) · SDG 11 (sustainable cities/communities) · SDG 12 (responsible consumption) · SDG 13 (climate action) · SDG 15 (life on land). Each vertical pilot contributes to multiple goals simultaneously.

6G-VERSUS.EU

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Co-funded by the European Union

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