6G-VERSUS

6G Vertical Trials for Sustainability: The Portuguese Cluster

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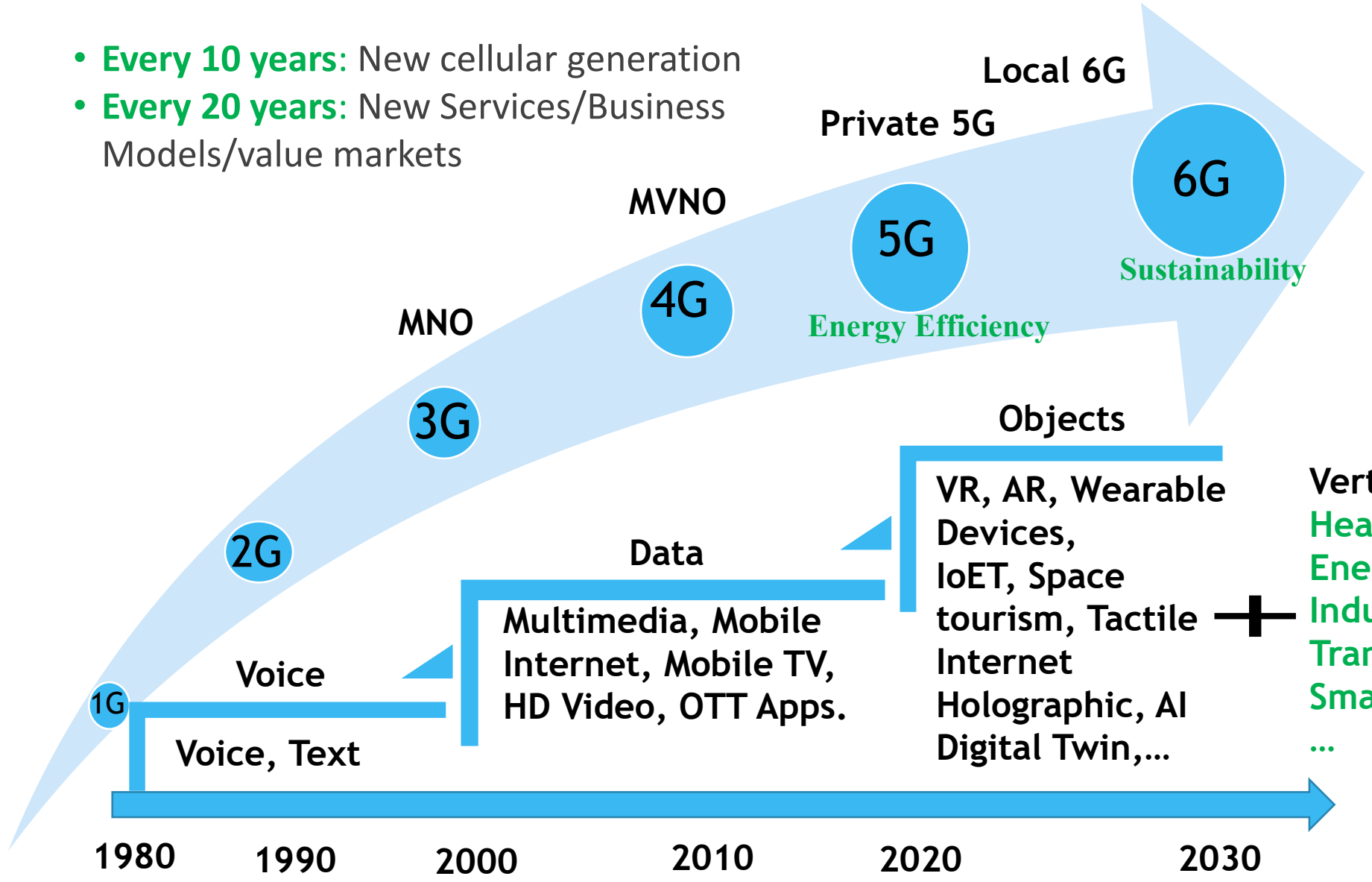
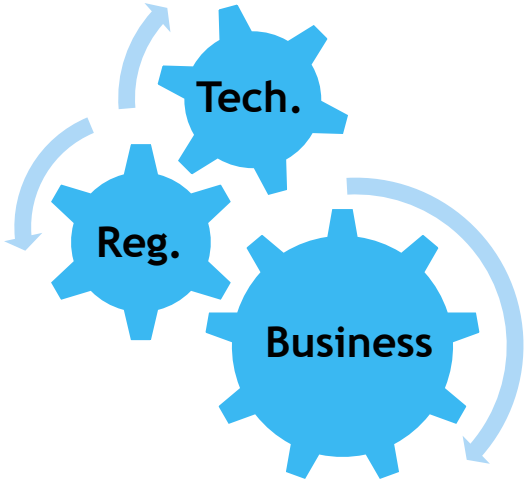
Evolution of Mobile Communications

- **Every 10 years**: New cellular generation
- **Every 20 years**: New Services/Business Models/value markets





Vertical-specific services
Health,
Energy,
Industry,
Transportation,
Smart agriculture
…

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6G, energy and sustainability

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6G provides a data-driven, hyper-connected world enabled by near-instant and unlimited wireless connectivity

Technology enablers such as higher frequency bands, IoT, AI-powered network management and edge computing

6G enables verticals productivity, security, sustainability and new business models

6G energy efficiency and 6G for energy solutions

6G introduction to market and the UN SDG both targeted for 2030

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6G & Energy intersection

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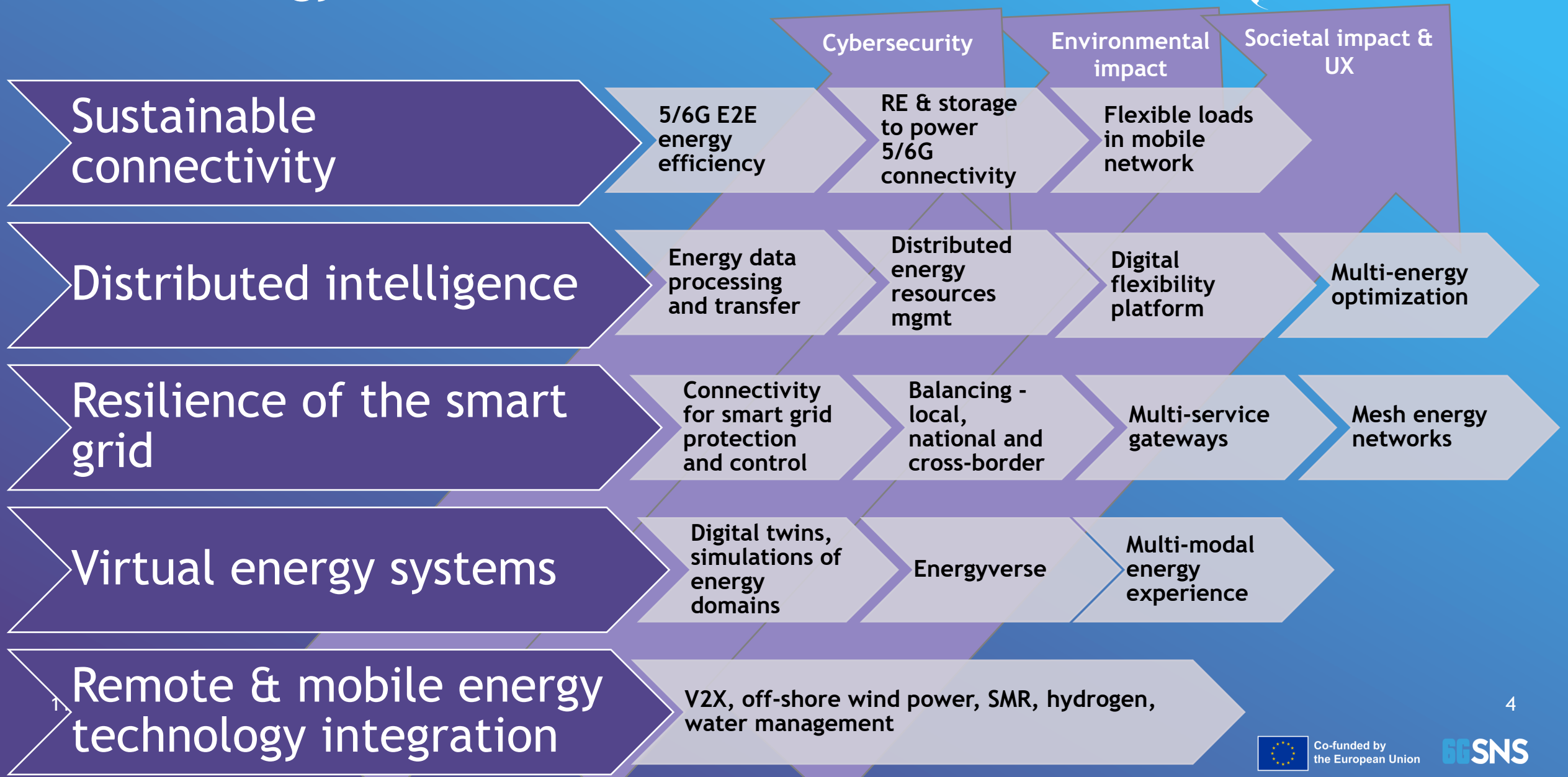

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6G-VERSUS Objectives

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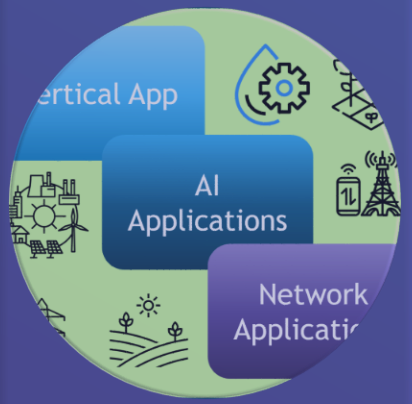

Design and Development of a 6G-Enabled Application Framework for the triplet of V-app, AI-app and N-app

Conduct 6G Trials to Assess AI, Network and Application Performance, concentrating on the principles of "sustainable 6G"

Integrate Advanced 6G Applications across 6 6G-SNS and non-SNS Testbeds

Evaluate the societal and environmental impact of 6G trials to ensure alignment with sustainability goals and societal needs and create new business models

Maximize the impact and adoption of 6G-VERSUS results through dissemination, communication, capacity building, standardization efforts, and exploitation measures.

Sustainability

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6G-VERSUS: Key figures

6G VERtical trials for SUStainability

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

Technical manager: ICCS / Xenofon Vasilakos

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

http://6G-versus.eu
https://www.linkedin.com/company/6g-versus/
https://x.com/6G_VERSUS
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https://www.instagram.com/6gversus/
https://www.youtube.com/@6G-VERSUS

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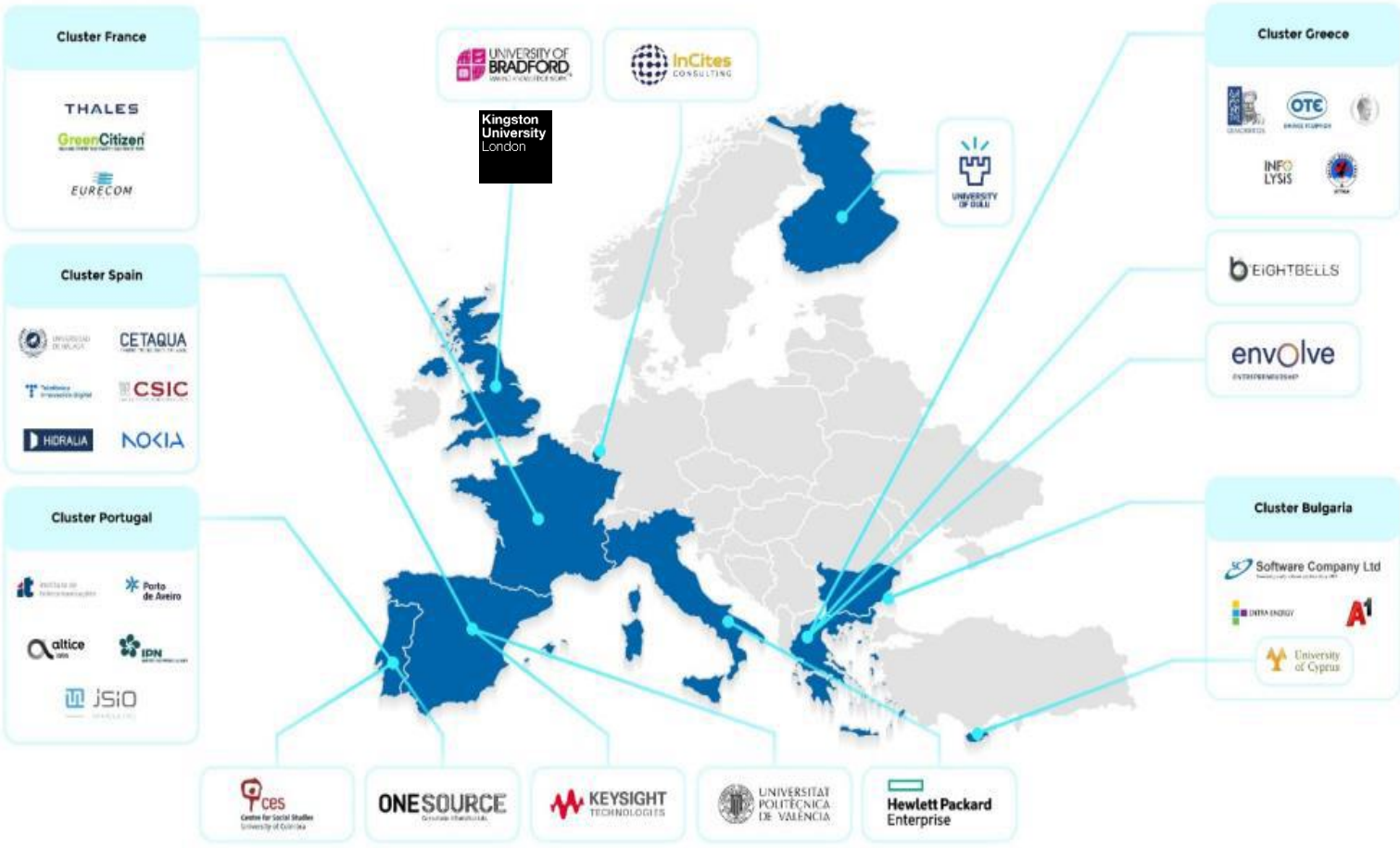
Partners

Participant No.	Participant organisation name	Short name	Country
1 (Coord.)	OULUN YLIOPISTO	UOULU	Finland
2	KEYSIGHT TECHNOLOGIES	KEYS	Spain
3	ONE SOURCE CONSULTORIA INFORMATICA LDA	ONE	Portugal
4	EIGHT BELLS LTD	8Bells	Cyprus
5	INCITES CONSULTING SA	INC	Luxembourg
6	UNIVERSITAT POLITECNICA DE VALENCIA	UPV	Spain
7	UNIVERSITY OF BRADFORD	UBRAD	UK
8	ENVOLVE ENTREPRENEURSHIP	ENV	Greece
9	CENTRO DE ESTUDOS SOCIAIS	CES	Portugal
10	NATIONAL CENTER FOR SCIENTIFIC RESEARCH "DEMOKRITOS"	NCSRD	Greece
11	ORGANISMOS TILEPIKOINONION TIS ELLADOS OTE AE	OTE	Greece
12	EREVNITIKO PANEPISTIMIAKO INSTITOUTO SYSTIMATON EPIKOINONION KAI YPOLOGISTON	ICCS	Greece
13	INFOLYSIS P.C.	INF	Greece
14	HELLENIC RESCUE TEAM OF ATTICA	HRTA	Greece
15	UNIVERSIDAD DE MALAGA	UMA	Spain
16	TELEFONICA INNOVACION DIGITAL SL	TID	Spain
17	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	CSIC	Spain
18	CETAQUA	CET	Spain
19	HIDRALIA	HIDRA	Spain
20	NOKIA SPAIN SA	NOKIA	Spain
21	EURECOM GIE	EUR	France
22	GREENCITYZEN	GREEN	France
23	THALES SIX GTS FRANCE SAS	TSGF	France
24	A1 BULGARIA EAD	A1	Bulgaria
25	ENTRA ENERGY	EE	Bulgaria
26	UNIVERSITY OF CYPRUS	UCY	Cyprus
27	SOFTWARE COMPANY	SCBG	Bulgaria
28	INSTITUTO DE TELECOMUNICACOES	ITAV	Portugal
29	ALTICE LABS SA	ALB	Portugal
30	APA-ADMINISTRACAO DO PORTO DE AVEIRO SA	APA	Portugal
31	JSIO - IOT HASSLE FREE	JSIO	Portugal
32	INSTITUTO PEDRO NUNES ASSOCIACAO PARA A INOVACAO E DESENVOLVIMENTO EM CIENCIA E TECNOLOGIA	IPN	Portugal
33	HEWLETT-PACKARD ITALIANA S.R.L.	HPE	Italy
34	KINGSTON UNIVERSITY LONDON	KUL	UK



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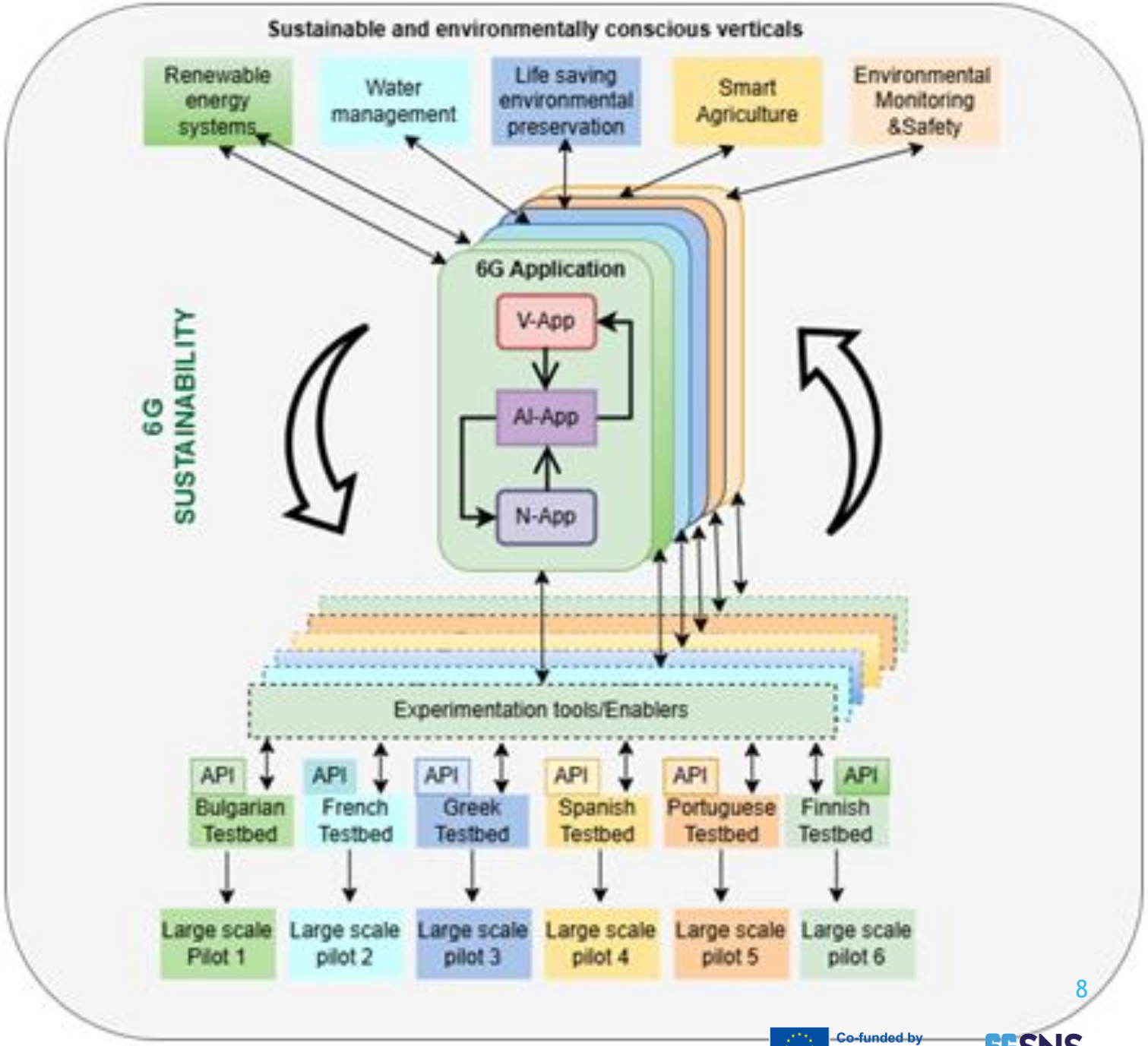
6G-VERSUS concept

The novelty lies in the transformation of a typical use case into a **6G Application**, i.e. a triplet of distributed but fully interacting software components that together realise an **AI-assisted vertical service**. Each 6G Application is composed of

- Vertical App (V-App),
- Network App (N-App), and
- AI-assisted App (AI-App).



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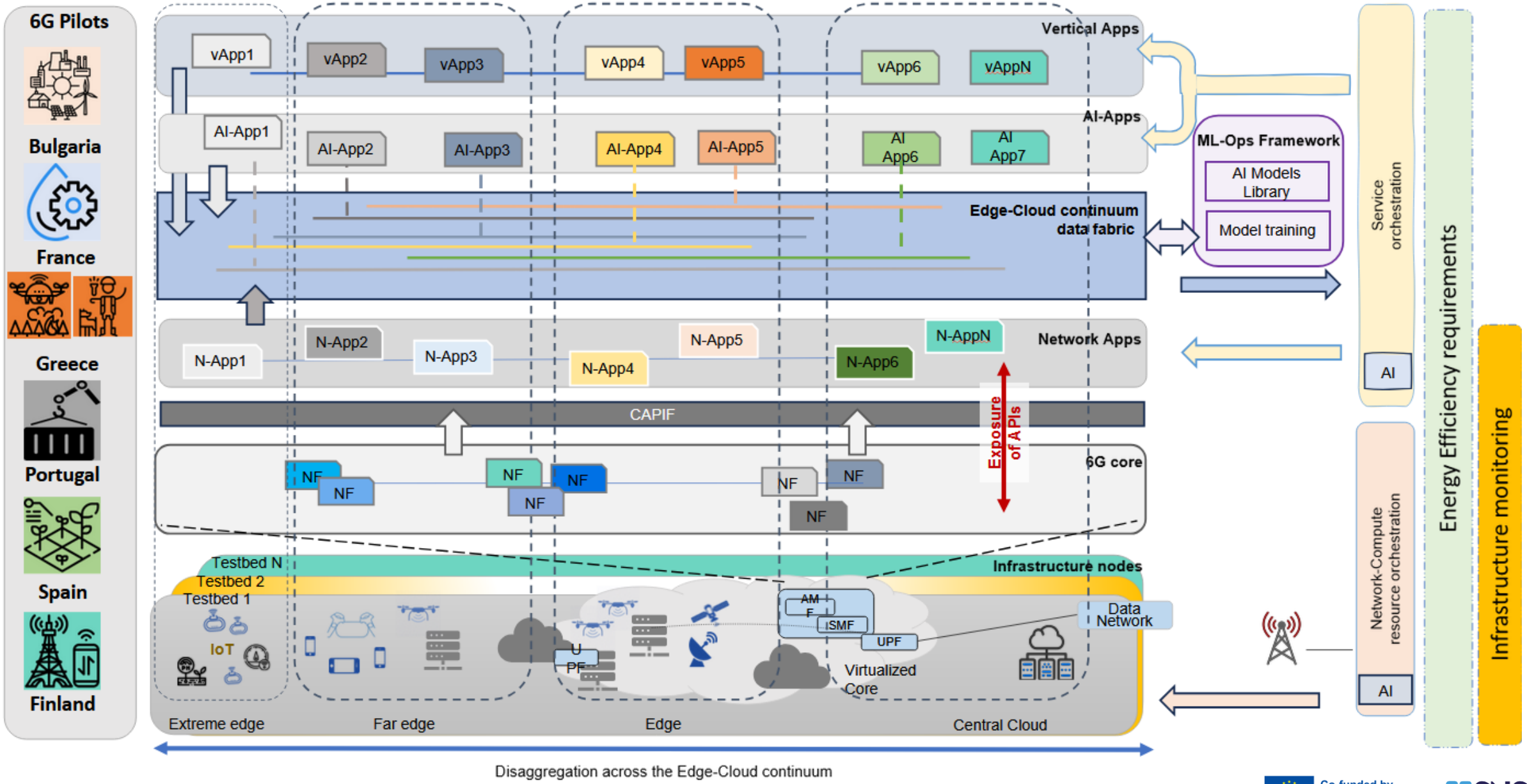
6G-VERSUS reference architecture



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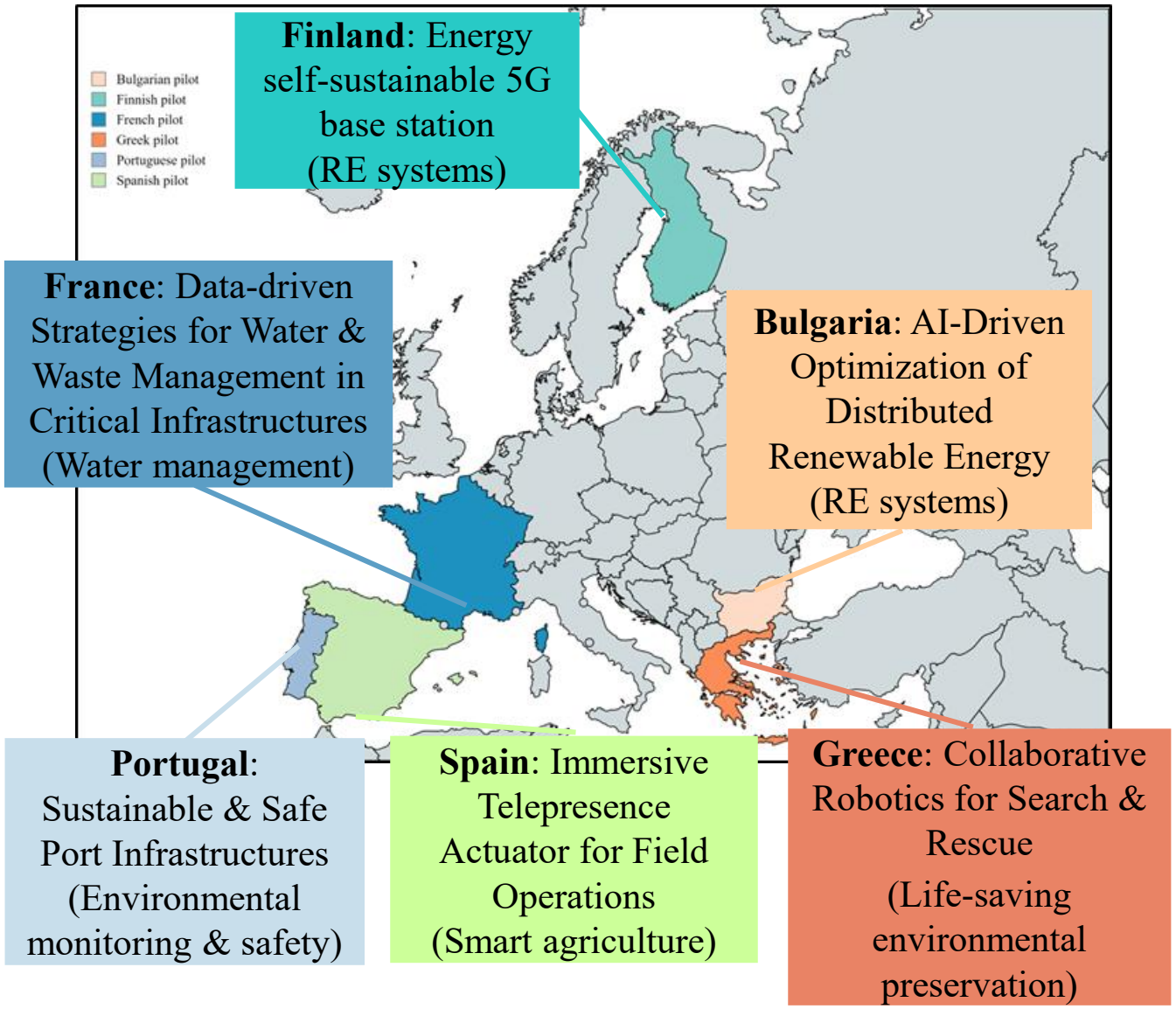
Pilot clusters



- 6 large-scale E2E pilots for 5 verticals
- Real-life sustainability use cases
- Integration with 5G/6G testbeds
- Novel technology architecture and methodology

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Portuguese Cluster - overview

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IPN → Coord. + XApp provider

instituto de telecomunicações
altice labs → Testbed + xApp providers

ONESOURCE Consultoria Informática Lda.
jsio IoT HASSLE FREE → XApp providers

Porto de Aveiro → End user

Aggregated map view of considered IoT data sources and their locations across the 3 scenarios

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Portuguese Cluster – objectives & scenarios

- The cluster seeks to address **Sustainable Development Goals (SDG) targets and upcoming environmental regulations**, exploring B5G and 6G's potential to enable innovative and energy-efficient approaches for improved environmental quality and safety awareness in smart Port campuses.

- **Use case**: Monitoring capabilities for environmental quality and safety levels in ports, comprising 3 scenarios

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S1: Port environmental awareness and enhancement

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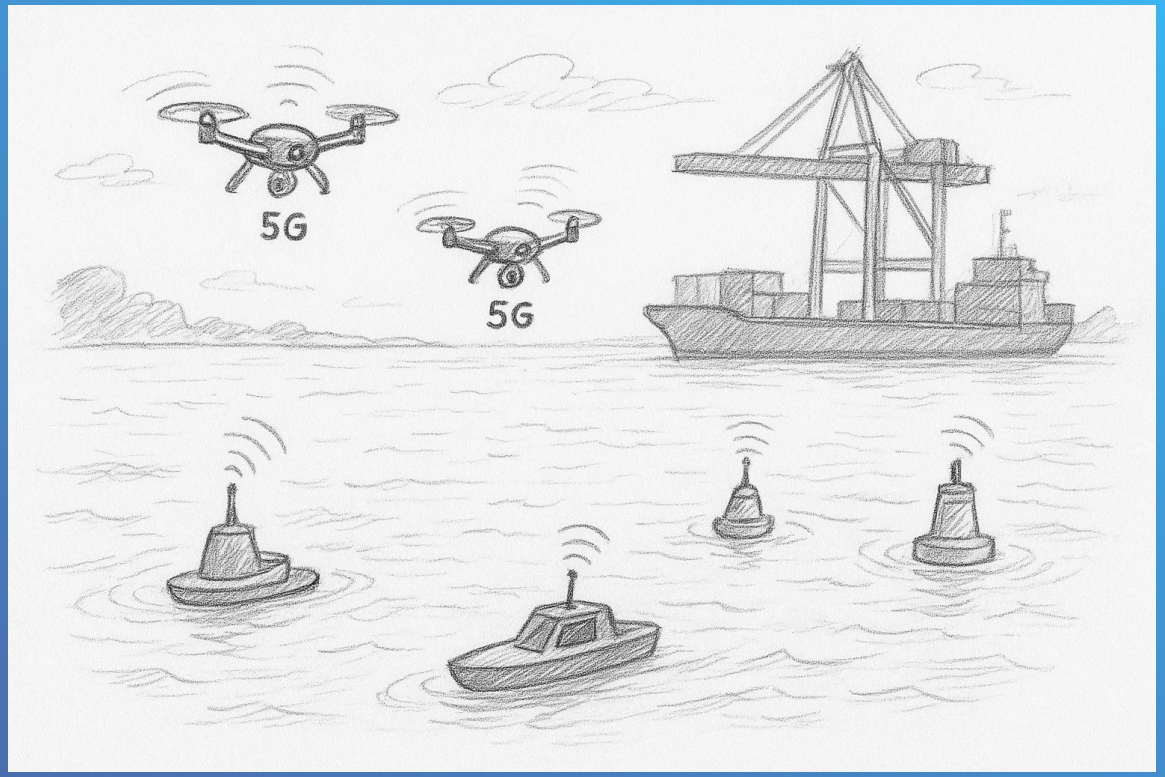
- B5G/6G for building **Port's environmental-centric replica** integrating real-time data, alerting and visualization capabilities for **monitoring, responding to, or anticipating environmental** issues within the Port.
- **5G NR RedCap** and zero-energy devices for environmental quality monitoring
- **Network APIs** for energy-efficient operation and dynamic configuration of devices
- **Energy--aware IoT communication scheduling** aimed at maximizing data transmissions efficiency
- Event-driven **on-demand activation of B5G-connected UAVs or RC boats** able to collect highly-rich data streams, providing additional important complementary context.



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S2: Port safety awareness and enhancement

- **Dynamic orchestration** of network and compute resources to enable new port operational capabilities
- **Edge analytics** for vehicle-related data (e.g., plates, classification, distribution) gathered around the port
- **High-speed, low-latency connectivity** linking cameras and central processing units through integrated networking and computing
- **Intelligent resource management** to optimize energy, compute, and network usage using adaptive, low-resource data processing strategies

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S3: Port infrastructure energy-awareness and enhancement

- **Leverages B5G/6G connectivity** to optimize energy consumption across buildings and smart street infrastructure, ensuring sustainable resource utilization.
- **Enhances EV charging efficiency** through dynamic power cutoff control, adapting in real time to energy demand and notifying vehicle owners accordingly.
- **Coordinates intelligent street lighting** within the testbed coverage area for improved energy efficiency and automated management.

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Key Performance Indicators (KPIs)

KPI ID	Title
KPI_001	Network radio energy consumption
KPI_002	Device Radio energy efficiency gain using 5G NR RedCap
KPI_003	Throughput
KPI_004	Slice provisioning time
KPI_005	Service provisioning time
KPI_006	Network energy efficiency
KPI_007	5G NR RedCap IoT device transmission efficiency
KPI_008	Relative Efficiency Index (REI)
KPI_009	Datalogger energy consumption
KPI_010	Energy harvesting efficiency
KPI_011	Mean Absolute Scaled Error (MASE)
KPI_012	Coefficient of Variation RMSE (CV-RMSE)
KPI_013	Forecast Bias
KPI_014	Inferencing speed
KPI_015	Sustainable energy used in EV chargers
KPI_016	Object detection accuracy (water)
KPI_017	Autonomous boat navigation precision
KPI_018	Area Coverage Efficiency
KPI_019	Water surface pollution detection
KPI_020	Water surface minimum object detection size

Key Value Indicators

KVI IDs	KVIs
KVI_001	Energy Consumption (Smart Lighting)
KVI_002	Proportion of Renewable Energy Use (EV Charging)
KVI_003	Proportion of Renewable Energy Use (Smart Lighting)
KVI_004	Environmental Incident Detection & Prevention
KVI_005	Road safety incident Detection & Prevention
KVI_006	Environmental Monitoring Coverage
KVI_007	Workforce Upskilling (Port Admin Staff)
KVI_008	Stakeholder Engagement Activities

Trials at Aveiro Port

- 6G-VERSUS, and specifically Portuguese trials, will demand the involvement of different societal stakeholders
  - National Ports
  - Environment organizations
  - Ports servisse providers & logistics companies
  - Smart infrastructure operators
  - **Local associations & group, citizens**

  - **Portuguese Trials @ Aveiro Port** starting **January 2026**

Get involved!

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Expected impact

Scientific	• generate new knowledge and insights of the capabilities of 6G technology for verticals and for advancing sustainability.
Technical	• demonstrate 6G vertical solutions that enhance the performance, reliability, and sustainability of communication networks.
Economic	• empower businesses and vertical industries to leverage 6G technologies for sustainable and profitable growth.
Societal	• raise awareness of the societal benefits of 6G technology and inspire broader adoption and investment in sustainable telecommunications infrastructure.
Policy	• influence the development of policies and regulations that support the deployment of sustainable 6G technologies.

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6G Vertical Trials for Sustainability

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