

Insights from Sustain6G for utilities

Program overview, with a focus on
6G for the energy utilities

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Quick Facts & Figures

Call

- [EU HORIZON-JU-SNS-2024-STREAM-B-01-07 Sustainability Lighthouse](https://european-council.europa.eu/media/en/press-room/pages/press-room.aspx?storyId=24012024-0001)
- R&I TRL levels 2-5 (Technology concept – Technology validated)

Project Management

- Project Coordinator: Christoph Schmelz, Nokia, DE
- Technical Manager: Olivier Bouchet, Orange, FR
- Innovation Manager: Anastasius Gavras, Eurescom, DE

Timeline

- January 2025 – June 2027 (2.5 years)

Budget & Effort

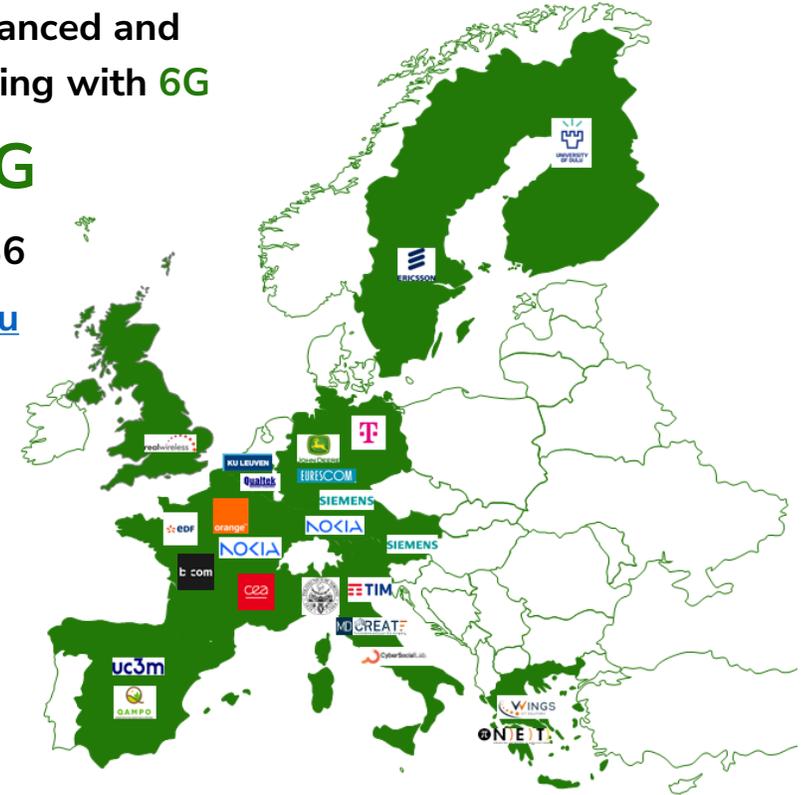
- Total effort: 1210 person months (= 40 full-time employees over 2.5 years)
- Total funding: 13 M€

SUSTainability Advanced and Innovative Networking with 6G

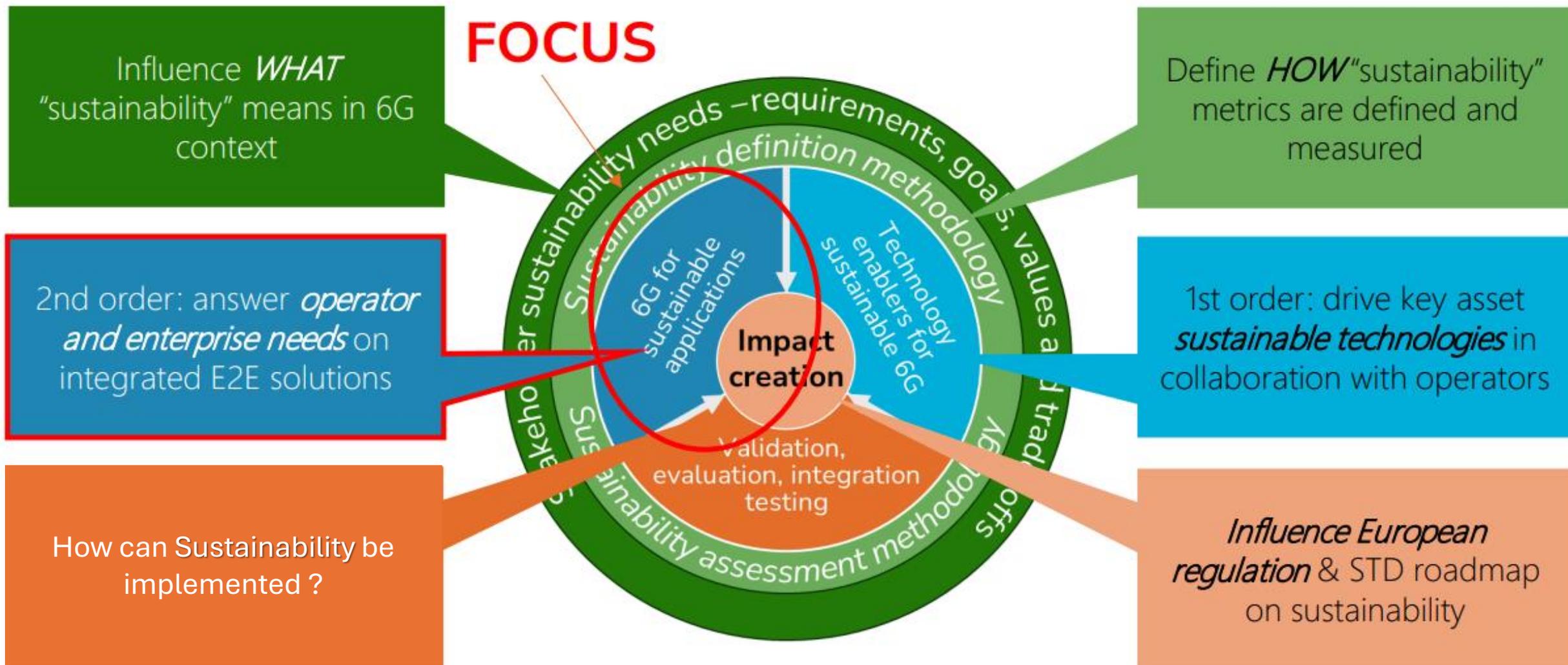
SUSTAIN-6G

Project # 101191936

<https://sustain-6g.eu>



Recall of the Sustain 6G project objectives



6G for sustainable applications –Smart Grid

Three verticals

SMART GRID

To create a flexible, resilient, and sustainable energy system that integrates renewables and empowers local energy actors.

Values

- Ensure grid stability even under fault conditions
- Enable sustainable use of distributed energy resources
- Optimize infrastructure and operational costs
- Support dynamic energy markets and demand response

Stakeholders

- Transmission and Distribution System Operators
- Flexibility Service Providers / Local Energy Market operators
- DER owners and prosumers
- Regulatory authorities



6G for sustainable applications –Smart Grid

Three use cases

Three use cases for **Smart Grid** that focus on the **LV distribution grid** :

SG1: 6G enabled grid balancing services from distribution grid assets (Owner: P-NET)

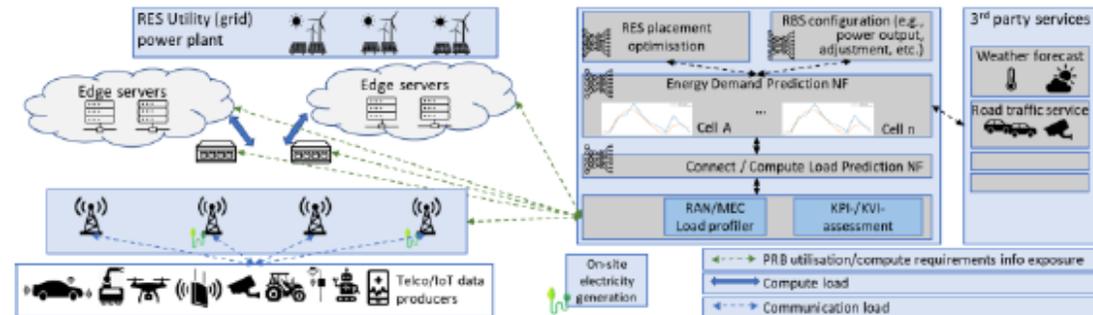
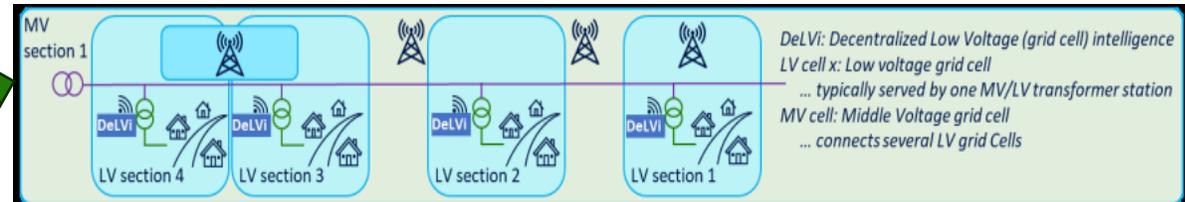
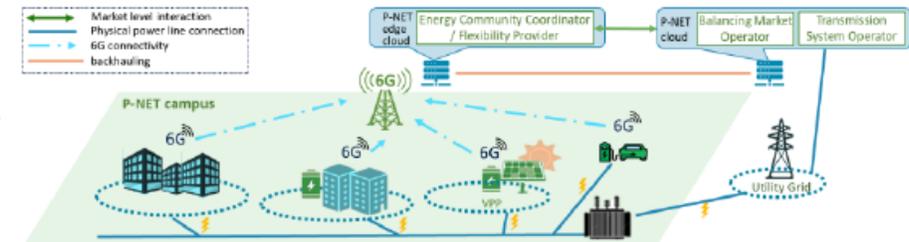
- Grid instability from distributed renewables and EV charging demands RT balancing

SG2: Resilient Grid Section Operation (Owner: SAG-AT)

- Ensure resilient grid operation also during comms losses

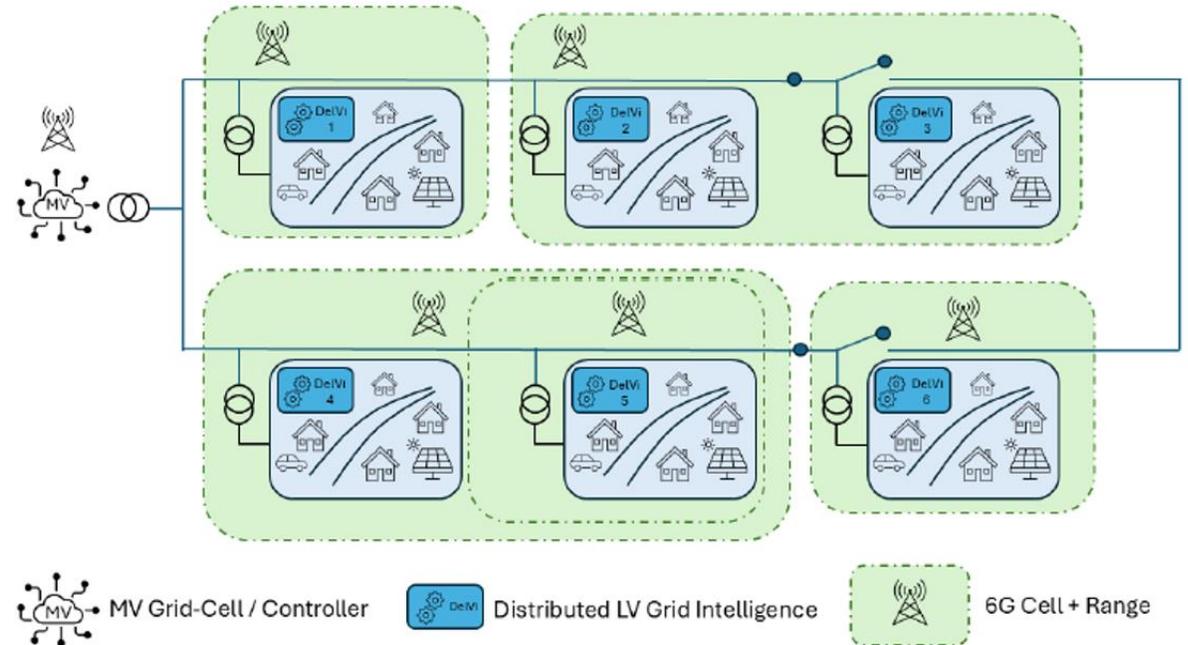
SG3: Joint Planning of 6G / Smart Grid Infrastructures (Owner: WINGS)

- Flexible, stable power for ICT and grid, integrating volatile renewables



SG2 – Resilient Grid Section Operation

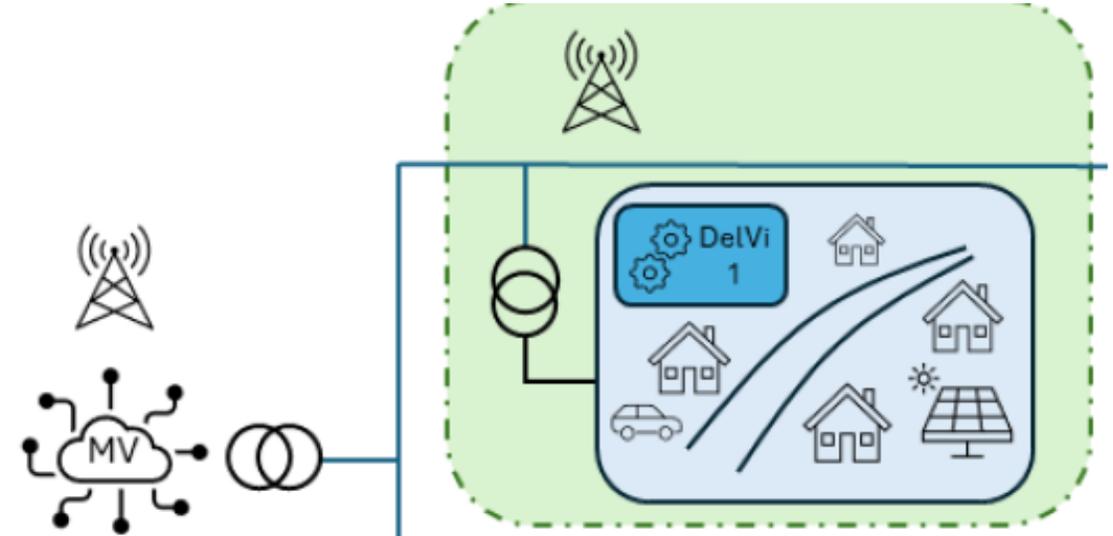
- **LV grid controllers** (« DeLVi » or « DS ») use 6G to talk to each other and to their « MV Grid-Cell/ controller » (CS)
 - The CS sets the *nominal* operation, but DSs can negotiate amongst themselves to trade energy
- **Partial communication failure in ICT (6G) :**
 - MV controller retains connection with some LV units.
 - LV units in the disconnected zone form a local communication cluster (green space)
 - Enables continued data exchange and decentralized control within the cluster
 - Fault isolation and partial grid functionality is maintained (resilience support)
- **Central failure in ICT :**
 - LV units form multiple isolated clusters where possible
Each cluster operates independently
- It has been proposed as a new use case into **3GPP** standards (S1-253317), in order to set new 6G requirements.
- Use of **BIFORST** Siemens’ platform for scenarios simulations.



LV grid sections – Comms requirements and values evaluation

Key telecoms requirements :

- Availability (3,4,5, 9s?)
- Power resilience/main holdover (72 hours??)
- Cybersecurity (NIS?)
- Latency (ms)
- Datarates (Mbps?)
- Data volume
- Others ?



The evaluation of sustainability impact will be conducted using **Key Value Indicators (KVIs)** –not complete- :

- **Environmental** : Reduced emissions, optimized resource use and lower energy consumption, etc.
- **Social** : Energy access rate (%), enhanced public safety and grid reliability
- **Economic** : cost saving, new business models and increased operational efficiency

These LV grid sections (400/240V) are the principal zones of interest within the Sustain-6G project

Takeaway/Discussion

Key Takeaways

6G is more than a technology leap – it's a strategic enabler for sustainability across verticals.

Agriculture, Smart Grid, and E-Health showcase how 6G can deliver measurable **environmental**, **social** and **economic** benefits.

Q&A

- We welcome your **inputs** and **feedback** !
- Are there any other **requirements** from the smart grid use cases which the audience might have, which could be proposed into **6G standards** ?
 - Remembering that within the Sustain-6G consortium we have access to **3GPP representatives**, including via **EDF, MNOs** and **equipment vendors**.

SUSTAIN Thank you for
6G your attention!



SUSTAIN 6G Disclaimer



Co-funded by
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Disclaimer: This work is Co-funded by the European Union under Grant Agreement 101191936. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of all SUSTAIN-6G consortium parties nor those of the European Union or the SNS JU (granting authority). Neither the European Union nor the granting authority can be held responsible for them.

Sustainability scope

A holistic view on all sustainability dimensions is required



Economic



Social



Environmental

Sustainable 6G

Long-term business viability & scalability
Market competition & innovation
Industry collaboration & partnerships
Cost efficiency & resource optimisation
Economic growth
Regulatory framework & policy support

Bridging the digital divide (accessibility)
Trustworthiness & Responsible AI
Stakeholder engagement
Ethical business practices
Social well-being
Cultural diversity
Technology ethics

Net zero network design, deployment and operation
Use of renewable energy sources
Environmental data collection
Storage and analysis
Material usage and circularity
Environmental Total Cost of Ownership

Sustainability in the context of 6G has 6 Dimensions

6G for Sustainability

Digital transformation
Innovative business models
Workforce development
Opportunities for SMEs
Value network integration
Global reach
Social & economic inclusion

Digital equity
Services with high societal value
Personal privacy and data protection
Ethical business practices
Reliable, resilient and accurate information
Support for democratic values

Vertical-specific environmental challenges
Biodiversity & geodiversity impact
Optimisation of natural resources
Monitor & reduce emissions
Supply chain improvements
Smart energy management
Sustainable mobility

6G for sustainable applications - Smart Grid

6G enabled grid balancing services

Renewable energy resources (energy, wind) + electric vehicle charging imposes distributed stochastic generation and consumption, requiring real-time balancing (monitoring & control) of the distribution network and distributed energy resources for resilience, stability and security.

- Proposed solutions requests real-time procurement of Fast Frequency Response (FFR) sourced from flexible assets at the grid's edge, and operations such as ML-based optimal power flow, to maintain system frequency
- Utilise Internet of Things (IoT)-enabled distributed energy resources at the edge of the smart grid to provide artificial inertia and leverage the features of 6G and cloud/edge IoT computing continuum to apply real-time adjustments for grid stability. Further the application of AI-based digital twin approaches for adjustment forecasting will be investigated

Resilient grid section operation

Resilient smart grids (power sources including wind, solar, fossil etc.) must efficiently deliver electricity while minimising disruptions (flexible adjustments) such as overloads and blackouts

- Proposed solutions include **real-time monitoring and control** of electricity flow (local + interacting + synchronisation), aided by **data analytics and predictive modelling**, requiring adaptable communication technology
- Grid with self-awareness and prioritisation mechanisms (Distributed Low-Voltage intelligence DeLVi), solutions to reduce energy consumption
- Communication solutions with **data rate adaptability and flexibility**, minimisation of restarts and connection losses to core infrastructure

Joint planning of 6G / smart grid infrastructures

Power supply for flexible and adaptive ICT implementations (including multiple network layers, technologies) requires flexibility itself, and must be able to handle local power generation as well as potential volatility of (renewable) power availability

- Micro-grids** offer a cost-effective solution for electricity demand management with leveraging localised power supply through deployment at cell sites or edge computing nodes, flexibility optimising electricity flows through innovative Energy Management Systems (EMS), involving local energy storage to ensure reliability during grid outages.
- Requires alignment of the operational interests of the mobile network and the smart grid with location specific optimisation to maximise cost-effectiveness (e.g. traffic-aware offloading of network load and advanced sleep mode operations)

