



Human-in-the-loop in the Frame of the Energy Transition

*Key takeaways from the workshop “Human-in-the-loop digitalisation for Europe’s energy transition”
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The [workshop](#), which took place at Sustainable Places 2025, looked at how to move **beyond the rhetorical use of the term *human-in-the-loop*** and explore **how this approach can be translated into concrete methodologies**, participatory processes, and people-centered technological solutions.

Organised under the umbrella of the [Smart Energy Cluster](#) by [ICONS](#), DEDALUS’ Dissemination and Communication leader, the workshop brought together four EU-funded projects — [DEDALUS](#), [CRETE VALLEY](#), [EnerTEF](#), and [ENPOWER](#) — that are advancing human-centred innovation in the digital and energy transitions.

Through an open and multidisciplinary exchange, the session explored the **barriers and enablers** that shape the scalability of this approach, highlighting the crucial role of the **Social Sciences and Humanities (SSH)**, **co-creation**, and **trust-building** as prerequisites for social acceptance.

Discussions revealed that the **energy transition is not merely a technical challenge**, but a **social and cultural process** demanding common languages, genuine participation, and inclusive digital tools.

In doing so, the workshop helped to redefine the concept of *human-in-the-loop*, pointing towards a new paradigm of **human-centred digitalisation** and **just, participatory innovation** in the energy domain.

The Key Takeaways of the workshop

1. Beyond buzzwords: from concept to implementation

While *human-in-the-loop* is widely referenced in EU projects, it is rarely implemented in robust and systematic ways.

Moreover, speakers stressed the need to transform it from an abstract notion into an **operational practice**, by:

- embedding user engagement and co-design from the onset
- balancing technological and social dimensions in every work package.
- ensuring that users are not passive recipients but **co-creators** of innovation

This shift helps move **from “tokenistic” participation to genuine human-centred design.**

A concrete example came from **EnerTEF**, represented by **Elissaios Sarmas (NTUA)**, which applies *human-in-the-loop* principles to bridge the gap between developers and end-users. Through co-creation workshops bringing together AI start-ups and major energy companies, **the project ensures that digital services — from fault detection to power-management optimisation — are not only technically advanced but also human-interpretable and user-driven.** This collaborative approach turns abstract algorithms into tools that can be understood, trusted, and effectively adopted by their target users.

2. Co-creation and the Social Sciences: building trust and making Innovation truly human-centred

All projects demonstrated that **co-creation and interdisciplinary collaboration** are the cornerstones of genuine human-centred innovation. Direct participation of citizens and local stakeholders emerged as essential for trust, adoption and long-term engagement, while the involvement of **social scientists and behavioral experts** proved crucial to translate human needs into actionable system requirements.

Successful practices included **deliberative workshops, living labs, community energy labs, and local advisory boards** bringing together actors from the demand, supply, financial, and institutional sides. These formats fostered mutual understanding and enabled a continuous dialogue between technical and social domains.

Experts in **Social Sciences and Humanities** played a key role as mediators — bridging languages, making results accessible and relatable, and helping define qualitative indicators of social impact. Their contribution ensures that co-created solutions are not only technically sound, but also **socially meaningful, trusted, and adoptable.**

An illustrative example came from the **Crete Valley project**, represented by **Christian Galletta (FEDARENE)**, which applies a living lab approach through a network of **community energy labs where citizens, researchers, businesses, and local authorities co-design, test, and evaluate energy solutions in real-life settings.** Supported by a **digital twin platform** that connects technical and social dimensions, the project demonstrates how digitalisation can serve as an enabler of participation, linking data, behavior, and decision-making in a continuous feedback loop between people and energy systems.

3. From economic to social motivation

Purely financial incentives are not sufficient to trigger lasting behavioural change. The strongest drivers are **intrinsic and social motivation**, such as a sense of belonging, trust, community identity, gamified engagement and personalised feedback, environmental awareness and collective purpose.

During the workshop, some projects illustrated how these dynamics can be activated in practice. In **DEDALUS**, represented in the workshop by its coordinator **Diego Arnone (Engineering)**,

gamification was identified as a key behavioural lever: rather than relying solely on monetary incentives, participants are encouraged to engage in demand response activities through playful, community-based mechanisms that make energy-saving actions both engaging and rewarding. As demand response inherently requires the active involvement of users, ensuring a continuous engagement process is essential to foster user acceptance and sustained participation over time.

Similarly, the **ENPOWER project** – represented by **Julia Blanke** (University of Cork), showcased the **PowerCell nudging tool**, which provides personalised energy production advice and uses interactive feedback loops to motivate behavioural change — a form of *soft gamification* that reinforces awareness and sustained participation over time.

By incorporating these psychological dimensions, projects can turn participation into a **meaningful, motivating and socially rewarding experience**, where citizens feel both empowered and connected to the broader goals of the energy transition.

4. Language as a bridge — or a barrier

A recurring issue is the **semantic divide** between disciplines: engineers communicate through data and algorithms, social scientists through values and narratives.

Projects that introduced **“translation” roles** — individuals fluent in both languages — showed higher success rates.

Language thus becomes not just a medium, but a **cultural interface** enabling continuous dialogue between humans and machines.

5. From the building scale to the community scale

The human-in-the-loop approach evolves from individual to collective dimensions. Co-creation at the **district or community energy level** introduces complexity but amplifies impact. Key lessons include the need to:

- tailor engagement strategies to local scales and cultures
- empower mediators such as municipalities and local associations
- develop **multi-level roadmaps** for participatory action

6. Towards a genuinely human-centred digitalisation - Conclusions

The workshop’s central message was unequivocal: **digitalisation must empower people, not replace them.**

Achieving this vision calls for a **continuous and collaborative design process** that bridges research, industry, policymaking, and citizenship. It also requires the **systematic inclusion of behavioural, ethical and social justice principles**, ensuring that technological progress goes hand in hand with social responsibility.

Success should no longer be measured solely in terms of efficiency or performance, but also through the **cultural, social, and emotional value created** for individuals and communities.

Ultimately, the workshop demonstrated that *“human-in-the-loop”* is not a slogan but a **demanding yet profoundly rewarding practice** — one that thrives on listening, empathy, translation, and

cooperation.

By uniting social and technical expertise, fostering citizen ownership and embracing adaptive, inclusive governance, Europe can move towards an **energy transition that is not only smart but genuinely human**.

To further explore these topics and hear the full discussion, the recording of the workshop is available at [this link](#).