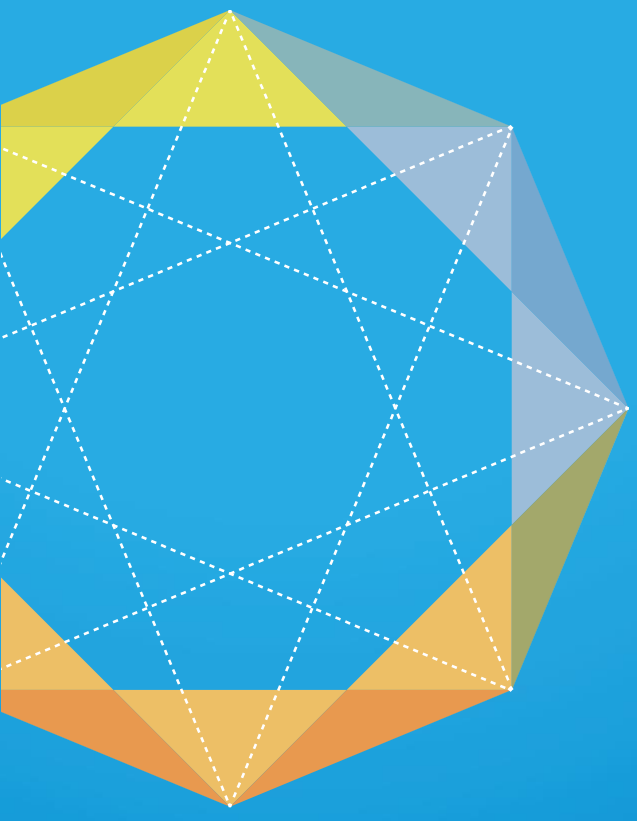
European Commission

# 21st ETIP SNET Regional Workshop

## AI & GenAI in Smart Grids



ETIP SNET

European Technology and Innovation Platform
Smart Networks for Energy Transition

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# 1. Context

As part of the ETIP SNET initiative, 2 regional workshops are organised for each energy market region (Western Region, Central Region Workshops, South-Eastern Region, Northern Region Workshops) to identify trends relevant for the energy sector and foster discussions among stakeholders along the energy value chain on specific topics. The main objectives of the ETIP SNET Regional Workshops are:

- To **present national and regional research and innovation projects** that tackle energy system integration challenges;
- To **highlight unresolved research topics**;
- To **ensure coherence between national and European perspectives**;
- To **promote knowledge sharing** among stakeholders and Member States.

The 21st ETIP SNET Regional Workshop involved the countries of the Central Europe region, namely Belgium, the Netherlands, Luxembourg, Poland, Austria, Germany, Switzerland, the Czech Republic, and Slovakia. The main theme of the event was *Artificial Intelligence (AI) & Generative AI (GenAI) in Smart Grids*, which focused on the integration of AI and GenAI into smart grids, by showcasing advancements, best practices, and real-world applications to optimise grid management, enhance flexibility, and boost efficiency, also with a key focus on ETIP SNET's strategic recommendations for AI adoption in smart grids.

The workshop attracted **30** participants in person and featured 10 speakers from the energy ecosystem. Attendees represented different stakeholder categories: Non-ICT suppliers (e.g., consultancy) (5), Research and Academia (6), ICT and network solutions providers (6), Distribution System Operators (4), Transmission System Operators (1), other companies (3), Equipment manufacturers and suppliers (3), Renewable energy providers (3).

The agenda of the event is presented below.

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| 10:00 | **Welcome and presentation of ETIP SNET**<br>*By Luis Cunha, ETIP SNET chair* |
| 10:10 | **Application of AI and GenAI in Smart Grids**<br>*By Luis Cunha, ETIP SNET chair*<br>*• Presentation of key challenges for deployment of AI and GenAI*<br>*• Next steps foreseen by ETIP SNET* |
| 10:40 | **Best practices and use cases of AI application from central European Countries**<br>*• DEDALUS - Diego Arnone, ENG*<br>*• BEGONIA - Elena Boskov-Kovacs, Blueprint Energy Solutions Gmbh* |
| 11.10 | **Break** |
| *11:25* | **Best practices and use cases of AI application from central European Countries**<br>*• LLM-based Automation of Engineering Workflows – Mihai Calin, AIT*<br>*• GenAI knowledge management - Karen auf der Horst, NETZE BW*<br>*• Siemens Energy AI Lab - Rachel Berryman, Siemens* |
| *12:00* | **Panel discussion: Missing links for effective AI and GenAI implementation**<br>*Moderated by Luis Cunha (ETIP SNET chair)*<br>*• Milos Subasic - Hitachi Energy*<br>*• Giuseppe Procaccianti – Dexter Energy*<br>*• David Steenmeijer - Enexis*<br>*• Pascal Plank, AGI and ENTSO-E (WG on Digitalisation within the Innovation Committee)* |
| *12:45* | **Conclusion and wrap up**<br>*By Luis Cunha, ETIP SNET chair* |

The workshop started with an introduction by Luis Cunha, ETIP SNET Chairman, providing a comprehensive overview of the ETIP SNET initiative outlining the initiative's vision, scope, governance structure, and key milestones, detailing both completed deliverables and planned ones. Luis Cunha pointed out that the community is currently revising its Roadmap & Implementation Plan and is open to enhance its organizational flexibility (i.e., by reorganising working groups) to better tackle emerging challenges.

# 2. Workshop Session #1: Application of AI and GenAI in Smart Grids

In this session Luis Cunha, ETIP SNET Chairman, **provided insights into the application of AI and GenAI in European Smart Grids and how the ETIP SNET initiative is addressing this topic** through the recent Strategic Position Paper on AI and GenAI in Smart Grids.

It was highlighted that the European Commission is currently revising the Digitalization of the Energy System Action Plan to incorporate AI-related considerations, with the goal of developing a comprehensive roadmap for AI deployment. This process will involve contributions from a broad range of stakeholders across the sector.

The session also explored the **definitions of traditional and generative AI**, highlighting the latter's transformative potential, particularly in operational planning and forecasting. While AI promises enhanced forecasting accuracy and operational efficiency, it also introduces cybersecurity risks that must be carefully managed.

The discussion further addressed the practical integration of AI in energy operations and forecasting. There was a clear call to prioritise implementation over prolonged conceptual discussions. Concerns were raised about the rising costs associated with various AI services, underlining the need for a consolidated, cost-effective approach. Participants agreed on the importance of benchmarking AI solutions tailored to European market needs and fostering collaboration between Distribution System Operators (DSOs) and Transmission System Operators (TSOs) to address shared challenges.

The session also touched on the **evolving landscape of AI governance**, including the potential regulatory implications of the upcoming AI Act. Then proceeded underlining the ability of Generative AI to produce synthetic data, offering a possible solution to challenges posed by data privacy regulations such as GDPR. There was discussion about the use of dedicated versus pre-trained foundational AI models, with general agreement that the choice should be driven by specific use cases. Challenges related to AI implementation in critical infrastructure were acknowledged, including issues in data collection and real-time monitoring and limitations in computing capacity for training models.

Moreover, the session featured a discussion on the AI Roadmap, which highlighted its contents, the timeline and the next steps, by taking into account the needed actions to implement the roadmap and incorporate the feedback from the energy ecosystem stakeholders.

Finally, the session focused on AI and skills development. It was emphasised the need for expert involvement in the conceptual development of AI solutions. A shortage of qualified personnel and fragmentation of AI solutions across the sector were noted as significant barriers, worsened by strong competition for talent from other industries. The ambiguity surrounding the AI Act was also discussed, with participants calling for clearer guidance to ensure consistent interpretation and application across organisations.

# 3. Workshop Session #2: Best practices and use cases of AI application from central European Countries

This session featured the DEDALUS and BEGONIA projects, funded by the Horizon Europe programme and part of the BRIDGE initiative, which showcased innovative systems to apply AI to Smart Grids.

The first project, **DEDALUS**, was presented by Diego Arnone, Head of Digital Twins and IoT Solutions research area at Engineering I.I. S.p.A. The project focuses on **demand response and energy efficiency**, emphasising the role of AI and real-time data analysis to optimise energy use and increase user engagement. Several real-life pilot projects were presented, notably in Italy and Greece, where AI technologies are being applied to reduce energy consumption while maintaining acceptable comfort levels in residential settings. The pilots presented are the following:

- In the **Italian pilot**, AI models based on smart thermostats, Heating, Ventilation, and Air Conditioning systems (HVAC) and Internet of Things (IoT) sensors were used to predict thermal comfort and adjust energy consumption through optimized HVAC scheduling. Three comfort-flexibility scenarios were explored, showing a 10-15% reduction in energy usage with high levels of user satisfaction and engagement. The model incorporated user feedback to continuously refine the comfort algorithms.

- The **Greek pilot** applied AI and reservoir computing techniques to predict household energy demand and identify high-impact demand response interventions. Although still under development, the pilot aims for a 20% reduction in energy costs and improved operational efficiency.

The discussion also addressed broader challenges faced by the project, including interoperability of smart devices, fragmentation of data models, limited user awareness of demand response value, and privacy concerns related to data sharing. The DEDALUS project is tackling these issues through digital tools, blockchain-based data protection, and co-designed services developed in collaboration with social science and humanities experts.

In conclusion, the DEDALUS project demonstrates the potential of AI to enhance demand response strategies by combining technical innovation with user-centred approaches, contributing to energy savings, grid stability, and long-term sustainability goals.

The second project, **BEGONIA**, was showcased by Elena Boskov, Managing Director and Co-founder at Blueprint Energy Solutions. BEGONIA is a **cross-sector initiative in energy and transport data spaces**, which aims to drive digital transformation in these sectors. The Begonia Project works on harnessing the power of AI to advance e-mobility, improve energy flexibility, and enhance grid intelligence across Europe, with the goal of reducing carbon emissions from heavy-duty vehicles and alleviate grid congestion, contributing to a more sustainable and efficient energy ecosystem. As a Coordination and Support Action (CSA), Begonia is not deployment-focused but rather supports ecosystem development and knowledge building. The project involves a wide consortium of partners across Europe.

Begonia has conducted an extensive investigation of operational digital platforms (ODP) and identified high-potential AI-driven use cases, such as an Electricity Customer Centric ODP and AI-driven ODP for integration of EVs, ETs, RES and the grid. These use cases are now under consideration for a €20M procurement call in Q3 2025 (total tender value €40M, co-funded at 50%).

Operational Digital Platforms (ODPs) are central to each use case and are defined by the European Commission as platforms that connect digital services to infrastructure, supporting flexibility services, grid integration, and dynamic energy pricing, among others. These will serve as foundational components of the future tender, which targets large consortiums for deployment and validation on a scale.

# 4. Workshop Session #3: Best practices and use cases of Generative AI application from central European Countries

This session featured 3 projects which showcased innovative systems to apply Generative AI to Smart Grids.

The first session featured a presentation by Mihai Călin, Research Engineer at the Austrian Institute of Technology (AIT) focused on the **application of large language models (LLMs) for engineering tasks, particularly to support researchers in the Engineering and Physical Sciences (EPS) domain.**

While LLMs can streamline various workflows, the primary emphasis was on enhancing data analysis. A generative approach was adopted using vector-based databases and the LangChain framework in Python, supported by the PHYS methodology to structure and manage data effectively. One major insight was the critical importance of well-structured input data, ideally organized into predefined machinery folders. The system comprises components like a "librarian" for knowledge handling, a "builder" that selects and executes relevant code, and a "customizer" to generate code for new, manufacturer-specific features. Despite progress, challenges such as hallucination persist, though mitigated through specific architectural choices. The proof of concept showed promising results, but human oversight remains essential to ensure accuracy and safe application, particularly when integrating with existing engineering standards and subsystems.

The second project was showcased by Karen auf der Horst, an Engineer at Netze BW. The project is focused on **the development of an intelligent Grid Lexicon, called NeLe, to preserve and share critical grid knowledge among its workforce using GenAI.**

Faced with the imminent retirement of a third of its grid technicians by 2025, the company identified a pressing need to retain specialised, often undocumented knowledge. NeLe leverages GenAI to provide reliable, context-

aware answers to field technicians by reading from a controlled knowledge base composed of official documentation and technician-contributed content. What sets the system apart is its participatory model: technicians can enrich the lexicon by adding new insights (e.g., text, images, videos) tagged to specific assets or general concepts. This ensures that implicit, experience-based knowledge becomes accessible to younger or newly transferred staff. The system architecture includes separate vector databases to manage verified documents and user input distinctly, enhancing answer traceability.

NeLe is currently being piloted in several regions, receiving strong engagement from younger technicians. While content gaps remain a challenge, the initiative emphasises the importance of usability and human contribution over a GenAI-first mindset. Looking ahead, Netze BW plans to expand the lexicon's utility through knowledge graphs and agentic AI, once foundational digital processes are established.

The final session was led by Rachel Berryman, Senior Innovation Manager and AI Lab Lead at Siemens Energy, **which presented the work of the AI Labs in Siemens Energy.**

The discussion centered on Siemens way to integrate AI in energy systems to face the energy trilemma: balancing affordability, reliability, and sustainability in the context of the global energy transition. Rising global electricity demand is driving fundamental changes in the energy ecosystem. These include accelerating wind power deployment, reinforcing grid infrastructure, and decarbonizing industrial processes, all while ensuring energy supply security, which depends on access to critical raw materials for technological development.

Artificial Intelligence plays an increasingly transformative role in the energy sector, unlocking new efficiencies and innovations but also introducing challenges. While AI enhances system performance and decision-making, it also increases the sector's energy consumption due to the computational power required for AI applications. This highlights the urgency of integrating AI more sustainably, which calls for workforce upskilling, improved trust and security, and more agile decision-making in an increasingly complex and interconnected energy landscape. In response, Siemens Energy is delivering advanced AI-driven solutions that meet customer needs while protecting the environment and empowering the workforce. **The company's AI strategy is built around six core enablement pillars**: AI Capabilities Development, Security & Governance, Best Practices & Consulting, Technology & Tooling, AI Partnerships & Innovation, and People & Culture.

To address the evolving skills gap, Siemens Energy has launched **tailored AI Learning Pathways**. The Business-Focused Pathway provides foundational knowledge in AI concepts, ethics, real-world applications, generative AI, prompt engineering, strategic deployment, governance, and workforce impact. Meanwhile, the Digital and Technical Pathway supports innovation through deeper exploration of technologies such as Machine Learning, Natural Language Processing (NLP), and Computer Vision, alongside ethical considerations and introductory programming skills.

**At the heart of Siemens Energy's approach is the AI Foundational Capability model**, designed to turn data into insights through the integration of advanced AI with deep domain knowledge. It provides various applications such as machine learning for image analytics, anomaly detection, edge ML, probabilistic modelling for reliability and risk, NLP for knowledge extraction and intelligent search, optimisation for complex system decisions, time series analytics for forecasting and synthetic data modelling.

To ensure ethical AI use, Siemens Energy enforces a comprehensive AI Governance Policy that defines clear principles for responsible AI deployment. It addresses legal compliance, data privacy, cybersecurity, and third-party rights, while fostering awareness of AI risks and unintended consequences to uphold trust and accountability in all AI applications.

## 5. Panel Session: Missing links for effective AI and GenAI implementation

The final part of the workshop was dedicated to a **panel session regarding the missing links for effective AI and GenAI implementation**, which featured the participation of the following speakers from the smart grid

ecosystem:

- David Steenmeijer, Data Science & AI Specialist at Enexis;
- Milos Subasic, Research Team Manager at Hitachi Energy;
- Giuseppe Procaccianti, Data Science Manager at Dexter Energy;
- Pascal Plank, Austrian Power Grid AG.

This session, moderated by Luis Cunha, ETIP SNET Chairman, examined the critical enablers and obstacles to effective implementation of AI, particularly regarding the application of Generative AI across the energy sector.

One of the central themes was the **need for standardised frameworks and comprehensive education to support the responsible use of GenAI**. Participants emphasised that without clear standards and proper training, organisations risk inconsistent or ineffective AI adoption. **Workshops and training sessions on AI and New Digital Infrastructure (NDI)** were highlighted as highly effective in improving awareness and enabling employees to identify relevant use cases.

Another core issue discussed was **Europe's talent gap in technology and AI**. Compared to the U.S., Europe suffers from underinvestment in higher education and limited career pathways, making it difficult to attract and retain skilled professionals. Academia struggles to keep pace with the fast-evolving AI landscape, and many researchers are lured away by better-paid industry positions, further weakening the region's capacity for innovation.

**Data management emerged as a significant bottleneck**. Many organizations still lack a data culture, failing to treat data as a strategic asset. As a result, data is poorly stored and underutilised. The panellists stressed the need to improve digital processes, ensure data quality, and promote interoperability, especially in the energy sector, where siloed data and operational congestion can lead to systemic risks such as blackouts.

The discussion also touched on **the importance of financial incentives to drive collaboration and data sharing**, taking cues from successful market integration strategies in the European energy sector. Examples included the integration of electricity markets and consumer-driven trading models enabled by smart meters.

Best practices from German and Spanish interoperability labs were presented as models for certifying AI solutions in critical infrastructure sectors. Such independent testing bodies could help ensure quality, transparency, and trust, elements deemed vital for user adoption of AI technologies. Transparency and explainability in AI tools were repeatedly cited as essential, especially in sectors like energy where accountability is key.

**When discussing the topic of AI regulation,** panellists raised scepticism about the AI Act effectiveness arguing that it lacks clear enforcement mechanisms and may be too rigid in its definitions of high-risk AI. The potential misalignment between the AI Act's requirements and sector-specific needs (such as congestion management or solar PV integration) was highlighted as a risk to innovation and operational efficiency.

Finally, the group stressed **the need for better coordination across European countries in energy production and grid management**. Past incidents, such as the blackout in Spain, underscored the dangers of poor interconnection and limited redundancy. There was consensus on the need for a proactive, systems-level approach to AI and digitalization in Europe, backed by stronger regulation, talent investment, and pan-European collaboration.

The meeting concluded with actionable priorities, including the creation of standardized AI frameworks, investment in education, better data governance, development of interoperability standards, and active engagement with regulatory bodies ahead of the AI Act full enforcement by the 1st August of 2026.