

Germany



Between TSO and DSO

Improved observability and coordination through digital twins





enhanced
observability and
controllability

advanced
forecasting for
optimized market
actions

smart
coordinated
planning

Concept

The German pilot demonstrates an integrated digital twin solution for distribution grid management, addressing the challenges of renewable energy integration and grid stability. Built on envelio's Intelligent Grid Platform, the demonstrator develops three core capabilities: dynamic grid monitoring combining live data with static models for real-time state estimation, an end-to-end flexibility solution for congestion management and grid planning tools with hosting capacity mapping for connection requests. The pilot analyses coordinated TSO-DSO interaction through standardized interfaces with defined connectors and a data space environment, supporting flexibility activation and grid optimization across voltage levels.

Key outcomes

- Dynamic grid monitoring system integrating static grid models with live measurement data for real-time state estimation at LV/MV level
- End-to-end flexibility management platform with envelope curve algorithms for preventive and reactive congestion management
- Concept for automated hosting capacity assessment with interactive maps and streamlined connection request processing
- Demonstration of applicability of data space structures for data exchange in combination with standardized connectors (between TSO, DSO and aggregator)

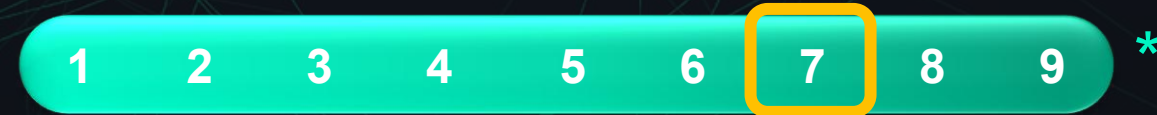
Impact/added value

- Transparent self-service access to hosting capacity information with faster response times for grid connection applicants and flexibility service providers
- Improved grid planning and operations through early congestion detection via state estimation, enabling proactive measures and higher renewable energy integration capacity

Time for deployment

All outcomes are immediately deployable

Technology Readiness Level



Potential users

- **Distribution System Operators (DSOs)** - Primary users for grid monitoring, planning, and congestion management
- **Grid Connection Applicants** - Developers and asset owners using self-service connection checks
- **Flexibility Service Providers** - Market participants offering congestion management services
- **All market participants** – standardized connectors and data space structure concepts

Lesson learnt

Our key learning is the strong dependency on regulatory frameworks and their direct impact on use case implementation. Late publication of technical specifications forces development based on assumptions, creating risks of costly redevelopment when final requirements arrive. On the technical side, combining state estimation with live monitoring data proved highly valuable - early congestion detection enables truly proactive grid management rather than reactive measures. A major challenge we encountered is the complexity of cross-partner data exchange - implementing the pan-European scenario proved significantly more difficult due to the coordination and technical integration required across multiple stakeholders with different systems and priorities.



Demo leader:



Demo partners:



westnetz



e-on



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TwinEU