# GridCloud

Advancing Decision-Making in Distribution Grids through Digital Process Twin Integration for Grid Planning & Operations

| | | | |
|---|---|---|---|
| **Programm / Ausschreibung** | Energie- u. Umwelttechnologien, Energie- u. Umwelttechnologien, ERANet (EU - Clean Energy Transition Partnership (CETP)) Ausschreibung 2023 | **Status** | laufend |
| **Projektstart** | 01.04.2024 | **Projektende** | 31.03.2026 |
| **Zeitraum** | 2024 - 2026 | **Projektlaufzeit** | 24 Monate |
| **Keywords** | Digital twin, AI decision-making, grid planning and operation, local energy communities | | |

## Projektbeschreibung

Das GridCloud-Projekt, das sich an europäische Verteilernetzbetreiber richtet, soll die Dekarbonisierung durch innovative digitale Lösungen vorantreiben. Mit Blick auf die Herausforderungen der Energiewende in Europa integriert GridCloud künstliche Intelligenz und Datenanalyse, um das Netzmanagement zu optimieren. Die vielschichtige Strategie umfasst: die Förderung der Zusammenarbeit von Stakeholdern für eine nahtlose grüne Energiewende, die Entwicklung von "Digitalen Prozesszwillingen" für die Digitalisierung von Systeminformationen und die Entscheidungsfindung in Echtzeit sowie die Automatisierung der Erstellung digitaler Zwillinge bei gleichzeitiger Gewährleistung der IoT-Kompatibilität für eine überlegene Systemleistung. Mit länderspezifischen Zielen in Österreich (erweiterte Netzsteuerung und Einbeziehung von Stakeholdern), Deutschland (Netzdatenintegration und Standardisierung) und der Türkei (Erkennung von Anomalien und Betriebsoptimierung) strebt GridCloud eine nachhaltige, effiziente und zuverlässige Energieverteilungslandschaft an.

## Abstract

The GridCloud project, aimed at European Distribution System Operators, seeks to advance decarbonisation through innovative digital solutions. Positioned against Europe's energy transition challenges, GridCloud integrates artificial intelligence and data analytics to optimize grid management. The multi-faceted strategy encompasses: fostering stakeholder collaboration for a seamless green energy transition; developing "Digital Process Twins" for system information digitalization and real-time decision-making; and automating digital twin creation while ensuring IoT compatibility for superior system performance. With country-specific goals in Austria (augmented grid control and stakeholder engagement), Germany (grid data integration and standardization), and Turkey (anomaly detection and operational optimisation), GridCloud aspires for a sustainable, efficient, and reliable energy distribution landscape.

## Endberichtkurzfassung

GridCloud set out to answer a fundamental question: can Digital Process Twins improve decision-making in distribution grids? After two years of development and demonstrations in three countries, the answer is yes, and the project has the evidence to show how.

Imagine a live, on-screen replica of an entire electricity network: every cable, every transformer, every solar panel, updated continuously with real data. An operator could spot overloaded equipment before it fails, simulate the impact of fifty new heat pumps in a neighbourhood, or identify the best location for a community battery, all without leaving the control room. That is the vision GridCloud built and tested in Austria, Germany, and Turkiye, advancing the technology from a laboratory prototype (TRL 4) to a system demonstrated in real operational conditions (TRL 7).

In Austria, EnergieAtlas uses satellite imagery to map solar generation across all 2,115 Austrian municipalities every 15 minutes, matching official national figures within 1.9% and validated against 214 ground weather stations. NetGen automatically builds realistic models of distribution grids for 2,093 municipalities across 14 grid operators using only publicly available data, with all generated networks passing standard power flow validation. GridBridge uses AI to translate grid data between formats, doing in seconds what would otherwise take a human expert hours; for safety-critical applications the team responsibly concluded that human oversight remains essential. Together with a cyber-physical simulation environment and a real-time pilot connected to 25 smart meters in the act4.energy community in Burgenland, these tools form a complete digital twin platform.

In Germany, the Schoenbrunn Digital Twin consolidated the heterogeneous data sources of Stadtwerke Wunsiedel into a standardised European format spanning five validation profiles, providing a replicable blueprint for any of Germany's approximately 900 distribution operators. A web-based Connection Request Analyzer built on this foundation turns what used to take days of expert work, deciding whether a new solar or wind installation can be safely connected at a given location, into a question answered in minutes under a range of weather scenarios.

In Turkiye, five solar-powered IoT sensor nodes deployed on the Karaburun Peninsula have measured temperature, humidity, vibration, and tilt continuously since November 2025 with zero downtime, protecting supply for around 1,270 customers in a region prone to lightning and storms. A detailed lightning simulation revealed storm-induced surge voltages roughly four times the level the equipment was designed for, leading the local grid operator GDZ Elektrik to revise its protection and maintenance strategy.

A cross-national scalability assessment found that the main barriers to wider deployment are no longer technological. Tools built on open standards consistently scored highest for cross-border replication; the remaining barriers are organisational and regulatory, including fragmented data practices, undocumented expert knowledge, and varying national rules. The cross-country test of NetGen from Austria to Turkiye succeeded only partially, demonstrating that tool portability requires not just software adaptation but mature open-data ecosystems in the target country.

A commercial spin-off from the Austrian Institute of Technology, called Raphson, integrates the GridCloud methodology into an AI-driven grid planning platform. It has been presented to more than 15 European grid operators and secured seven Letters of Intent for paid pilot deployments, with the first deployments underway in 2026. Initial analyses suggest the approach can reduce the total cost of grid expansion by around 30% compared to traditional planning, by combining conventional reinforcement with smart batteries, electric-vehicle charging, and demand response.

## Projektkoordinator

- AIT Austrian Institute of Technology GmbH

## Projektpartner

- Enlion Innovation GmbH