Improved Data Quality Through Higher Grid Transparency with the Intelligent Grid Platform

Case Study | 2024

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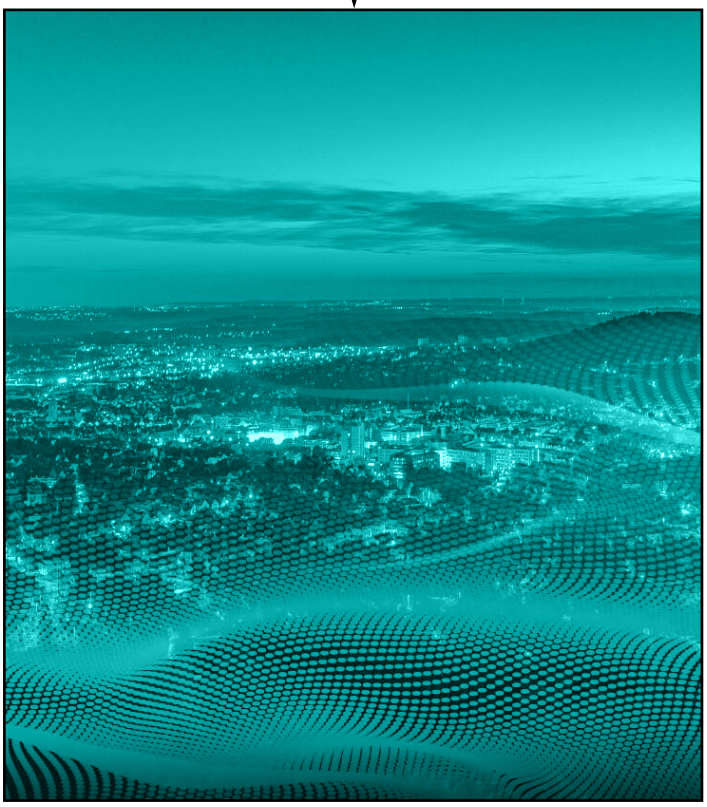
Customer Portrait

FairNetz GmbH is the responsible distribution system operator for the Reutlingen region. Other than the gas network, FairNetz is also responsible for the planning and operation of the electrical grid, which encompasses an overall length of over 3000 km and over 120 000 connection points. Established in 2015, FairNetz GmbH is a full subsidiary of FairEnergie GmbH. At 75,1 percent, Stadtwerke Reutlingen GmbH is the majority share owner of Fair Energie, with the investment partner ‘EnBW Kommunale Beteiligungen GmbH’ owning 24,9 percent.



FairNetz GmbH; fairnetzgmbh.de

Overview

“In some cases, it would not have been possible to anticipate the high load without the IGP. The IGP provides calculation results which already take existing as well as approved but not yet installed generators into account. That is why we were able to visualize a rapid concentration of assets set to be put into operation and based on this information, we can already initiate grid expansion measures at an early stage.”

Mona Keller
Head of Asset Management & Strategic Planning
at FairNetz

The issue & what FairNetz set out to achieve

The number of renewable energy systems that need to be integrated is rising rapidly and with it, the number of connection requests that need to be handled. Missing integration between systems as well as an insufficient degree of digitalization lead to many processes still being carried out manually, which leads to an ever-increasing workload. That is why digitizing and automating the mass processes around grid connection requests was at the core of FairNetz’ IGP use case.

Project results

Achieving a higher degree of digitalization and automating the connection request process

Basis for the automation of downstream internal processes

Productive execution of **60%** of all connection requests within four months of introducing the web portal

Productive execution of approx. **1000** connection requests within the first **8** months

50% of all requests are assessed positively in under **5** minutes

Regular and automated exports of process data for further processing in other source systems

99% of the PV requests and **60%** of the requests for EV charging station are calculated in the **IGP** and can be approved immediately

Permanent data quality improvement in the low voltage grids

Foundation for sound and long-term strategic grid planning and the respective investments

Background

Today, grid data is often maintained manually and in separate data silos, which, given the increase in grid connection requests, can lead to a temporal misalignment between the data maintenance and the different data status in the source systems. The lack of automation in the data synchronization between the relevant systems and the related temporally delayed grid transparency impedes not only daily processes such as the handling of connection requests, but also makes determining grid reinforcement measures and the investment planning for the future grids more difficult.

Particularly over the last two years, FairNetz has seen an enormous rise in connection requests for new PV systems and EV charging stations. The resulting workload wasn't manageable anymore with the existing processes and evaluation logic. That is why FairNetz set the following goal for the first part of the project: Introduce IGP-powered processes that facilitated a permanent improvement of the grid data quality, as well as the creation of a computable grid model for the entire medium and low voltage grid.

In the next step, the improved data quality will be used to accelerate the handling of connection requests. In addition, FairNetz wants to analyze the grid participant structure in order to further improve the data basis for the calculation logic and to be able to proactively determine specific grid reinforcement measures such as switching out transformers or line amplifiers. Furthermore, the company strives to create a foundation for sound grid expansion investments.

Project objectives

Intelligent Grid Platform short: IGP

The Intelligent Grid Platform (IGP) is an assistance system that supports a variety of technical processes in the planning and operation of electrical grids. The focus in our further collaboration with FairNetz is on planning applications.

Basis for the grid planning

Connection Request	Digitalizing and largely automating the entire technical evaluation process for new connection requests for power generators and consumers.
Grid Planning	Manual editing of assets and grid participants for one or more neighboring grids, e.g. by enabling the interactive changing or adding of line segments, as well as the adding of load and generator types.
Grid Study	Creation and evaluation of scenarios for future supply tasks by indicating penetration rates; from extensive data on one or several grid segments to information on the entire grid area.

Connection Request

The Connection Request application enables users to largely automate the technical connection request process for new power generators and consumers.

- Photovoltaic systems
- Heat pumps
- EV charging stations

Challenges

Due to the rapidly increasing number of requests for PV systems and EV charging stations, which FairNetz receives per e-mail or by post, the manual effort needed to carry out the data entry for grid calculations is also rising.

In order to calculate the integration possibilities, the necessary information from different systems needs to be aggreggated manually.

In light of the increasing connection requests, it will also become more important to include already approved, but not yet installed generators in future grid calculations for new requests.

The approved generators need to be post-processed individually and manually entered into further systems such as energy data management (EDM) or network information systems (NIS).

Problem solving

Deployment of a digital web form for the connection requests: The relevant process data is submitted automatically in the IGP, significantly cutting down on time. At the moment, 60 % of all requests are submitted via the web form.

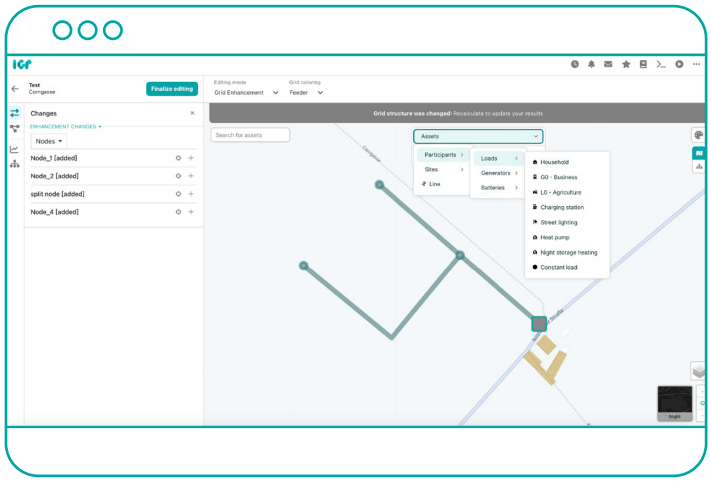
Automated evaluation: Possible grid connection variants are automatically determined by the IGP and immediately go through a technical evaluation. At the moment, approx. 1000 connection requests have been productively planned and evaluated with the IGP.

Approved, yet not connected or installed generators are automatically reserved in the grid model and are taken into account in future requests.

Partially automating data post-processing: The approved generators are automatically exported on a weekly basis. Thanks to these exports, further process steps can be carried out using automations. This way, data maintenance, as well as the further processing in the EDM and NIS is largely carried out by automation through imports of processed data sets.

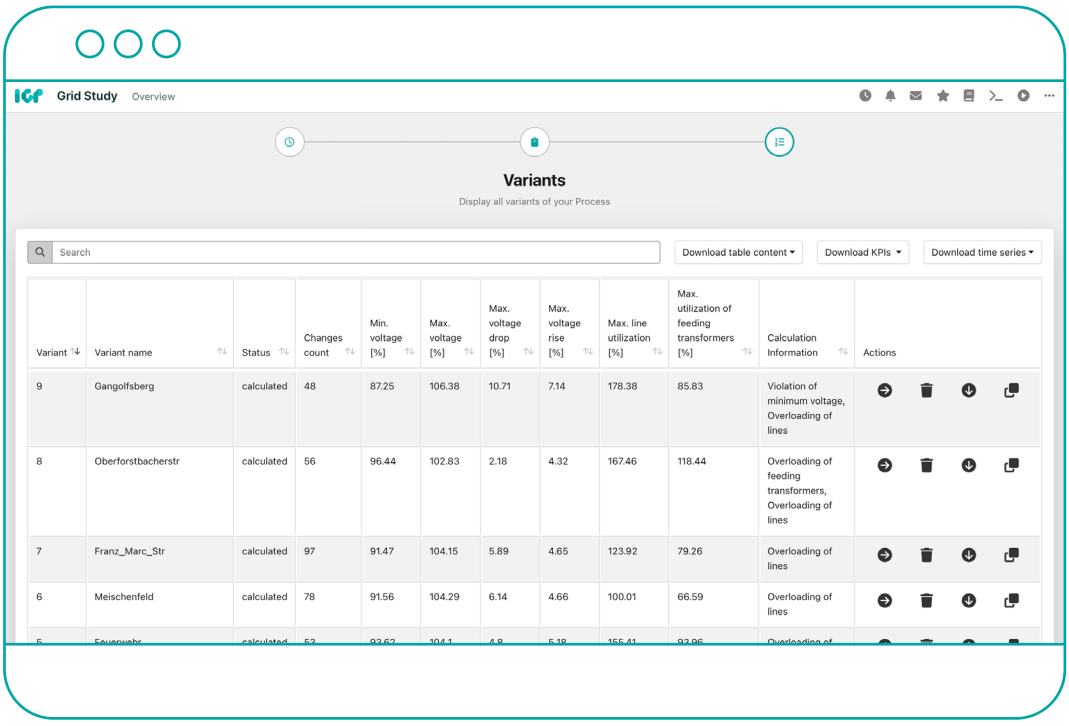
Grid Planning & Grid Study

The Grid Planning and Grid Study applications facilitate an evaluation of existing grid structures and the performance of diverse future scenarios in order to make justified decisions in regard to grid reinforcements or grid expansion.



First image:
Adding different power supply units

Second image: Evaluating planning scenarios in the grid study



Initial situation

The estimated calculations of integration possibilities for new generators are carried out based on a rough, manual grid load calculation.

Due to the lack of grid transparency, high load can sometimes only be determined through considerable manual effort.

What was done with the Intelligent Grid Platform

Precise calculation of the load and voltage ratios: Not only information from the NIS, but also consumption and measurement data are unified in the IGP

Thanks to the improved calculation precision, technically necessary grid optimizations and reinforcement measures, e.g. changes in switching or necessary replacements for transformers or line amplification, can be determined/ displayed much faster and easier.

In order to plan the grid expansion measures and the respective investments needed for them, FairNetz has contracted an external service provider to deliver entry data based on the existing supply structure, the potential for renewable energy generation, as well as socio-economic factors. Based on this data, around 20 individual grid studies were created using the Grid Study application in order to determine the future peak loads that can be prospectively expected in the grid, as well as to prioritize the necessary reinforcement and expansion measures depending on the grid area.

Data quality

“It was only after we introduced the IGP, that we were able to identify the grid segments that showed unsatisfactory data quality. After that, we were able to swiftly determine the data inconsistencies and gaps and subsequently clean up the data.”

Mona Keller
Head of Asset Management & Strategic Planning
at FairNetz

Using the IGP to blend grid data from different systems, FairNetz is able to perform various calculations for the entire grid in order to continuously improve data quality and refine the grid model.

From practice

Example: Data enrichment

The grid calculation for a specific low-voltage area showed a high load, even though this area had only a few electricity consumers according to the data provided from NIS. Upon closer examination of the consumer data that came from the EDM, FairNetz was able to determine in the grid model that the high load was caused by a large number of heat pumps recorded in the system. Yet, the technical information about these heat pumps was missing in the NIS entirely. As a result, FairNetz enriched the data in the NIS by adding approx. 1000 heat pumps.

Example: Data correction

Although the IGP indicated a high calculated load for a specific area, the actual station load based on measurement data was found to be low. The data investigation revealed very high capacity coming from storage heaters that had been recorded in the NIS and therefore, transported into the grid model where they were used for calculations. At the same time, FairNetz could see in the EDM data that many end-customers who presumably were in possession of storage heaters had relatively low electricity consumption. As a result, FairNetz conducted a customer survey and was able to remove 25 MW of storage heating capacity from the NIS. These 25 MW reflect approximately 6% of the substation capacity in FairNetz‘s grid.

Project results & further milestones

Thanks to the Intelligent Grid Platform, FairNetz was able to partially or fully automate the approval processes for 99 % of all PV systems and 90 % of all EV charging stations that were requested. Introducing a digital web portal also led to significant time savings when it came to entering the process data. In addition, FairNetz can also add approved, but not yet connected or installed generators to the grid model and take them into consideration for future calculations. Based on a dynamic and extensive grid model for the entire grid area, the data quality can be continuously improved in order to perform precise calculations for future scenarios. Among other use cases, FairNetz now also uses the IGP for strategic grid planning.

In summary, FairNetz was able to gain the following advantages from using the Intelligent Grid Platform

Higher digitalization of connection processes, facilitating the automation and acceleration of other related internal processes

Regular and automated data export of previously approved processes for further processing in other source systems

Permanent data quality improvement in the low voltage grids

Foundation for sound and long-term strategic grid planning and the respective investments

Next steps

- Displaying live measurement data within the IGP and, if necessary, optimizing the grid participant structure in case the calculation results deviate from the live measurement data
- Refining the calculation logic based on new technical and scientific insights
- Increasing the quality of the results and creating a foundation for further automation within the internal processes
- Changing the leading cross-system connection object ID to a grid location ID
- Assigning each grid location to a feeder and a station with the help of the IGP in order to fulfill the future requirements of controllable consumption devices, the CLS management as well as market communication processes
- Strategic grid planning based on cross-sector infrastructure planning; particularly under consideration of the transmission grid operators' grid development plan and the local, technically sound and prospective heat supply under the German government's target requirements for climate neutrality

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