



Integration of dispersed generation



Energy management and active network integration

At a glance

Successful integration of dispersed and renewable generation into distribution networks relies heavily on effective planning and operation strategies. Siemens Power Technologies International (Siemens PTI), your provider of network consulting, network planning software and trainings on the Siemens T&D portfolio, can provide you with a wide spectrum of consulting services covering both decentralized energy management and active network analysis for optimized interconnection and operation strategies.

We can enhance your business with the following services:

- Expert know-how and field experience to help you develop the most cost-effective solutions
- State-of-the-art software tools (e.g. PSS[®]SINCAL) and advanced case-specific software tools to explore the full potential of dispersed and renewable generation
- Interconnection guidance, network impact analysis and solutions for any issues related to dispersed generation

The challenge

Due to both environmental and supply security requirements there are increasing shares of distributed energy resources (DER) comprising dispersed and renewable generators, controllable loads and possibly co-generation or storage units. However, beneficial integration of dispersed and renewable generation into a distribution grid poses a considerable challenge to existing network planning and operation methods and software tools.

In addition, large shares of dispersed generation may change the conventional top-down structure of the electricity industry. A whole new genre of technical and economic issues will arise from this change and novel solutions will be required.

Utilities have noted this trend since a long time already. In earlier times, small distributed generators were connected to the distribution grid without special system studies. Today, also distributed generators have to provide services that were typically in the responsibility of large power plants connected to the transmission system only.

Thus, numerous technical details and conditions need to be connected when distributed generators are connected to distribution networks. In consequence, a significant set of studies is required.

Our solution

With our unique strengths in developing individual solutions and our vast experience, we offer high-quality engineering solutions for both network-based and plant-based problems of dispersed and renewable generation – or even both aspects combined.

Our main service area covers:

Network analysis

- Steady-state and dynamic calculation of DER system conformity with the network concerning
 - Loading of network and equipment, transmission constraints
 - Power quality
 - Fault ride through behavior, short circuit power
 - Protection of units and network

This approach enables the network operator to identify the right connection strategy before the actual installation of DER. The optimum solution has to consider several aspects such as optimum connection point to the grid, dimensioning of the switchgear considering technical and economical aspects, losses, power quality and reliability of supply.

Siemens PTI – Network Consulting

Answers for infrastructure.

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Power quality impacts

The impact of DER to be connected to the grid will be investigated considering voltage differences, flicker and harmonics with respect to the valid national and international rules and regulations.

The network model can be easily and efficiently created with the powerful import options of PSS®SINCAL on the basis of GIS (geographical information system) data.

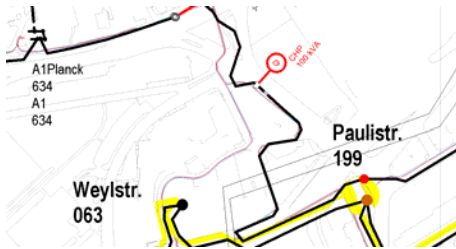


Figure 1: Calculation based on geographical network model

The necessary calculation steps will be carried out with PSS®SINCAL. They are embedded in a calculation framework, which allows the automated calculation and evaluation of a large number of required calculations. Furthermore, the results will be compiled to a detailed report. This approach enables us to carry out a complete network study in a very efficient way.

Optimum connection points

If the shortest connection to the grid should not be technically valid, then another connection point will be determined with respect to technical and economical aspects. The routing will be done on the real trench course, which enables us to take realistic investment costs into account.

De-coupling concepts

Due to their significant amount to total power production, DER have to participate in ancillary grid services. Therefore the de-coupling relay should not trip instantaneously in case of external faults. In fact, the de-coupling switch

should only trip, if the stability of the generator can not be guaranteed anymore.

Therefore the calculation of the stability limit of the generator is required to determine proper setting values for the de-coupling equipment.

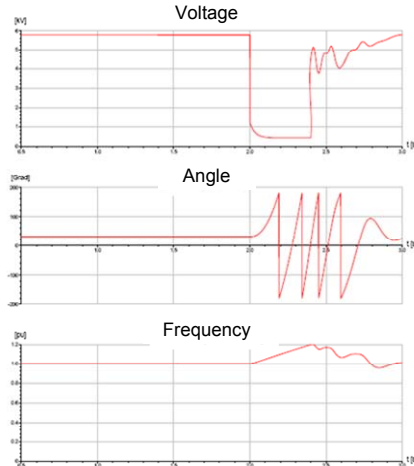


Figure 2: Determination of the de-coupling criteria with dynamic simulations

Protection Concepts for DER

DER have to be protected against impacts of external as well as internal faults. Therefore protection concepts depending on the power and the importance of the generation unit have to be designed.

Furthermore we are able to carry out the necessary protection calculations with protection settings for all related protection devices.

Power quality measurements

If DER are connected to the power grid via electronic converters, then the generation units will contribute to the harmonic load of the grid.

If the harmonic content of the bus voltages exceeds the limits, we are able to elaborate the necessary improvement measures. To reach this goal we can offer you different services, for example

power quality measurements or filter design.

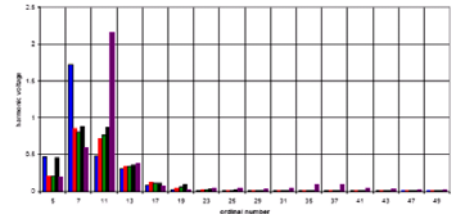


Figure 3: Determination of the harmonics for a network with dispersed generation

Application example

The services are already provided to several distribution companies. Remote access to the network database of the client, where agreed accordingly, enables us to update the network model in a very efficient way. The calculations of the relevant planning variants take place within a dedicated planning framework. This allows us to carry out a complete DER connection study in a very efficient way for calculation of the results and the preparation of the relevant reports.

Additional service areas

Beyond the connection studies for DER we are at your disposal for further consulting services of our large portfolio.