

REFERENCE CASE

Keeping the voltages within the limits

ABB power distribution for a greener, smarter and stronger grid



Besides keeping the nodal voltages within the required limits, the coordinated control also guarantees that the power flows never exceed given limits, hence protecting the grid infrastructure.

The project

ABB (PGGA), EKS (Elektrizitätswerk des Kantons Schaffhausen AG) and ZHAW (Zürcher Hochschule für Angewandte Wissenschaften) ran a pilot project in 2016-2017 on the topic of renewable integration and Volt-VAR management.

The involved partners developed, simulated, implemented and tested a pilot installation in Dettigkofen (DE). This comprises a low-voltage line-voltage regulator (LV-LVR) equipped with new functionalities for coordinated reactive power control (RPC) and active power control (APC) of PV inverters.

Besides the direct and indirect voltage control functionality, it also includes an active power limitation as a backup function in order to protect the involved infrastructure from temporary overloading.

The challenge

The main motivation behind this work has been to enable the integration of a large amount of renewable energy sources without expensive grid extensions, to fulfill the given power quality standards and to protect the infrastructure from possible overloading; all this ideally in a minimum intrusive way with regard to the end-customers and at minimum cost. In addition, the installation shall be as easy as possible, ideally without any prior grid model analysis.

The solution

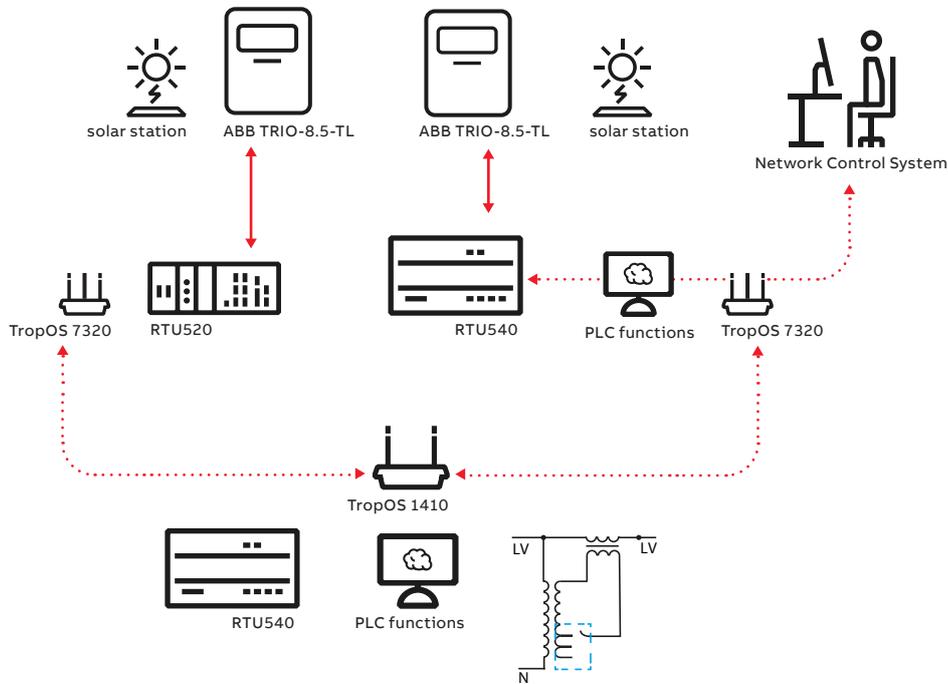
The developed solution is based on an ABB LV-LVR (Line Voltage Regulator), extended with an additional control logic running on cost-effective remote terminal units (ABB RTU540 and RTU520) and using an ABB TropOS wireless communication to two ABB TRIO PV inverters in order to coordinate the power production according to the actual conditions in the grid.

Different control strategies such as control with only the LV LVR, Active Power Curtailment, and Reactive Power Control have been engineered and tested, independently or in combination, in three separate campaigns in summer and autumn.

Results and benefits

From the voltage measurements collected during the testing, with and without voltage control, it is clearly visible that the implemented voltage control substantially improves the power quality in the grid.

The local LVR control results in the desired decrease of voltage in the “downstream” grid branches independent of the end-customers behavior and is fully under control of the grid operator.



Solution configuration

The measurements show, on the other hand, that in the part of the grid being studied, it is not possible to integrate more PVs without any additional voltage control, since even with the LV LVR the power utility's internal voltage limitations were exceeded and the voltage value can be expected to rise even higher.

By adding Active Power Curtailment and Power Factor control, the voltage could be kept within limits in the grid. With the installed solution, based on the tested cases and additional simulations, it would be possible to increase the installed PV peak power by about 25% without any additional grid reinforcement. New PV roof-top installations or extension of existing ones could be implemented easily and in a short time.

Besides keeping the nodal voltages within the required limits, the coordinated control also guarantees that the power flows never exceed given limits, hence protecting the grid infrastructure (in this case the LV-LVR transformer).

Customer feedback

“With the solution from ABB, EKS could supervise and manage critical grid branches with a high density of renewables with minimum efforts. With the development of the renewables energy installations the ABB solution may contribute to an economical way for stabilizing the grid without having to invest in extensive grid extensions.”

The products



RTU520



RTU540



TropOS 7320



TropOS 1410



ABB TRIO-8.5-TL



Low Voltage Line Voltage Regulator

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