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**Self-organization and autonomous functions  
in distribution substations interacting with next generation distribution control  
centers**

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**Abstract;**

Due to the extensive increase of distributed renewable energy sources and the demand for flexibility on the overall electricity market, distribution grids will need to be extended intensively. With the trends towards Smart Grids, the required grid expansion shall be limited.

On smart distribution grid level, there are several new functions under development and under test in pilot projects. These functions are protection, fault location, power quality monitoring, topology optimization, RES-curtailment, wide area voltage control or state estimation, for instance.

New kinds of distribution control centers are using cloud technologies to interlink various kinds of information sources and data. The communication demand is fulfilled basically with internet technologies. Flexible and cost efficient system setups include various applications including big data analytics.

However, some smart grid functions would be more beneficial in terms of system security and stability if they act self-organizing or autonomously. The huge number of distribution grid branches cannot be supervised and operated manually. Actions beyond the basic protection functionality shall act locally on distribution substation level. In such case a specific hardware device based on standard technology like industrial automation need to be implemented in the substations, containing all the required functionalities in a flexible and even extendible and updateable way.

- Which functions can/should act self-organized and autonomously within the distribution grid?
- Which communication is necessary and how does it look like?
- If there is mobile communication / internet involved in the communication anyway, which functions should be implemented in the cloud?