INTELLIGENT MANAGEMENT OF DISTRIBUTION GRIDS

D. RIESENBERG, Mauell GmbH, Germany

T. LINNEMANN, Mauell GmbH, Germany

SUMMARY

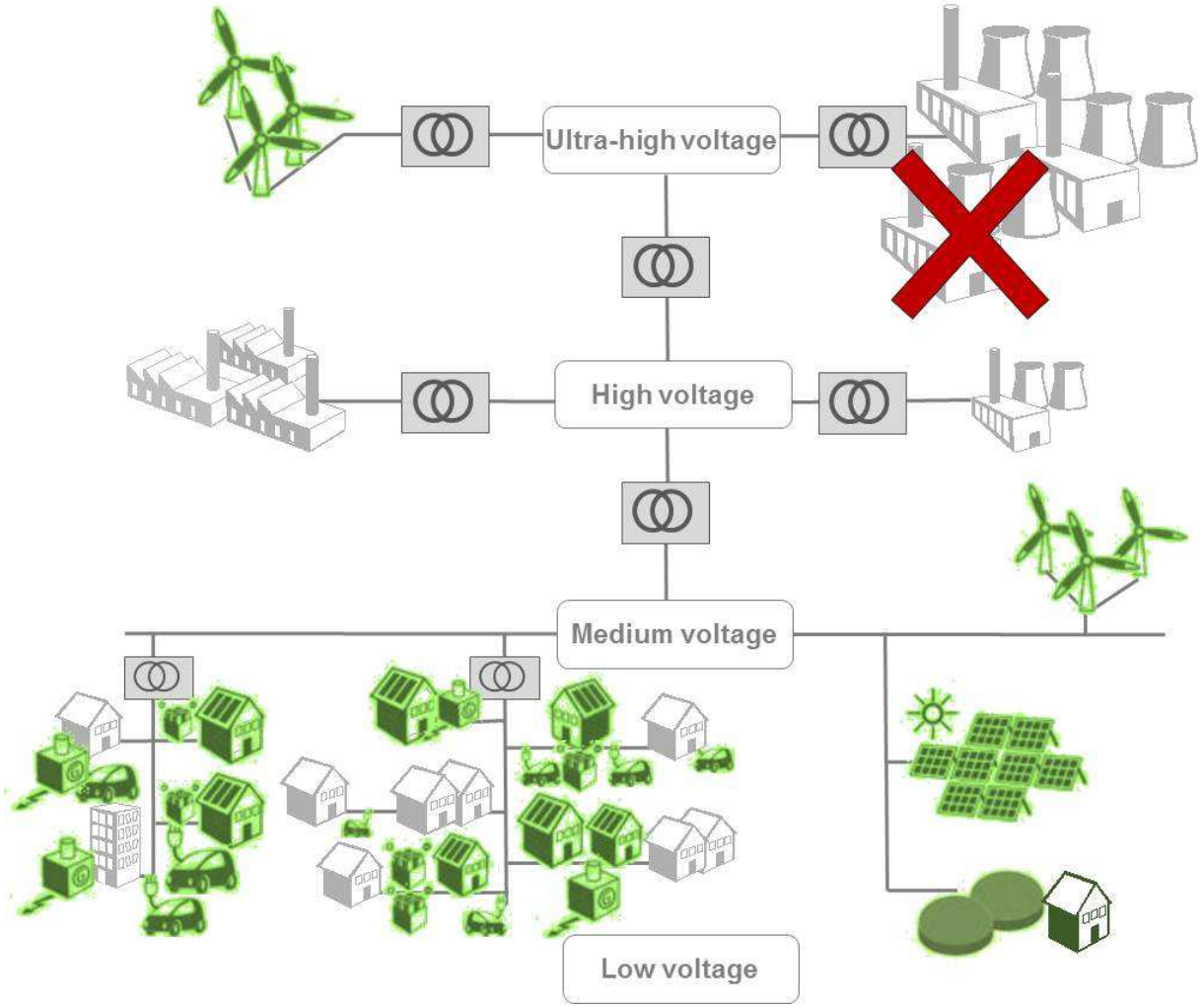
iNES- the intelligent distribution substation for the low-voltage grid

The increasing number of decentralized generating plants and consumers with a high demand for power can lead to voltage band violation (DIN EN 50160) and equipment overload situations in the distribution grid. The protection systems of today's distribution substations, however, can neither detect nor actively respond to these problems. Core component of the intelligent distribution substation is the decentralized management of the low-voltage grid capacities. "Intelligence" in this respect means automatic identification of the grid status in real-time and provision of appropriate control and regulation measures so that the available grid capacity can be optimally utilized.

Key words: iNES, intelligent distribution substation, low-voltage grid, Smart Grids, Smart RTU, decentralized generation of renewable energy, a self-sustaining monitoring and control system, intelligent energy

INTRODUCTION

Over the last several years, Europe's energy supply systems has undergone fundamental changes, with drastic effects especially for the generation of electrical energy.
Centralized generation is increasingly replaced by decentralized generation of renewable energy.

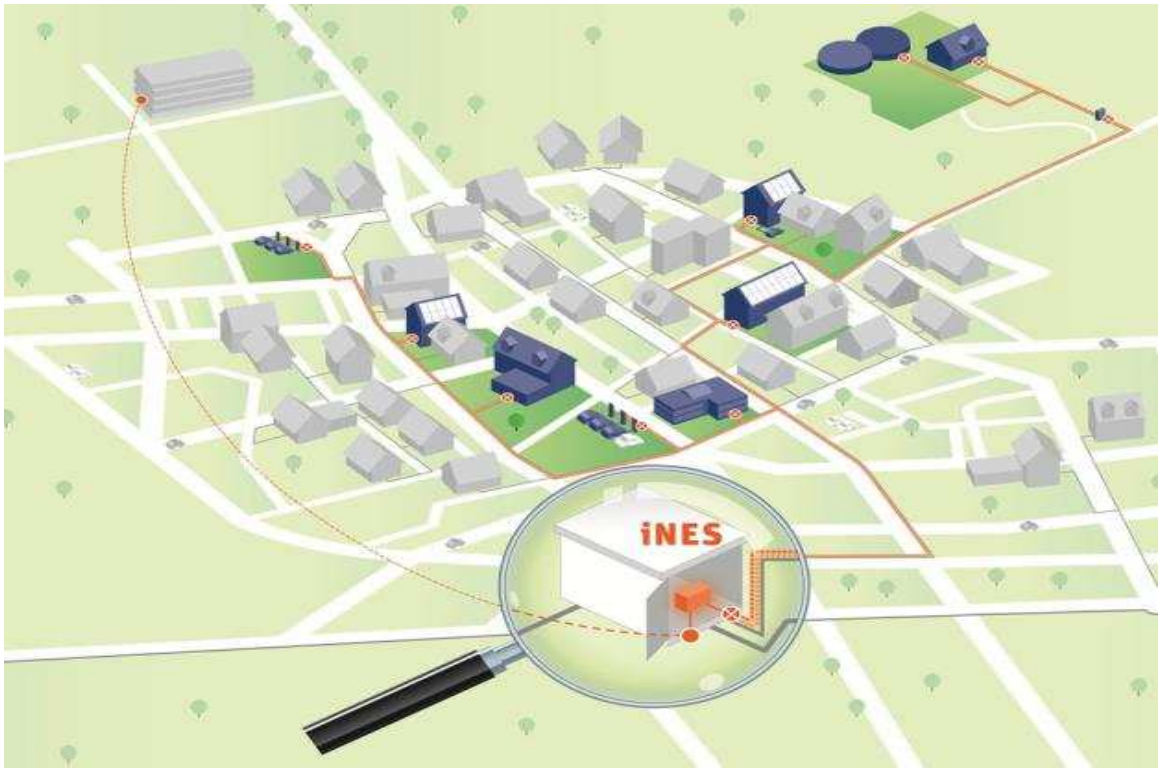


The existing medium and low voltage supply grids however, were not designed nor prepared to cope with the problems that may result from the volatile, decentralized feed-in of renewable energy,

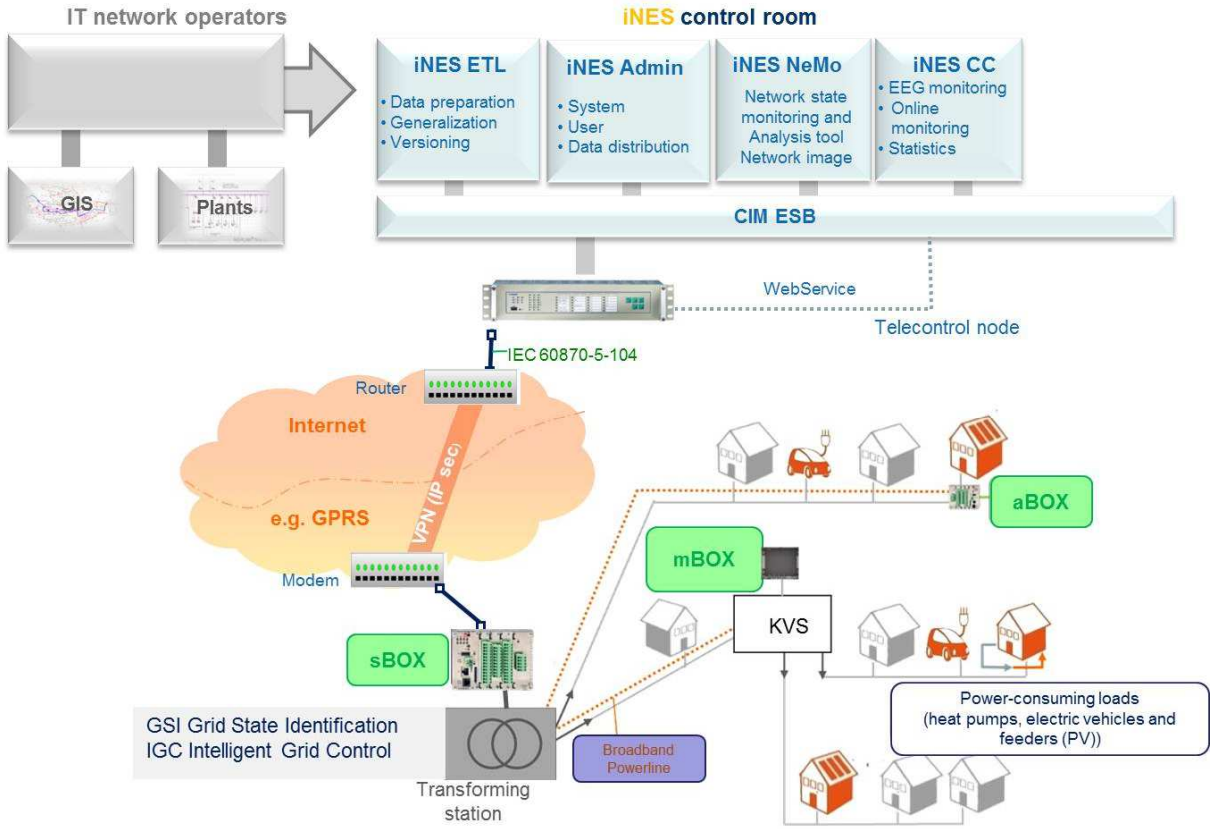
The problems which have to be solved are:

- voltage band violation
- maintaining voltage stability
- equipment overload.

To meet these challenges, a self-sustaining monitoring and control system for the low voltage grid has been developed. This system monitors the low voltage grid's infeed and power flow situation and controls individual decentralized generating units and consumer loads to compensate for any instability.



The system's core component is a new and cost-effective control unit (Smart RTU) installed in the distribution substation of the low voltage grid. The control unit communicates with the control sensors and actuators positioned in the grid at only a small number of critical points. Merely 10% to 15% of the network nodes and feed-in stations need actually to be equipped.



A newly developed power flow algorithm computes the grid status and determines possible changes in the grid topology, forming the basis for an intelligent, secure and self-sustaining grid control in real-time.

CONCLUSION

This innovative project has already received several awards. Amongst others, it received the Hessian States price in Germany for intelligent energy in the category "energy grids" and was appraised to be a very innovative alternative to conventional grid extension measures by the German Commission for Electrical, Electronic and Information Technologies of DIN and VDE.
The project was developed in cooperation with the University of Wuppertal in Germany, Bilfinger Mauell GmbH, Mainova AG Frankfurt, and SAG AG.