

# Grid integration of DER with an Intelligent Distribution Station containing Electricity Storage

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**Abstract—** In the near future the power flows in LV and MV distribution grids will increasingly fluctuate because of the growing number of Distributed Energy Resources and developments in power demand. To manage these fluctuations, while maintaining Power Quality and Reliability, an Intelligent MV/LV Distribution Station is designed by a Dutch consortium. In addition to the normal Distribution Station equipment, the Intelligent Distribution Station contains an electricity storage unit as well as extra monitoring and control equipment. Lab tests, modeling calculations and a demonstration in a live grid of the Dutch grid operator Continuon are planned. These will show to what extent this new type of equipment can help to improve the integration of Distributed Energy Resources into the LV-grid.

*Distributed Generation, Energy Storage, Power Quality, Distribution Grid*

## I. PURPOSE

The objective of the Intelligent Distribution Station is to monitor and control an underlying LV grid with a high degree of DER (Distributed Energy Resources) and simultaneous peak loads. Functions of the Intelligent Distribution Station are in the field of peak load management, improvement of Reliability, supply of Reactive Power, Power Quality Monitoring [1], Power Quality enhancement and additional services (such as fraud detection and energy management). Optional functionality will include the intentional islanding of LV grid segments during outages or service restoration.

## II. METHODS

To deliver these new functionalities, the Intelligent Distribution Station will integrate a new combination of state-of-the-art equipment. In addition to a normal MV/LV distribution station it contains the following equipment:

1. a 'SmartTrafo' smart transformer for stepless control of the voltage level on the LV busbar
2. a battery for storage of electrical energy
3. a bi-directional inverter coupled to the electricity storage unit
4. an agents based control system: the PowerMatcher [2]
5. a communication system between the Intelligent Distribution Station, smart meters and home appliances.

A schematic outline of the Intelligent Distribution Station is shown in Figure 1.

## Intelligent MV/LV-Distribution Station

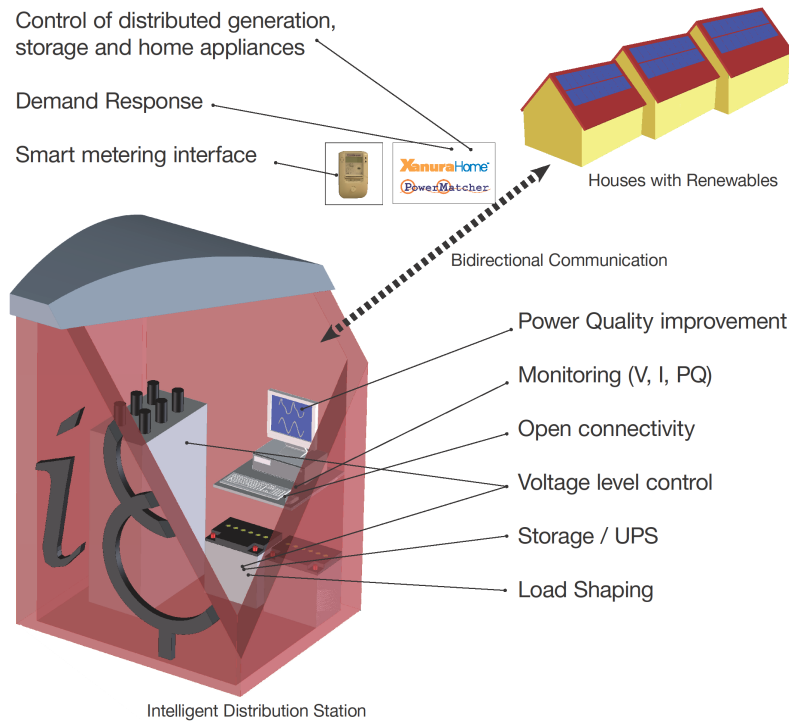


Figure 1. Schematic outline of the Intelligent Distribution Station, that monitors and controls a LV grid, DER units and home appliances.

### III. RESULTS

Currently the design phase is being finalized and test plans are being formulated. At the conference the final specifications of the prototype will be shown.

### IV. CONCLUSION

In 2009 and 2010 the results of the lab tests, modeling calculations and the live grid demonstration will be published. These will show to what extent this new type of equipment can help to improve the integration of Distributed Energy Resources into the LV grid.

### V. ACKNOWLEDGEMENTS

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