The embedment of ZUQDE-project into the power system holistic approach

Albana Ilo
University of Technology of Vienna
Institute for Energy Systems and Electrical Drives

FINESCE final event "Utility 4.0"
15-16 September 2015, Berlin, Germany
Central Volt/Var Control in presence of DG’s

ZUQDE → Zentrale Spannungs ($U$) – Blindleistungs ($Q$) Regelung Dezentraler Erzeuger

Project data

- Start: July 2010
- End: April 2012
- Funded by: Neue Energien 2020, Austria
- Total budget: ~0.55 Mio. Euro
- Partners: Salzburg Netz GmbH; Siemens AG
- Operation: The region Lungau in Salzburg, Austria was continuously operated automatically, in closed loop for more than one year.

Developed based on the:

- “Energy supply chain net” holistic approach
- Distribution System State Estimator
- Volt var control

Source: ZUQDE 2012, final Report

FINESCE final event "Utility 4.0", Berlin 2015
Per definition the "**Energy Supply Chain Net**" is a set of automated power grids, intended for “Chain Links” or “**Links**”, which fit into one another to establish a flexible and reliable electrical connection. Each individual “**Link**” or a “**Link**”-bundle operates independently and have contractual arrangements with other relevant boundary “**Links**”, “**Link**”-bundles, and suppliers which inject directly to their own grid. Each “**Link**” or “**Link**”-bundle is communicatively coupled with the other relevant “**Links**” or “**Link**”-bundle’s via the usual communication instruments.

A technical system consists of three major elements:

- **Hardware**
- **Automation**
- **Communication**

**Link - Paradigm**

**Source:** A. Ilo “Link- the Smart Grid Paradigm for a Secure Decentralised Operation Architecture”, accepted to be published in Electric Power Systems Research - Journal - Elsevier

FINESCE final event "Utility 4.0", Berlin 2015
Link - Paradigm

Architecture Elements

FINESCE final event "Utility 4.0", Berlin 2015
The distributed Link-based power system operation architecture


FINESCE final event "Utility 4.0", Berlin 2015
Medium Voltage Grid-Link type

Schematic presentation

Use case → Load-generation process


FINESCE final event "Utility 4.0", Berlin 2015
MV-Grid-Link and Producer-Link, realized and operated in the framework of ZUQDE project

Reactive power and voltage control
MV-Grid-Link and Producer-Link, realized and operated in the framework of ZUQDE project

Reactive power and voltage control

\[
\cos(\phi) = \text{const.}
\]

FINESCE final event "Utility 4.0", Berlin 2015
Conclusions

- The consideration of the holistic power system approach creates the possibility to eliminate the contradictions and challenges arising from the high DG share presence.

By using the ZUQDE-system:

- the voltage was controlled automatically and the network operation was being dynamically optimized in real-time.

- the grid have been operated with lower operational voltages.

- the demand reduction was realised smoothly. It was observed a load reduction potential of more than 5%.

- a further increase in DG production capacity in the critical Lungau MV grid section of about 20% is realistic.
Thank you for your attention

Albana Ilo
University of Technology of Vienna
Institute for Energy Systems and Electrical Drives
Telefon: +43 (0)1 58801 370114
Mail: albana.ilo@tuwien.ac.at

FINESCE final event "Utility 4.0"
15-16 September 2015, Berlin, Germany