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

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

ZUQDE → *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:

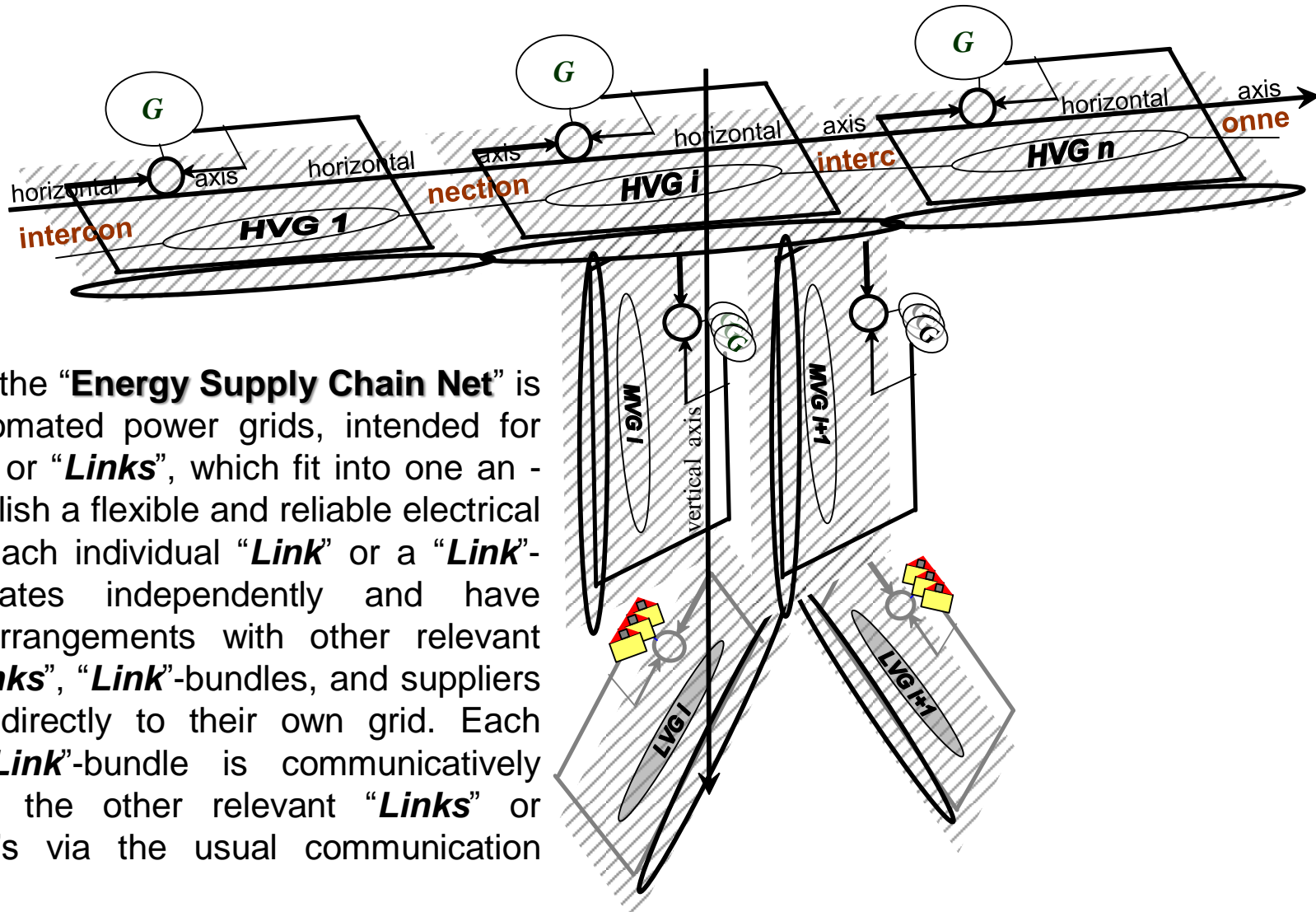
- **“Energy supply chain net” holistic approach**
- Distribution System State Estimator
- Volt var control

Source: ZUQDE 2012, final Report

A. Ilo, W. Schaffer, T. Rieder and I. Dzafic, “Dynamische Optimierung der Verteilnetze—Closed Loop Betriebsergebnisse,” VDE Kongress 2012, Stuttgart, Germany

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Power system overview based on the “Energy Supply Chain Net” model: horizontal und vertical axis



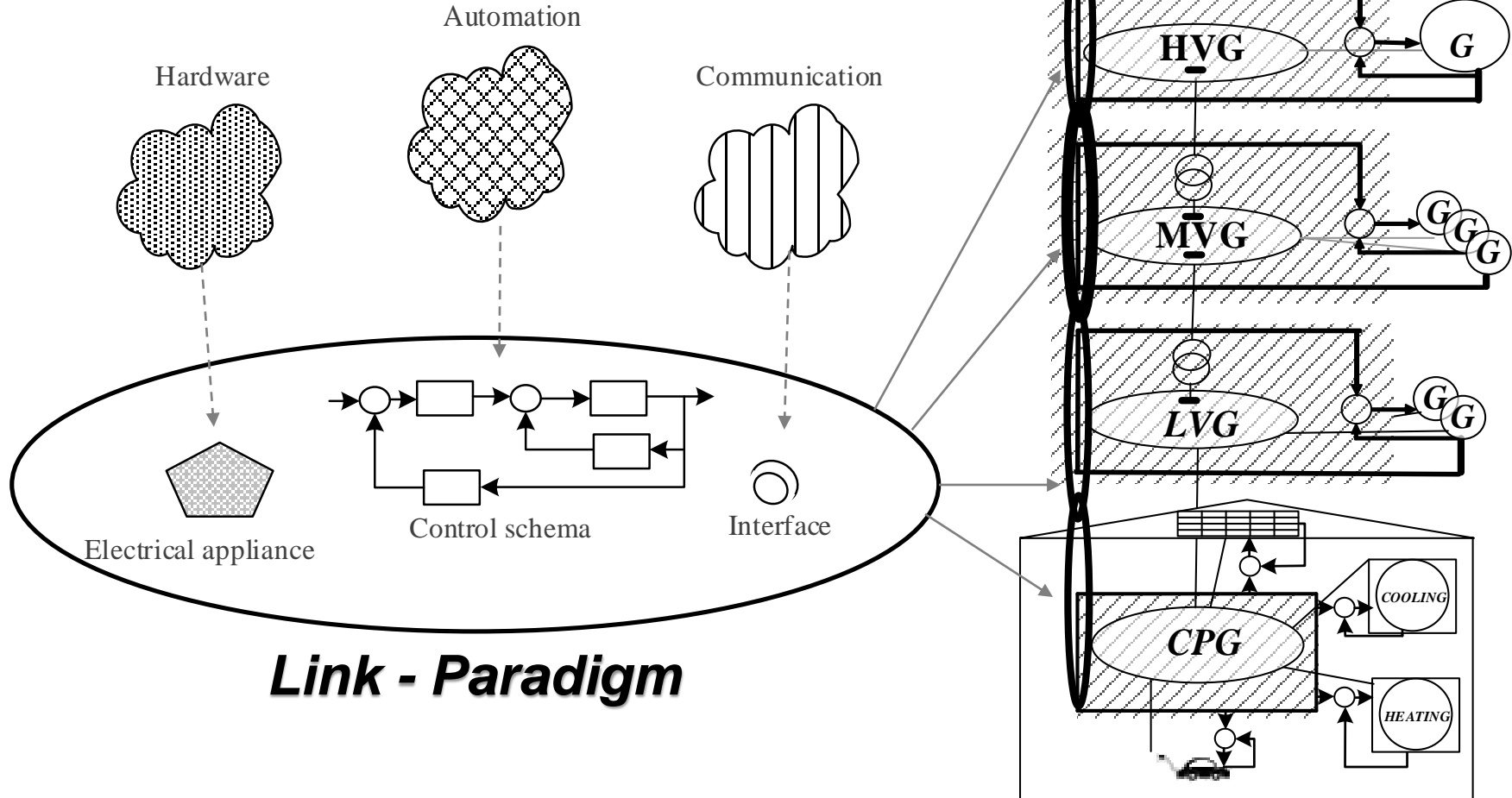
Per definition the “**Energy Supply Chain Net**” is a set of automated power grids, intended for “Chain Links” or “**Links**”, which fit into one another to establish a flexible and reliable electrical connection. Each individual “**Link**” or a “**Link**”-bundle operates independently and have contractual 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

Source: A. Ilo “The Energy Supply Chain Net”, *Energy and Power Engineering*, Volume 5 (5), July 2013.

“Energy Supply Chain Net” - Vertical axis

The Link Paradigm

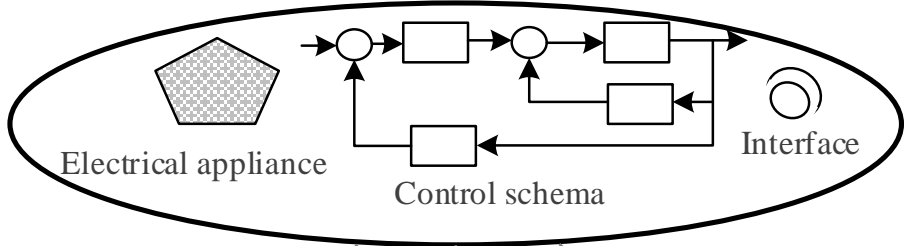
A technical system consists of three major elements:



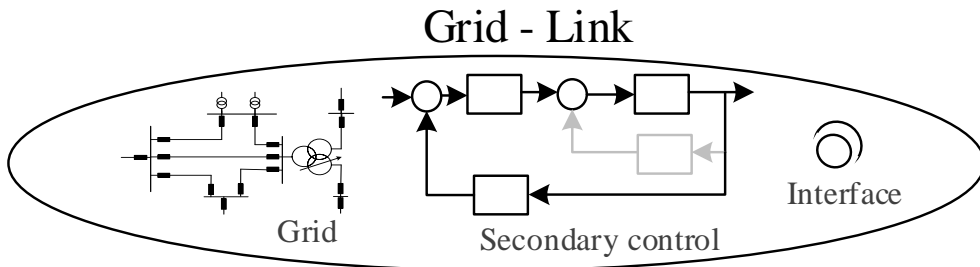
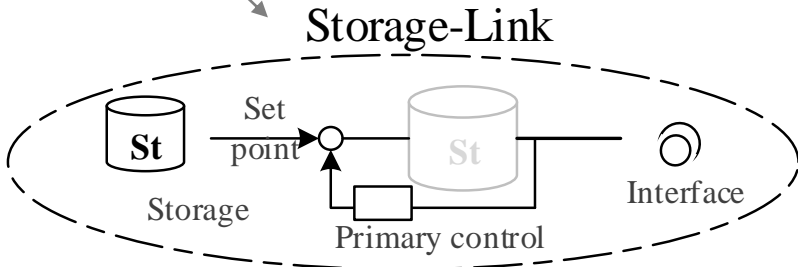
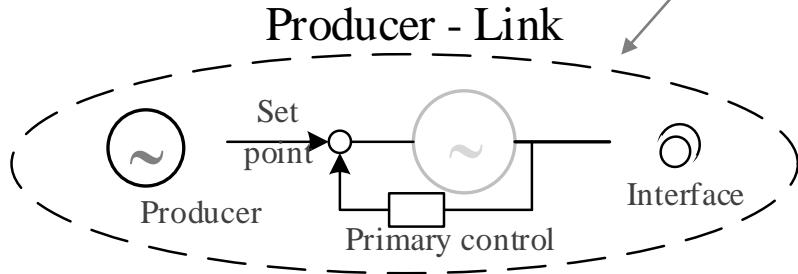
Link - Paradigm

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

Link - Paradigm

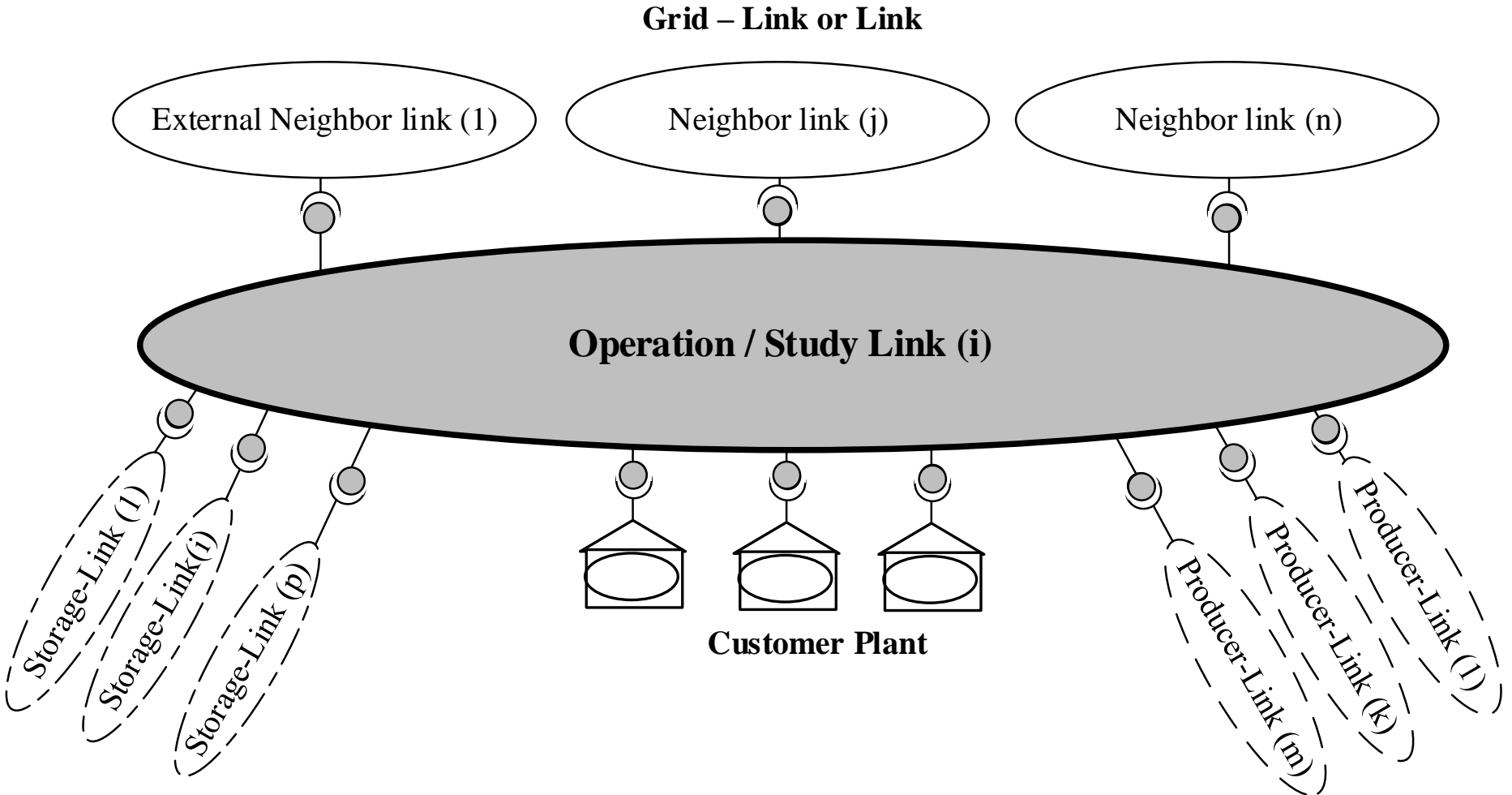


Architecture Elements



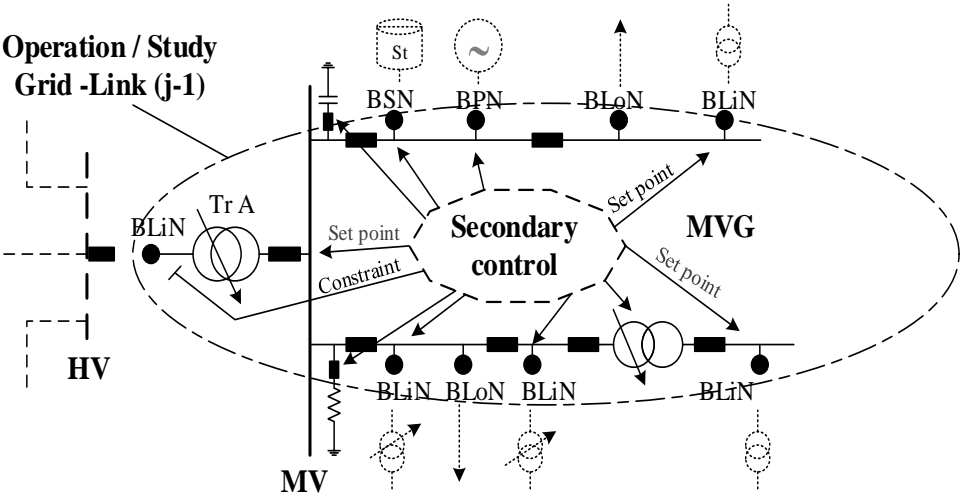
Source: A. Ilo "Link- the Smart Grid Paradigm for a Secure Decentralised Operation Architecture", accepted to be published in Electric Power Systems Research - Journal - Elsevier

The distributed Link - based power system operation architecture

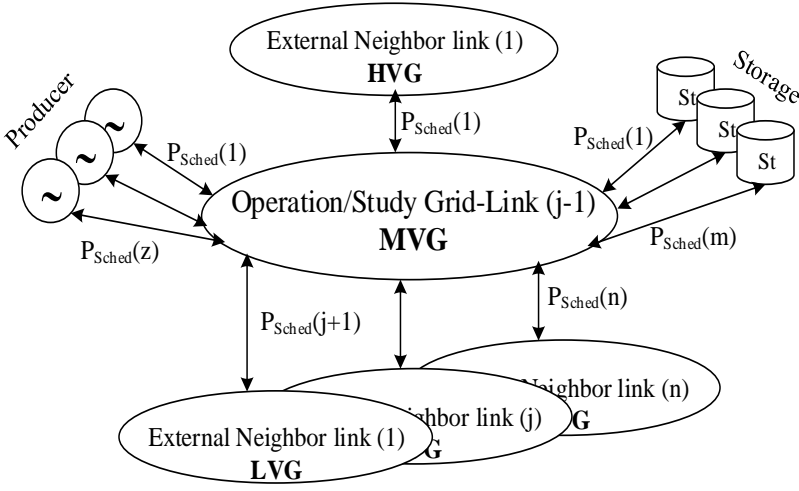


Source: A. Ilo "Link- the Smart Grid Paradigm for a Secure Decentralised Operation Architecture", accepted to be published in Electric Power Systems Research - Journal - Elsevier

Schematic presentation



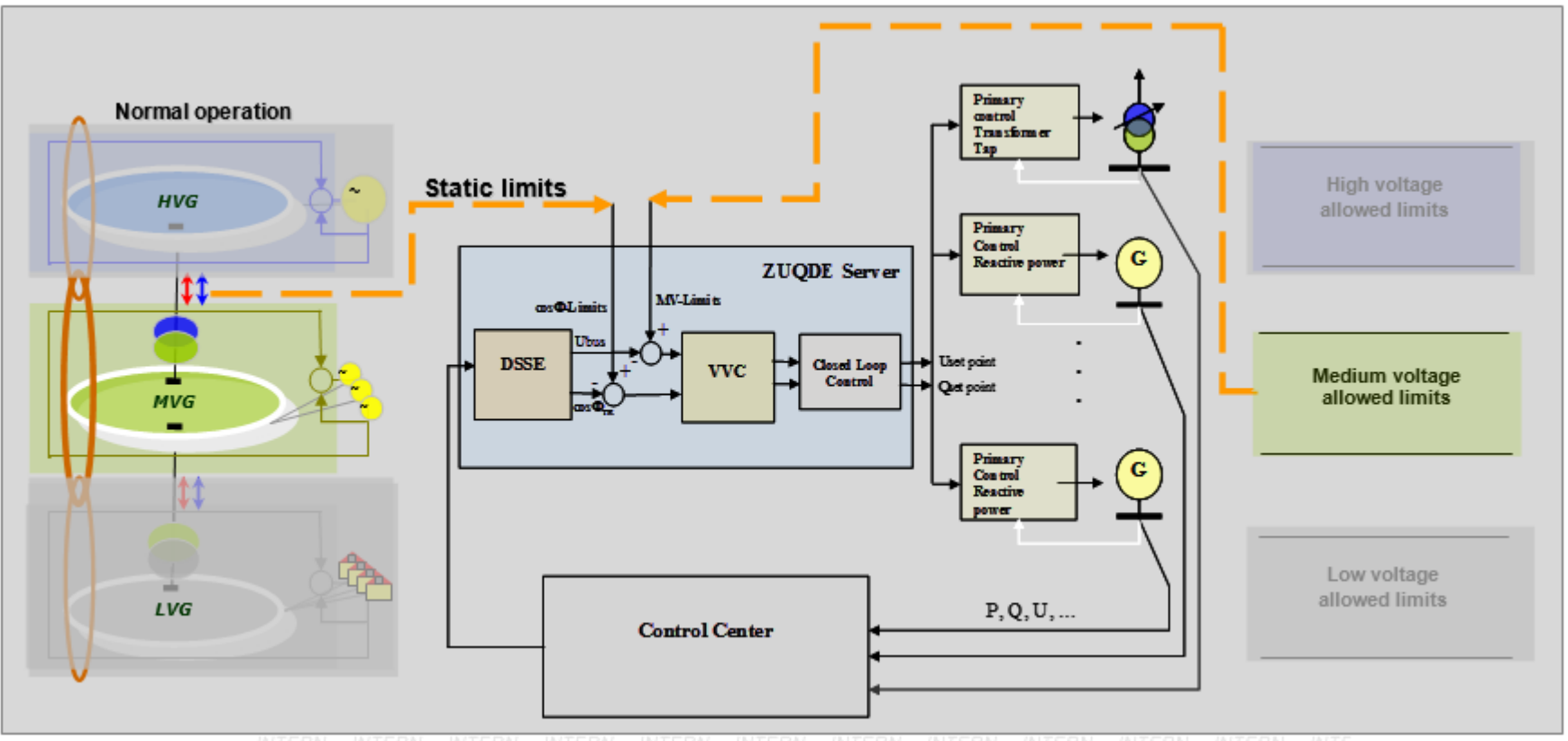
Use case → Load-generation process



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

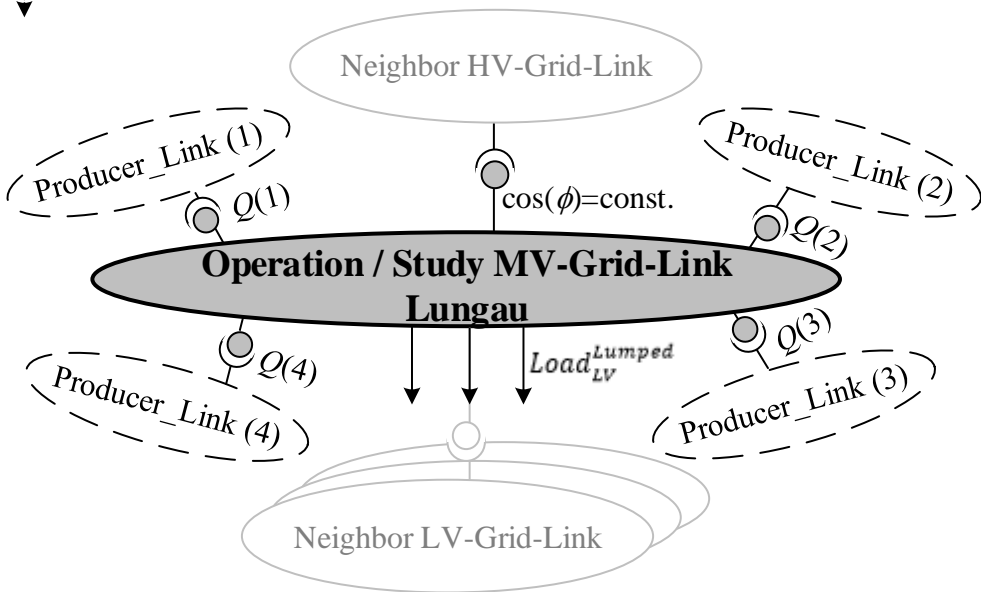
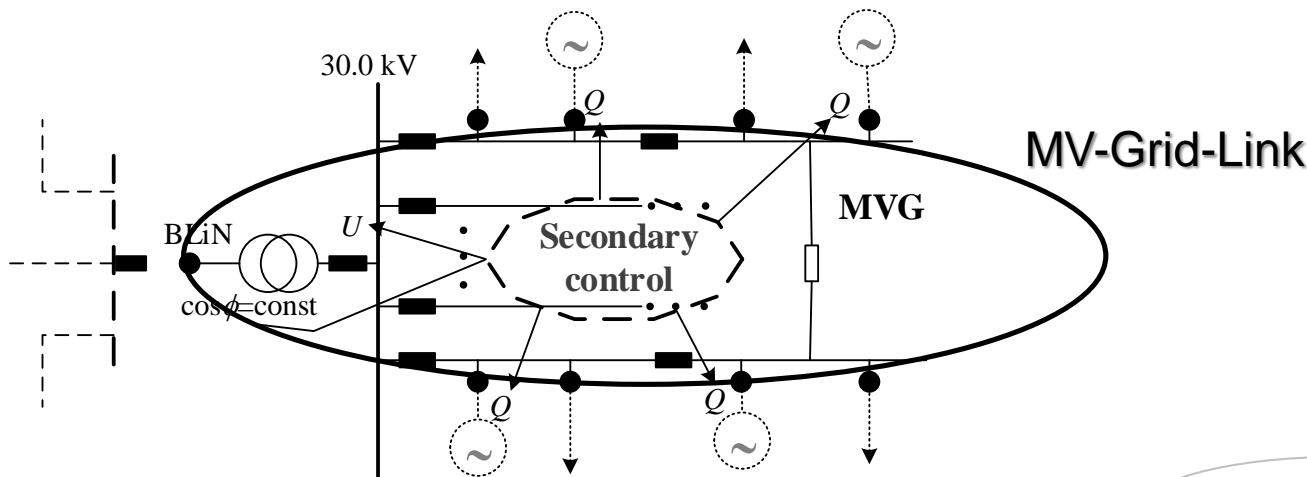
MV-Grid-Link and Producer-Link, realized and operated in the framework of ZUQDE project

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



- 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



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Thank you for your attention

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