

Power Systems Physics and Market Rules in Presence of High Distributed Generation Share

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Abstract: The holistic market power model is built on the “Energy Supply Chain net” holistic technical model of power systems. From the *LINK* paradigm and the *LINK*-based architecture is derived a flat business model across the whole electricity industry. Power market consists of horizontal and vertical balancing groups. In the horizontal balancing groups are classified the actual existing balancing groups operated from the transmission system operators, called transmission balancing groups. The newly introduced vertical balancing groups, called distribution balancing groups, should be operated from the distributed system operators. Both balancing

group operators, apart from operating their grids, also act as control area managers. In this role, they must ensure that injection and withdrawal of electric energy are balanced at all times. The aggregator remains as a market player but participates only in the distribution balance group, thus reducing drastically the number of exchanged data. Based on this model power systems analyses can be easily included in market power analyses, thus creating the condition for reconciliation of power system physics and market rules.

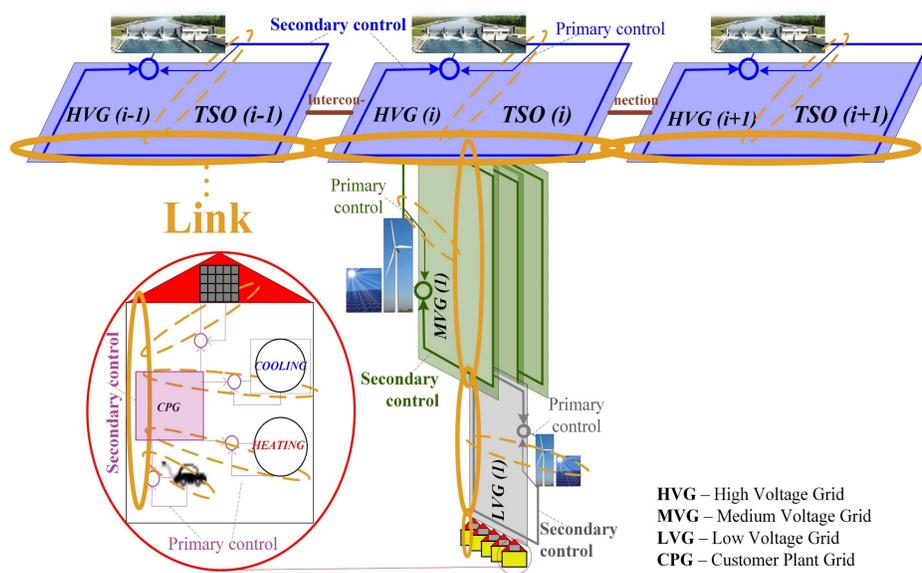


Fig. 1. “The energy supply chain net” – holistic model

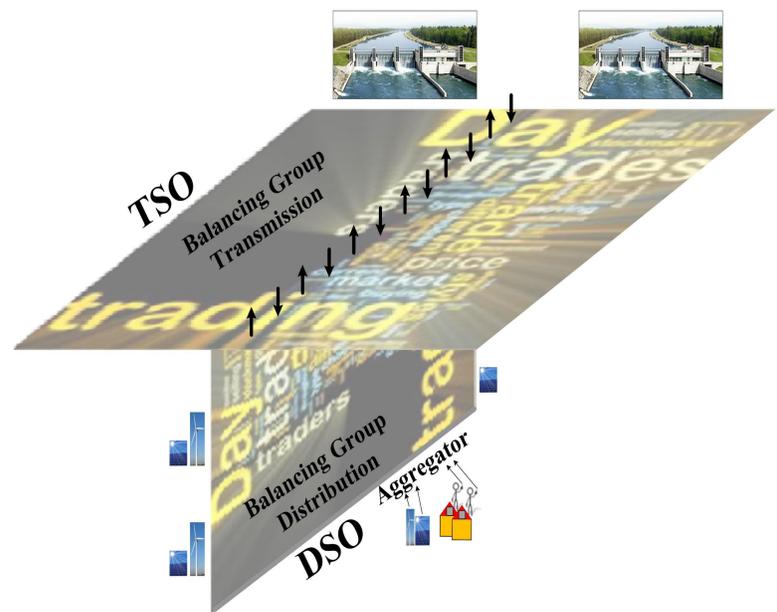


Fig. 2. Holistic power market model

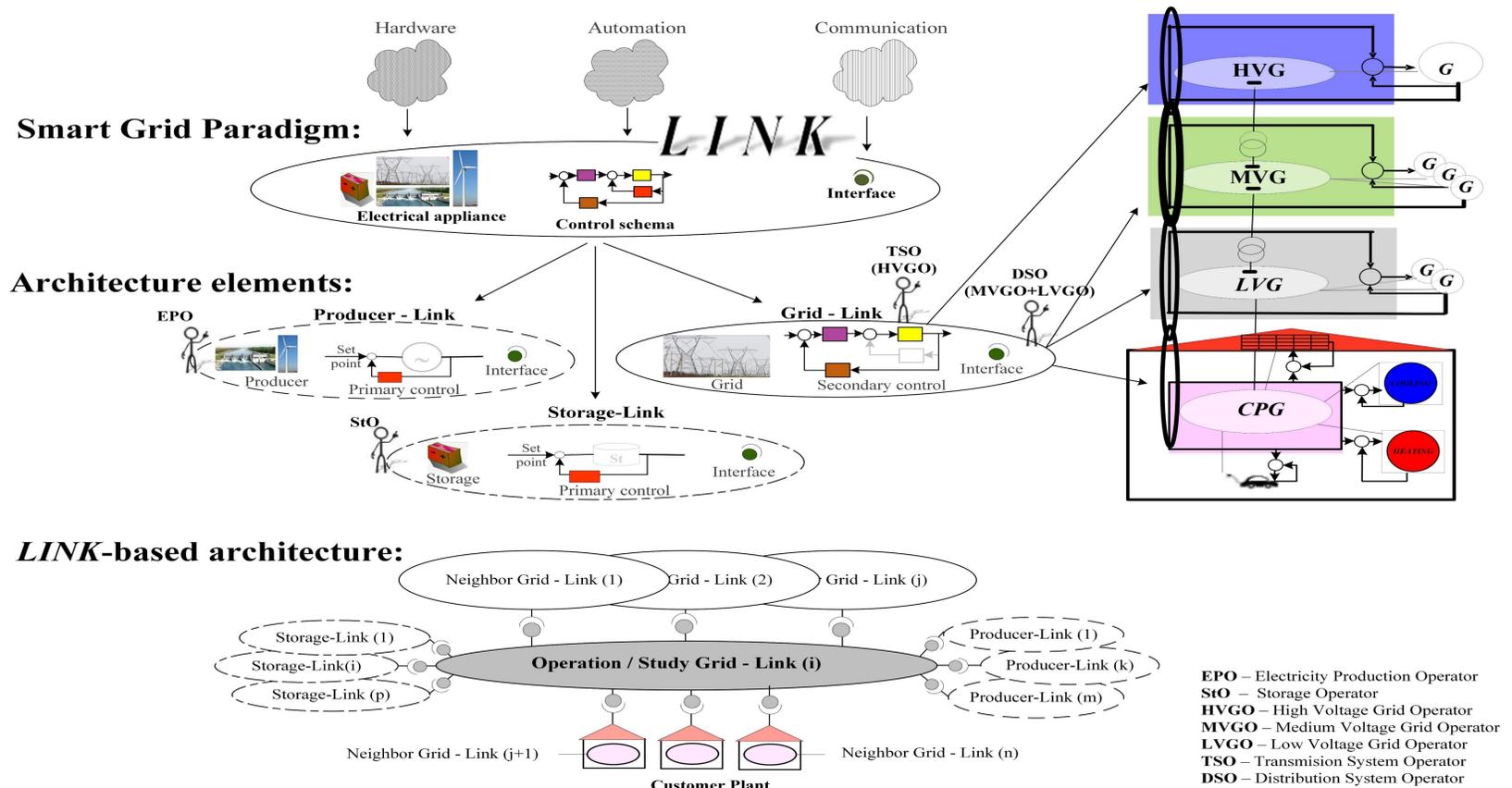


Fig. 3. Overview of the smart grid paradigm, architecture elements and the *LINK* – based architecture

Conclusions: The *LINK* paradigm and the derived *LINK*-based architecture enables allows a flat business model across the electricity industry. It requires fewer approvals from authorities, which leads to fast decisions as well as to faster realisation of technical and business solutions of higher flexibility and wider range than today’s possibilities. The presented holistic power market model fits perfectly with the energy supply chain net model and eliminates the challenges, which exist

between the power physics and market rules. The link structure with its secondary control routs the fluxes conform the market requirements. The distributed *LINK*-based architecture minimizes the amount of the data, which needs to be exchanged. As a consequence today’s ICT challenges are bypassed and costs for IT-infrastructure are drastically reduced.