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Title: Energy storage combined for flexibilization of power plants

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Abstract

The increasing global energy demand together with the need for more sustainability and safety of supply and competitive energy cost has led to considerable changes in energy policies all around the world. Especially in Germany but also in entire Europe over the past decade the penetration of renewable energy sources (RES) became remarkably visible in the electric grid. The intermittent character of the RES and their high cost now require new measures for balancing the grid and reducing the consequential cost burden.

The paper presents three novel approaches for integrating energy storage and conversion technologies in conventional power plants to make new and existing power plants more flexible towards grid balancing and value creation by new products.

The “Power to Methanol” (PTM) concept for energy storage is a technology which today easily can be applied to overcome many of the challenges which arise from the switch to more renewable energies. An oversupply and consequential curtailment of electricity can be avoided when in a cost competitive and sustainable way the trans-sectorial concept of energy transformation towards transport fuels like methanol derived from the power plants or grid electricity and CO₂ is implemented. The technology is especially suited to offer measure to absorb excess electricity while keeping (CHP) power plants always grid connected to provide primary and secondary control as well as back-up power.

“Liquid air energy storage” (LAES) is a technology for large grid scale applications. The LAES system developed jointly by MHPSE and Linde has similarities to compressed air energy storage (CAES) which both uses electricity to compress air during charging phase and uses air turbine expanders to produce electricity, but in LAES compressed air is further liquefied and stored in liquid air tanks on-site, thus avoiding CAES’ dependency on air-tight caverns. Therefore depending on grid configuration, a LAES facility can be installed near transmission substations, wind / solar generation facilities, or beneficially integrated in existing power plants for daily electricity storage.

“Battery/Generator-Combination” is the implementation of a battery storage module direct into the electric system of a power plant. It is raising the capability for grid balancing of this unit significantly. This leads to the advantage that smaller power plant units can serve the same grid balancing work and so also minimize the must run capacities for the “Energiewende”.