ENERGY STORAGE FOR GRID SCALE APPLICATIONS COMBINED WITH CONVENTIONAL POWER PLANTS – INNOVATIVE CONCEPTS FOR SUSTAINABLE ENERGY CONVERSION AND USE

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Abstract

The increasing global energy demand together with the need for more sustainability and security of supply and competitive energy cost has led to considerable changes in energy policies all around the world. Over the past decade especially in Germany but also in the entire Europe the penetration of renewable energy sources (RES) became remarkably visible for the electric grid. The intermittent character of the RES and their massive introductions call for new measures for balancing the grid and reducing the consequent cost burden.

The paper presents two novel approaches for grid-scale energy storage to balance the volatile energy production of RES. Technology is available to integrate 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 cross sectoral approach of Power to X storage technologies, where X can be liquids, fuels or power, offers a double advantage, namely decarbonization and electricity storage.

The “Power to Methanol” (PTM) concept for energy storage is a technology which today 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 electricity is stored in transport fuels like methanol which is produced using grid electricity and CO2.This technology is also a demand side management (DSM) service to absorb excess electricity while keeping 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); they both use electricity to compress air during charging phase and they use air turbine expanders to produce electricity during discharging phase, 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.