This paper presents the results of a thermodynamic and economic evaluation of a novel hybrid combination of a compressed air energy storage (CAES) and a combined cycle power plant (CCPP). The new cycle is modeled on the basis of a GE LM6000 gas turbine model, an adiabatic compressor model, an air expander, and a conventional dual-pressure heat recovery steam generator (HRSG) configuration. Furthermore, a detailed design of the recuperator is presented. With the simulated components, a storage efficiency of 60% is reached. In combined heat and power (CHP) configuration, the total efficiency of the plant reaches up to 86.2%. The thermodynamic and economic performance is compared to a conventional LM6000 combined cycle. For the economic evaluation, the German electricity day-ahead prices and average gas price of the year 2014 are used. Overall, it is found that the CAES/CCPP concept exhibits far more operation hours per year and a higher profit margin than the compared CCPP. Taking into account the investment and operational costs, especially with steam extraction, the net present value (NPV) of the novel cycle is higher than that of the combined cycle, despite the challenging market environment for storage technologies in Germany.