Financial Feasibility of Storage Technologies in Electricity Systems: Empirical Evidence from Chile

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Overview

In recent years, electricity generation from intermittent and unpredicted nature of Renewable Energy Technologies like wind and solar energy has increased substantially in many countries. These technologies have some unique characteristics compared to the traditional technologies, which create challenges in planning and operating power systems. Among the potential impacts, the emergence of high penetration rates of renewable energy sources in the energy mix of power systems presents a great challenge in energy generation and load balance maintenance to ensure power network stability and reliability. There have been great efforts in looking for possible solutions, including Electrical Energy Storage (EES), demand side management (demand response, intelligent energy systems, and smart loads) and, interconnection with external grids. Amongst all the possible solutions, EES has been recognized as one of the most promising approaches [1-4]. The reason is that EES can have multiple contributions to power network operation and load balancing. These mainly include (i) meeting peak electrical load demands, (ii) providing time varying energy management, (iii) improving power quality/reliability, (iv) meeting remote and vehicle load needs, (v) supporting the realization of smart grids, (vi) helping with the management of distributed/standby power generation, and, (vii) reducing electrical energy import during peak demand periods [1-4]. Today, storage technologies, going from batteries to pump-storage plants, are increasingly relevant as the technologies pass the demo and prototype phases to a wide market implementation phase. The only remaining barrier for its implementation is the price tag of the storage systems, but even this barrier is quickly disappearing. The main purpose and contribution of this paper is to evaluate the financial feasibility of storage technologies in electricity systems and, in particular, if such technologies are financially sustainable, or if not, how far they are from becoming viable.

Methods

In order to provide empirical evidence, the analysis includes examples of applications of storage technologies in the Northern Interconnected System of Chile (SING). These cases include six power plants with leading renewable technologies: wind and PV solar. The analysis considers simulations having storage system operated to run focused on minimizing transmission losses, price arbitrage and postponement of transmission investment.

Results

The results obtained from the simulations show that, using current prices of the studied technologies, the rate of return will depend heavily on the operation strategy used in the system. If storage is used to diminish transmission losses, the rate of return will be far below the breakeven line. On the contrary, if the storage is used for price arbitrage, the rate of return will be close to profitability. An improvement on storage efficiency or a decrease on the cost of storage systems could make this type of investment financially viable in the near future.

References

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