Paris energy storage economics

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The energy systems of developed countries are undergoing a fundamental transformation towards sustainability requirements, with the dominance of renewables and the decline of fossil fuels. Although renewable energy sources are environmentally friendly, they cannot supply the required amount of energy in an evenly distributed manner. Owing to the volatility of the power source and demand, various energy-storage systems have become increasingly important.

The European Union is making extensive efforts to restructure its energy infrastructure. With respect to the Paris Climate Agreement, nations around the world are driving forward the transformation of their energy industries and industrial sectors away from fossil fuels and towards renewables. The goal is to achieve a climate-gas-neutral energy economy by 2050. Coal phase-out will be binding upon all EU member states by 2038.

The loss of conventional power plant capacities leads to a reduced supply of spinning reserves and qualified primary control power. However, renewable energy sources can only provide these system services to a limited extent. Therefore, industrial-scale energy storage facilities are necessary to stabilise the European power grid. They can compensate for the residual loads by providing positive and negative control powers required for load control within the grid.

One such solution is the use of autonomous cellular energy systems. These regional balancing groups offer electric power according to demand (location-, time-, and quantity-based) from the point of view of sources, to store it and to obtain it from the point of view of sinks.

Currently, energy storage system (ESS) projects are highly desirable in society and are widely discussed [3, 4]. ESS are essential technologies for the modernisation of the electric grid. The balance between supply and demand, stability, control of voltage and frequency delays, and improvement in the quality of electricity supply are all important attributes that make ESS-type technologies suitable for application.

The financial cost of a system is also an important factor in deciding whether to use a particular technology [9]. Although prices are expected to decrease in the future as technology becomes more widely used, other energy storage systems may still be more advantageous for some applications. The decision to use a particular energy storage technology should not only analyse the technical parameters but also reflect the economics of the project.