Malaysia compressed air energy storage

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The development and utilization of renewable energy is an important remedy for the worldwide fossil energy crisis and environmental pollution issues [1]. Due to the volatility and randomness of renewable energies, such as the wind and solar power, integration of such energy resources into power grid imposes great challenges on the secure operation and power quality of modern power systems [2]. Thus, how to utilize renewable energies in a safe, efficient and economical way has gained much attention.

Energy storage technology is an important means to solve the above problems. With the capability of reshaping the load profile, energy storage system (ESS) adds additional flexibility on system operation and helps utilize large-scale renewable energy [3]. Meanwhile, large-scale energy storage technology can reduce the gap between peak and valley loads to enhance the efficiency of generation assets. Undoubtedly, ESS plays

an important role in smart grid and energy internet and becomes a hot topic in the field of energy research [4, 5].

The effectiveness of hybrid energy storage by combing micro CAES with flywheel ESS is modeled and verified in [6]. CAES and super capacitors based hybrid ESS is also verified in [7]. The joint operation of power system considering pumped storage and distributed CAES is investigated in [8].

Undoubtedly, CAES technology is still in the early stage of development. To understand CAES technology deeply and explore future application directions, this paper introduces the fundamental principles and the state of the art of CAES technology, and analyzes the related key technologies and research progress. Application prospects of CAES in smart grid and energy internet are also depicted to promote the development and application of CAES technology.

CAES is an energy storage technology based on gas turbine technology, which uses electricity to compress air and stores the high-pressure air in storage reservoir by means of underground salt cavern, underground mine, expired wells, or gas chamber during energy storage period, and releases the compressed air to drive turbine to generate electricity during the stage of power supply [13, 14]. In simple terms, the charge life of CAES depends on its mechanical level, which means it is not easy to become fatigue as the battery. Normally, the life of CAES is 30 to 40 years.