# Dushanbe energy storage research and development

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Being in line with the strategic goal of the Republic of Tajikistan in ensuring energy security and development of internal and external energy infrastructure (electrical networks and substations) as one of its top priorities in the National Development Strategy 2030, JICA supported the construction and rehabilitation of two substations in Dushanbe city, which are directly contributing to achieving of energy sector strategic goals.

Construction of the distribution substations with cutting-edge technologies will improve the issues of supply reliability, such as frequent power outages caused by substation equipment"s overload and abrupt power outages raised from the failure of aged equipment.

In this paper, the energy storage technology profiles, application scenarios, implementation status, challenges and development prospects are reviewed and analyzed, which provides a useful reference to the future energy storage technology development in terms of electricity market, investment decision and policy formulation.

According to the way of energy stored, the energy storage technology can be classified into five major categories, i.e. mechanical energy storage, heat-energy storage, electrochemical energy storage, magnetic energy storage and chemical energy storage [33].

Redox flow battery mainly includes vanadium redox flow battery, zinc bromine flow battery. The vanadium redox flow battery has long lifespan and high life cycle, but has disadvantages of low energy and power density, slow response. Zinc bromine flow battery has advantage of high energy density, low cost and frequent deep discharge, but it also has the problem of high self-discharge rate caused by electrode reaction producing complex.

Sodium sulfur battery has advantages of high energy density, good power characteristics, and long cycle life and so on. It has become well-developed MW level electrochemical energy storage technology, and has realized commercial operation. However, it uses the flammable metal sodium material, and operates in high temperature (300-350?C) conditions, which poses an issue of safety risk. The comparative analysis of various types of electrochemical energy storage technologies is shown in Table 2.

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