World's Largest Superconducting Flywheel Energy Storage System

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1. Introduction

RTRI has developed a superconducting flywheel energy storage system (Fig.1). It has a large flywheel (4,000 kg with a diameter of 2 m) levitated by an innovative superconducting magnetic bearing devised by RTRI. This system is the world's largest mechanical type of energy storage system that can be discharged and charged. The significant merit of this system is that it implemented high-temperature superconducting technology at a commercial machinery level for sustaining a superconducting state without using a refrigerant such as liquid nitrogen.

2. Superconducting Flywheel Energy Storage System

A flywheel energy storage system works by converting electric energy into the kinetic energy of a flywheel. It can be charged by increasing the revolution speed, and conversely, discharged by decreasing the revolution speed. One of the characteristics of this system is that the flywheel size has been enlarged to raise its output and capacity. Another characteristic is the use of a superconducting magnetic bearing that can levitate such a heavy object weighing about 4 tons and keep the flywheel floated for a long period of time while minimizing the loss of rotating energy. Maximum revolution speed of this system is 6,000 rpm and its output is 300 kW. It has an energy storage capacity of 100 kWh, indicating that this is the largest superconducting flywheel energy storage system in the world.

3. Future Perspectives

While solar power generation gives clean and renewable energy, it is difficult to provide stable power generation. An objective of the newly developed superconducting flywheel energy storage system is to realize smooth output of power generation by concurrently using solar power generation. It is expected that this concept will facilitate stable power supply from solar power generation to grid electricity. Moreover, by installing our system in each electric railway substation, the charging and discharging of the regeneration canceled energy can be implemented, thereby contributing to the improvement of the railway energy efficiency.

The development of this system has been carried out since FY 2012 and is subsidized by the New Energy and Industrial Technology Development Organization.

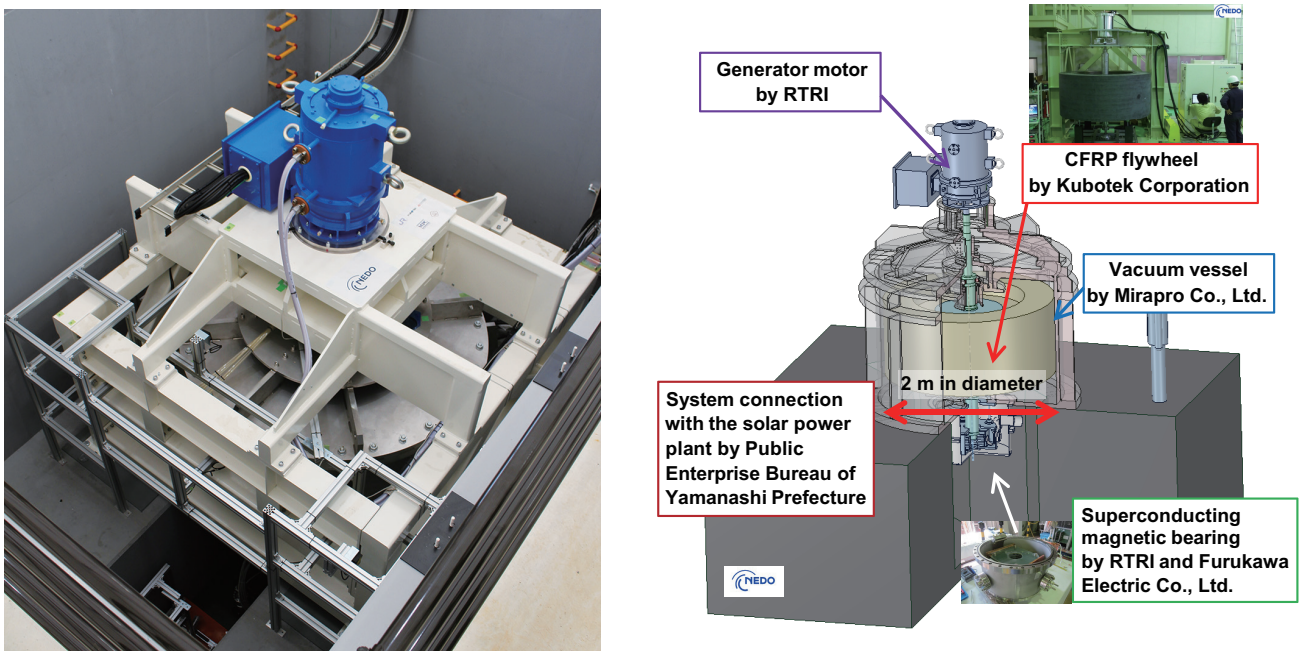

Fig.1 Superconducting Flywheel Energy Storage Unit