

Energy Storage System for a Pulsed DEMO (P3-J-177)

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Several designs have been proposed for DEMO, some of which will operate in pulsed mode. Since a fusion power plant will be required to deliver continuous output, this challenge must be solved. For the reference DEMO, energy storage is required at a level of 250 MWhe with a capability of delivering a power of 1 GWe.

Although DEMO is scheduled to be built in about 30 years, the design of the energy storage system must be based on current technology, focusing on commercially available products and on their expected future trends.

From a thorough review of the different technologies available, thermal energy storage, compressed air energy storage, water pumping, fuel cells, batteries, flywheels and ultracapacitors are the most promising solutions to energy storage for a pulsed DEMO. An outline of each of these technologies is described in the paper, showing its basis, features, advantages and disadvantages for this application.

Following this review, the most suitable methods capable of storing the required energy are examined. Fuel cells are not suitable due to the power requirement. Compressed air energy storage has a lower efficiency than the required one. Thermal energy storage, based on molten salts, so more energy can be stored with a better efficiency, and water pumping are shown as the main solutions, based on existing technology.

However, those are not the only solutions capable of solving our challenge. Hydrogen production, using water electrolysis, hydrogen storage and combustion in a combined cycle can achieve our energy and power requirements with an acceptable efficiency.

All these solutions are studied in detail and described, evaluating their current cost and efficiency in order to compare them all.