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SMES usage and power grid applications at RIs

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The on-going increase of regenerative energies with the strong meteorological fluctuation, leads to high strain for the stability of the 50 Hz grid frequency. To keep the 50 Hz stable the transmission system operators use the primary control for fast acting. This primary control has to be active for the first 15 min till other regulations take over. Short-time energy storages can be used for this purpose. Although only a comparably small amount of energy can be stored, they are able to provide high power for this period of time. They can be charged and discharged rapidly and have a high degree of efficiency. Superconducting magnet energy storages (SMES) belong to this group of short-time storages and a frequency stabilisation is possible. Due to the high investment, this technology is not used nowadays. However, in the long term operation no further wear and tear occurs, which keeps the maintenance costs low.

Particle accelerator sites have already a large amount of assets that may reduce the cost for the operation of a SMES. These are on one side soft skills like the knowledge of the operation of superconducting magnets structures with the corresponding protection, the power electronics, regulation and control technology. Additionally, there is hardware available such as powerful high voltage connections to the mains, reactive power compensation, cryo plant, etc.

At DESY a study was done to check the use of a SMES for the primary control. For dimensioning a potential SMES, parameters of existing plants were taken as e.g. LHC or ITER. The technical functionality with power supply, regulation and protection was simulated. Additionally, the regulation behaviour with real frequency data of the mains of 2012 was investigated. Finally, the German reserve market was analysed to check a possible amortization of such a plant.

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