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# Energy Storage Modeling Library (ESML) for DC NANO- GRID

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When renewable energy introduces the term "energy storage"automatically comes. Because electric power is consumed the instant it is produced so electrical energy storage technologies are designed to absorb electrical energy directly and release it as electrical energy (act like a generator) at a later time. To mitigate the problem of intermittency of renewable energy as well as to improve the controllability of transmission and distribution systems, energy storage is an important factor. It can be used from a very small scale to large scale such as cell-phone, pumped hydro storage (PHS), compressed air energy storages (CAES) and so on. For medium or high power applications, micro grid can be used to provide power to its local area. But when there is need of a medium scale or large-scale energy storage, and PHS and CAES are unavailable, the only solution is to integrate small-scale energy storage systems together to form an energy storage DC Nano-grid. So, modeling of different types of storage devices and techniques is very important issue to figure out more about various characteristics of each one before starting the control, management and implementation process. Different storage devices and techniques are modeled and simulated in this work as the following: Lead-acid battery, Nickel-Cadmium (Ni-Cd) battery, Nickel-metal hydride (NiMH) battery, Lithium-ion (Li-ion) battery, ZEBRA battery, Sodium-sulfur battery, Ultra-capacitor, Flywheel energy storage (FES), Super-conducting magnetic energy storage (SMES), Vanadium redox flow battery (VRB), Zinc bromine flow battery (ZnBr), Compressed air energy storage (CAES) and Pumped hydro storage (PHS). MATLAB software, Simulink and Power System toolbox are used in modeling and simulation process. Then the concept of energy storage DC Nano-grid based on the different results characteristics is illustrated. Finally, a comparison of energy storage technologies for power Applications is presented.

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