TECHNO-ECONOMIC STUDY ON MITIGATION OF SOLAR INTERMITTENCY USING BATTERY ENERGY STORAGE SYSTEMS

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Thesis/Dissertation submitted in partial fulfillment of the requirements for the degree Master of Science in EE

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Dr. L.N. Widanagama Arachchige

Abstract

According to the government policies, it has been planned to integrate at least 20% of non-conventional renewable energy (NCRE) by year 2020. Among all these NCRE sources solar power has the lowest capital cost and smallest implementation period. Since solar is an intermittent power source, its output power varies drastically with the cloud cover. This phenomenon results in power system stability issues. With varying power generation, system frequency tends to vary risking the stability of the power system.

In the least cost long term generation expansion plan 2018 – 2037 of Ceylon Electricity Board, it has been proposed to integrate 1,000 MW of solar capacity into the Sri Lankan network by year 2025. Among this, 300 MW will be connected as rooftop solar plants to the low voltage network and the remaining 700 MW will be connected to the medium and high voltage network as 1 MW-10 MW plants or solar parks.

But with the current generation mix, this total solar power isn't be able to absorb to the national grid due to stability issues. Therefore, Battery Energy Storage Systems has been utilized in order to maintain system stability according to the grid code while absorbing 1000 MW of solar power into the system. 150 MW of battery capacity has been required to maintain the frequency stability and could be commissioned as 50 MW each in Kolonnawa, Kappalturei and Hambantota grid substations considering the power loss.

Keywords: *Solar power, Battery Energy Storage Systems, Power system stability, intermittency.*

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