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Optimal Power Flow with Hydro-Thermal Scheduling Incorporating Battery Energy Storage System (BESS) Using Driving Training Based Optimization (DTBO)

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Abstract:
Nowadays, energy storage devices are crucial to interconnected power systems. They could be applied to peak shaving in addition to reducing variations brought on by dispersed power sources. The ability to include massive battery energy storage system (BESS) into power systems is made feasible by advancements in battery technologies. The impact of BESS on hydro-thermal scheduling is examined in this paper using optimal power flow (OPF) model that incorporates BESS. The suggested model aims to reduce the overall cost of generation while taking the BES's charging, discharging expenses into account and to reduce the frequency deviation. The model takes into account various power network constraints in addition to state of charge (SOC) constraints. The suggested model establishes the ideal output power for every interval and the timing of battery charging and discharging. The usefulness and validity of the suggested model are demonstrated by the numerical example based on the IEEE-57 system. Driving Training Based Optimization (DTBO) has been used to find the best solution.

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I. Introduction
It is necessary to make improvements to the conventional p ms. The goal of this work is to optimize generation scheduling over a long time horizon by utilizing the possibl storage devices.

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***Abstract*—Now a days, energy storage devices are crucial to interconnected power systems. They could be applied to peak shaving in addition to reducing variations brought on by dispersed power sources. The ability to include massive battery energy storage system (BESS) into power systems is made feasible by advancements in battery technologies. The impact of BESS on hydro-thermal scheduling is examined in this paper using optimal power flow (OPF) model that incorporates BESS. The suggested model aims to reduce the overall cost of generation while taking the BES's charging, discharging expenses into account and to reduce the frequency deviation. The model takes into account various power network constraints in addition to state of charge (SOC) constraints. The suggested model establishes the ideal output power for every interval and the timing of battery charging and discharging. The usefulness and validity of the suggested model are demonstrated by the numerical example based on the IEEE-57 system. Driving Training Based Optimization (DTBO) has been used to find the best solution.**

***Index Terms*—OPF, LFC, DTBO, BESS, PID.**

I. Introduction

It is necessary to make improvements to the conventional power generation scheduling systems. The goal of this work is to optimize generation scheduling over a long time horizon by utilizing the possible integration of large-scale energy storage devices.

Over the past few decades, several heuristic and conventional optimization algorithms have been given by researchers to address the OPF challenges. The performance of the control techniques was assessed by G.O. Cimuca [1] who created its for a flywheel energy storage device connected to a wind generator. C. Abbey and G. Joos' study [2] examines the use of super capacitors for energy storage in wind energy applications. An hourly-discretized optimization method was developed by Castronuovo and Lopes [3] to find out the best daily operation plan for wind turbines with hydro generating pump storage devices. In order to optimize the cost of the hydro-thermal scheduling system combining PV units, Rituraj Singh Patwal [4] suggests PSO with mutation methods (PSO-MS). Evolutionary programming techniques have been introduced by Hota et al. [5] to address the issue of generation/pumping scheduling in hydrothermal systems that utilize pumped storage plants. The scheduling problem for hydrothermal generating with a pumped-storage unit was modeled by Neshad et al. [6] and solved using lexicographic optimization. A modified sub-gradient approach is used to find the ideal schedule for the OPF problem in the existence of a pumped-storage unit, as reported by Fadil and Urazel [7]. BES devices could modify its i/p and o/p power more quickly than conventional energy storage systems, allowing it to respond to changes in the environment. Furthermore, battery energy storage's rated capacity and power have increased to hundreds of MWh and dozens of MW [8], encouraging a wide range of uses in power systems. The integration of battery energy storage systems has made some recent advances, as documented in [9]. Sunanda et al. [10] suggested moth flame optimization (MFO) to schedule hydrothermal systems' best generation while integrating renewable energy sources (RESs) like wind and solar power. In order to solve the optimal wind-solar-hydro-thermal scheduling problem while taking valve loading effects into account, Prahlad et al. [11] suggested an improved cheetah optimizer (ICO).

The suggested approach uses both traditional generators and BESS with the goal of lowering the load frequency variation and the total cost of generation. The best generating outputs

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