運用・環境観点に基づくスマートグリッドの最適運用

Form 3

Abstract

Title: **Optimal Smart Grid Operations with Economic and Environmental Aspects**
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World-wide power generation sectors are interested to smart grid. In a smart grid has been being introduced more renewable generations because the use of fossils has been increasing in the power generation sectors around the world. Due to increasing demand for electricity, the price of fossil fuels is increasing. On the contrary, this extreme use of fossil fuels is causing global warming and carbon dioxide emissions as well as natural resources (fossil fuels) have been diminishing. Therefore, consumption of fossil fuels should be reduced through shifting production from fossil fuel based energy to renewable based energy. That is why, renewables based distributed generations (DGs) are getting more popularity. DGs are expected to play a vital role in the future energy demand and market. DGs consist of wind generator (WG), photovoltaic (PV) generator, concentrated solar power (CSP), biomass power generation, hydro plant, geothermal plant, smart house, energy storage system (ESS) and so on are sources of energy which can deliver a variety of benefits including improved reliability if they are operated properly. On the other hand, the problems are required high amount of money for initial investment and output power of renewable energies are uncertain for different weather conditions. However, power producers should consider optimization technique for reducing the operational costs and maximize the profits as well as considering the consumers' benefit. Besides, as installation of renewable energy systems are expensive, so utility companies need to calculate the Break-Event Point (BEP) and Net Present Value (NPV).

Nowadays, the installations of PVs in the smart grid have been growing dramatically because the price of PVs is falling drastically. The massive penetration of PVs' power at the day-time changes the load demand of thermal generations of a smart grid which creates duck shape load curve called duck curve. This research solves the duck curve problem, increase the renewable generation, reduces CO2 emissions and usages of fossil fuels. This research introduces CSP instead of battery storage because the battery consumes grid power while charging and has efficiency loss but CSPs have own solar sources of energy. This research also considers the consumer sides, they have rooftop PV and Fuel-Cell in their smart houses so on, and consumers also get benefits through demand response scheme. Finally, All the proposed methods are summarized. Scopes of future research have also been described.

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