

Fault Protection and Dynamic Control Strategy for High Renewable Energy Micro grids

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DESCRIPTION

The landscape of power distribution systems has changed as a result of the incorporation of substantial renewable energy sources into micro grids. It is important to ensure these micro grids' stability, and resistance as their importance in improving the use of sustainable energy increases. Due to their variable nature and susceptibility to system interruptions, renewable energy sources such as solar and wind have a great environmental advantages but also present special obstacles. Due to the availability of these renewable resources, micro grids that run independently or are connected to the main grid need particular fault prevention methods.

Micro grids with a large proportion of renewable energy could not be immediately compatible with the common fault protection systems created for conventional power grids. Innovative methods that can quickly identify and isolate faults while maintaining system stability are required due to the dynamic and quickly changing nature of renewable power. A further requirement for advanced dynamic control systems is the efficient management, storage, or transfer of the excess energy generated under ideal renewable conditions to the main grid.

A micro grid is a group of interconnected loads that utilize distributed energy resources like micro turbines, diesel-powered generators, renewable energy sources, and all other types of distributed energy resources at the transmission level with defined electrical boundaries and the ability to operate in either grid-connected or island mode. Transient and dynamic disruptions develop in the micro grid as a result of the intermittent, discontinuous, and variable nature of renewable sources. Disturbance control and fault protection in micro grids are more challenging than in conventional grids due to the system's low fault current and low resistance.

The most difficult aspect of micro grid defense and dynamic control is figuring out whether there is an issue or disturbance in

the system. The micro grid may exhibit transient properties that are comparable to transient and dynamic disruption at initial faults.

Transient disruption control should be used in the event of a failure to stop the building from collapsing and to make sure the proper breakers trip. While their initial characteristics are very similar to those of the problem, intermittent and dynamic disturbances shouldn't cause the circuit breakers to trip.

By utilizing the energy storage system's dynamic disturbance management technology, it is possible to ensure safe and stable operation under conditions of high absorption of renewable energy, and it is possible to enable 100% utilization of renewable energy production in a micro grid system. Using real-time load and power generation surveillance, analysis and control technology and relying on power and energy storage energy to successfully mitigate transient and dynamic disruptions, respectively to achieve unanticipated seamless transitions from grid connected mode to island mode improve the system's safe and stable operation level. The exact location as well as quick isolation of the micro grid's fault components are realized using the Park conversion and the fault detection technology of branch voltage and current harmonic rapid change rate.

When operating on an island the Total Harmonic Distortion (THD) rate of current and voltage is less than 3% when using power and load side complete treatment technology. Domestic and foreign specialists have rated the micro grid static disruption control technology, transient disruption control technology and fault protection technology as international leaders.

Energy storage systems are used for secure and stable operation, continuous monitoring and evaluation to prevent disturbances, fault recognition technology for accurate positioning and fast fault isolation and comprehensive technology for treatment to reduce all harmonic distortion rates. The proposed innovations have been assessed as being of globally leading quality.

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