

Research and Practice of Resilient Smart Grid Based on Hainan Island in China

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Resilient infrastructure for climate change

This paper presents the research and practice of Hainan Island Smart Grid, which lies in the only provincial (Hainan) Smart Grid demonstration area of China.

Large-scale integration of multi-type renewable energy (RE) sources (intermittent energy sources) has become an important feature in Smart Grids development all over the world. It is internationally recognized that the island (or weak-tie connected) power grids are the best platforms for intermittent energy integration test and demonstration because of their abundant RE resources, scarcity of conventional energy, and technical difficulty with accommodation of intermittent energy.

The research on Hainan (the second biggest island in China) power grid have achieved a comprehensive breakthrough in power grid planning, analysis, scheduling, operation, relay protection, security control, disaster prevention, and other key areas in multi-type RE source integration. Based on the theoretical research and technological innovation, the country's first demonstrative weak-tie power grid with RE penetration not less than 15% has been established in Hainan.

This paper focuses on the key part of the research project - optimal scheduling and complementary operation and a new framework of multi-time-frame robust scheduling/dispatch system based on the key concept of "extreme scenario" (proposed by the nominee in 2010, just as the "Do-Not-Exceed limit" in ISO New England) is first proposed, which is different from most other robust approaches and lays special emphasis on the engineering characteristics of power system operation.

The research will continue for a long time and provide green power for China (Hainan) Pilot Free Trade Zone and Free Trade Port, and also aims to establish the international technical standards for resilient Smart Grids.