In order to meet the energy demand and at the same time to achieve sustainable development objectives on a global scale, the Danish government has set a long-term strategy of fossil fuel free country by the year 2050. However, the decline of conventional power generation units and a rising amount of converter interfaced components (wind turbine, HVDC, and Photovoltaic) may have negative effects on the stability of the power system. These components do not have enough inertia response to control frequency excursion, so the power grid can depend on few synchronous machines for frequency regulation and reduce the system inertia. Consequently, the frequency stability of the system will be easily jeopardized. To address these issues, the paper studies frequency characteristics of future Western Danish renewable-based system that uses a majority of wind turbine generators. Different scenarios of wind turbine penetration, governor responsibility of synchronous generators, and disturbance are simulated to examine the impact of highlevel renewable energy integration on the system frequency characteristics. The effect of synchronous condensers for the frequency stability enhancement is investigated. It can be concluded from the comparative simulation results that synchronous condenser demonstrates a satisfactory performance for improving the system frequency stability.