This paper proposes a coordinated voltage control scheme (CVCS) which enhances the voltage ride through (VRT) capability of an offshore AC grid comprised of a cluster of offshore wind power plants (WPP) connected through AC cables to the offshore voltage source converter based high voltage DC (VSC-HVDC) converter station. Due to limited short circuit power contribution from power electronic interfaced variable speed wind generators and with the onshore main grid decoupled by the HVDC link, the offshore AC grid becomes more vulnerable to dynamic voltage events. Therefore, a short circuit fault in the offshore AC Grid is likely to have significant implications on the voltage of the offshore AC grid, hence on the power flow to the onshore mainland grid. The proposed CVCS integrates individual local reactive power control of wind turbines and of the HVDC converter with the secondary voltage controller at offshore grid level. This secondary voltage controller controls the voltage at the pilot bus, the bus with the highest short circuit capacity in the offshore AC grid. By maintaining voltage at the pilot bus, reflecting the voltage variations of the entire offshore zone, the voltage profile of the offshore grid is indirectly maintained. During steady state operation, the secondary AC voltage controller generates reactive power references for individual wind turbines (WTs) based on their participation factors (PFs) and available reactive power margins, while during dynamic voltage events; the secondary voltage controller generates additional reactive power reference signals for WTs and the HVDC converter, to enhance VRT capability of the offshore AC network. The Participation Factor of each WT is calculated from their dV / dQ sensitivities w.r.t. the pilot bus. The WT and the HVDC converter control is modified to accommodate additional reactive power reference from the secondary controller, while maintaining their local VRT capability. A detailed model of 800 MW VSC-HVDC connected OWPP cluster developed in DigSILENT platform is considered in this study. VSC-HVDC transmission system operates at +/- 320 kV with active power balance (hence DC voltage) control assigned to the onshore converter, while frequency and AC voltage control at the offshore substation assigned to the offshore converter.