With the increasing penetration of wind turbines grid utilities require extended reactive power supply capability not only during voltage dips but also in steady state operation. Wind turbines with doubly-fed induction generators (DFIG) are able to control active and reactive power independently. The reactive power capability is subject to several limitations resulting from the voltage, current and speed, which change with the operating point. This paper discusses the steady state reactive power loading capability of DFIG based wind turbines by taking into account the most important physical phenomena restricting the reactive power supply of DFIG based wind turbine systems. The active-reactive power diagram is systematically derived by considering the typical power-speed relationship and converter loading limits. The authors discuss also some special operating modes limiting the reactive power capability together with aspects of modeling and control that give rise to these limitations.

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