

Winter Ice Operation Mode

Introduction

GE offers a Winter Ice Operation Mode (WIOM) control option for Turbine Control software version 042 and greater on the 1.X platform, and version 044 and higher on the 2.X platform. This upgrade provides stall mitigation during blade icing events. By optimizing pitch controls, the WIOM control option improves power output. In addition, the option reduces the effects of icing on blade stall, which in turn reduces potential blade vibrations.

Applicable Platforms

All 1.X and 2.X MW series wind turbines, particularly in colder climates.

Technical Description

Snow and ice accretion on wind turbine blades is common for units located in winter climates. Winter blade ice-fouling can produce aerodynamic stall, resulting in reduced power output (See Figure 1). Turbine operation with blade stall can also lead to increased blade vibration levels. In rare cases, blade vibrations at a resonant frequency can lead to blade damage. WIOM is a software enhancement that features TSR pitch control to reduce stall and gain back lost power during iced operation.

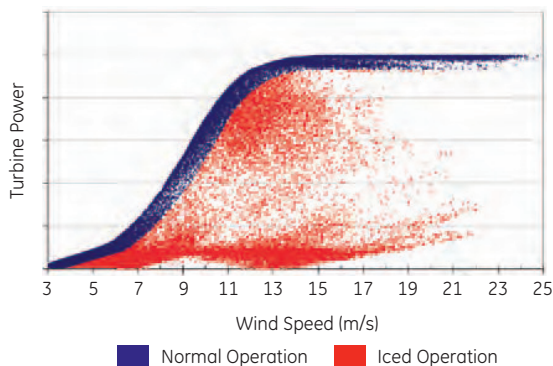


Figure 1. Representative power production data demonstrates that wind turbines perform worse under iced conditions than under normal operations.

TSR Pitch Control

Anti-stall operation is accomplished with a blade tip speed ratio (TSR) algorithm executed by the PLC. The TSR pitch control algorithm intends to improve power capture for the rotor while reducing the risk of blade stall (See Figure 2). The tip speed ratio is calculated from the turbine rotor speed and density corrected anemometer wind speed inputs, and is evaluated every 40 ms. The modified pitch control scheme will become active when icing via low power is detected.

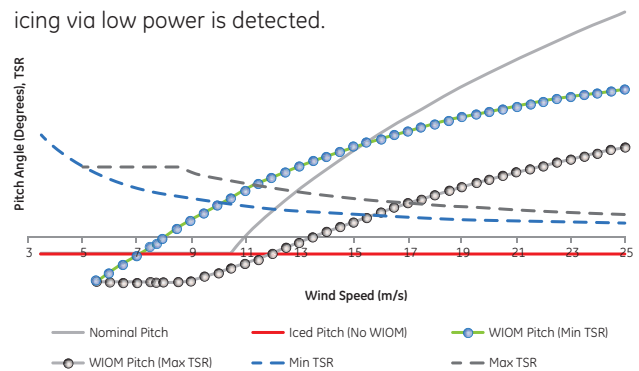


Figure 2. TSR pitch control schedule

Benefit

WIOM has been developed to mitigate blade stall due to icing, which may result in an increase of annual energy production by approximately 1% to 3% for sites with four to six months of winter weather opportunity.

Scope of Supply

WIOM Turbine Control Software enhancement

Scope of Work

GE will provide the installation and commissioning resources necessary to implement this upgrade.

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