CSD_ALL WFs_ALL REGIONS_BLACK PAINTED BLADE ANALYSIS IN WTG FOR BIRD PROTECTION

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1. Scope

This document summarizes all the actions that have been promoted by SGRE to analyze the effect of painting in black one blade of a wind turbine for bird protection.

2. Background

A couple of studies have shown that a black painted blade in a WTG (Wind Turbine Generator) might have positive results regarding bird preservation.

SGRE is concerned that this solution implies certain technical difficulties since there are several reasons why blades are usually painted in a light-grey or off-white color (not considering the aeronautical markings). Among them, there is the recommendation of the International Civil Aviation Organization, being that “the rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines should be painted white, unless otherwise indicated by an aeronautical study” [1].

These concerns were also shared by other industry relevant manufacturers, motivated by one recent publication [2], and were summarized in one paper published by the AEE, the Spanish wind business association, under the title Painting of Wind Turbine Blades as a Prevention Measure for Birds [3].

Some of the technical issues that appear in the document are: (1) any black paint would have different conductivity properties than current RAL7035 or RAL9010 paints, hence, a new ad-hoc design of the lightning conductor electrodes of the blade (lightning protection system) would need to be evaluated. Besides, (2) adding a paint layer to an already painted blade adds additional weight that may cause issues in the balancing of the whole rotor system that would be difficult to quantify, especially if only one blade per rotor is painted. Furthermore, (3) wind turbine blade paint systems are intrinsically embedded in the type certification of the wind turbine and re-certification of a different type of paint system would take a long time (up to six months) impossible to assume by the project schedule. All these changes may (4) potentially reduce the performance and therefore the power output of the wind turbine, either through premature wear and tear or due to the excess of protection materials to be added. In addition, (5) blades are manufactured in groups of three, hence introducing one black blade will increase production costs and logistics and installation complexity. Maintenance perspective is not better. Blade inspections are typically done visually, with drones equipped with cameras. In the case of black blades, (6) possible cracks could be undetectable and critical observations could be overlooked. Besides, (7) blade add-ons and spare part blades in different colors will double warehouse inventory, also increasing the complexity of logistics and supply chain.

The paper, [3], concludes that the effect of black blades on birds’ behavior still needs to be carefully researched and that the first experimental impressions indicate that must be evaluated on a project basis, depending on the colors of the surrounding landscape. In this sense, black blades would only stand out in places covered by snow most part of the year, which was the case of the wind farm in [2]. Furthermore, the paper also states that, aiming of the birds monitorization and collisions avoidance, there are other alternatives in the market that can provide equal or even better results, such as the combination of cameras and speakers in the towers or nacelles of the wind turbines.

3. Further works

SGRE contacted several paint manufacturers to find the coating that better fitted the needs of this study. The first approach was that the paint had to fulfill GMS12010 internal specification [4]. The nominated supplier resulted to be Bergolín, with its water-based paint Bergopur Aqua Decklack color RAL9004, “signal black” [5]. The manufacturer announced that, according to its own internal laboratory tests, the black color could reach about +30ºC compared to the same paint with standard grayish color (RAL7035).

Later, SGRE contracted Tecnalia, an accredited R+D laboratory in Spain to perform experimental tests with this raw material. On the assumption that black paint will influence on the heating of the blade in sunny days, Tecnalia conducted an “accelerated test” with various glass-fiber composite test specimens painted in both white and black, which were exposed to a simulated solar radiation of 900 W/m^2 at an ambient temperature of 25ºC.

The results show that the samples painted in black heated higher, reaching temperatures up to 11ºC higher than the samples painted in white. The average temperature measured in the rear surface (not exposed to the radiation), 71.3ºC, exceeded the glass transition temperature of the composite material. As a consequence of the high temperature, mechanical properties of the material might be affected leading eventually to delamination. This could originate structural serious damages, including total failure. Total failure of the blade brings severe safety implications, such us serious injury risk for the wind farm staff or even people living in the area.

The second part of the study, the “Heat Transmission Test” is ongoing on the experimental wind farm of Aoiz. It consists of the exposure of the samples to natural radiation outdoors. Preliminary results support the ones obtained in the laboratory, although due to the non-controlled radiation, peaks of much higher temperature than in laboratory tests have been observed. This brings up the idea that average environmental temperature is a variable to consider and should be further analyzed.

4. Conclusions

SGRE concludes that the provided evidence should not be neglected and solidly defends avoiding painting in black any blade in any wind farm.

In case there is any environmental requirement to protect birds in one area, SGRE shall provide support to the installation of any other system available on the market.

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