CSD_ITALY_RENEXIA_CASALDUNI W.F._SGRE CONCLUSIONS ABOUT PAINTING BLADES IN BLACK

Document ID and revision	Status	Status date (yyyy-mm-dd)	Language
GD543377 R0		2022-05-30	es-ES

Original or translation of	RDS-PP®
Original	

File name
GD543377_CSD_ITALY_RENEXIA_CASALDUNI W.F._SGRE CONCLUSIONS ABOUT PAINTING BLADES IN BLACK

Updates made since the previous revision

Confidentiality:	Deliverable Type	Doc Classification:
3 / CUSTOMER INFORMATION	S12 - General Characteristics Manual	STD - Support

Siemens Gamesa Renewable Energy S.A. Parque Tecnológico de Bizkaia, Edificio 222, 48170, Zamudio, Vizcaya, Spain
+34 944 03 73 52 – info@siemensgamesa.com – www.siemensgamesa.com

Table of contents

1. Scope

This document summarizes all the actions that have been promoted by SGRE to provide an answer to the requirement of RENEXIA of painting in black one blade of each wind turbine in the project of CASALDUNI W.F.

2. Precedents

Since the very first moment RENEXIA notified the need, as requested by the regional environmental authority, of painting in black one blade of each wind turbine in the project of CASALDUNI W.F., with the goal of preserve birds species in the area, SGRE started an exhaustive work to try to clarify the real viability of this solution.

At first, and as indicated in previous communications, SGRE was concerned 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 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 [2].

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, [2], 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 is not the case for CASALDUNI W.F. in terms of latitude and altitude. 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 specification [3]. The nominated supplier resulted to be Hempel, with its Hempathane 55930 [4].

After it, SGRE contracted Tecnalia, an accredited R+D laboratory of proven confidence 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/m2 at an ambient temperature of 25ºC.

The results show that the samples painted in black heated more, reaching temperatures up to 11ºC higher than the samples painted in white. The average temperature reached 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 eventually leading to delamination what 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 personnel or even people living in the area.

The second part of the study is still to be performed; the “natural test” consisting of the exposure of the samples to natural radiation in outdoors. It will be carried out in the SGRE experimental wind farm, AOIZ, and it is expected to last at least one month.

4. Conclusions

SGRE holds that the provided evidence should not be neglected and solidly defends avoiding painting in black any blade of the project of CASALDUNI W.F.

In case there is any strong environmental recommendation or requirement to protect birds in the area, SGRE shall provide support to install on its wind turbines any other well proven system available on the market.

5. Disclaimer

This document or embodiment of it in any media and the information contained in it are the property of Siemens Gamesa Renewable Energy. It is an unpublished work protected under the copyright laws free of any legal responsibility for errors or omissions. It is supplied in confidence and it must not be used without the express written consent of Siemens Gamesa Renewable Energy for any other purpose than that for which it is supplied. It must not be reproduced in whole or in part in any way (including reproduction as a derivation work) nor loaned to any third part. This document must be returned to Siemens Gamesa Renewable Energy on demand.

6. References

1. ICAO. Annex 14 Volume I, Aerodrome design and operations
2. Asociación Eólica Española (AEE). Pintado de Palas de Aerogeneradores como Medida de Prevención para la Avifauna
3. GMS12010. Polyurethane paint specifications
4. Hempel Hempathane 55930 paint datasheet

Digitally signed by: Toto Paolo
Date: 02/08/2023 12:51:37