Anti-collisions avifauna project report
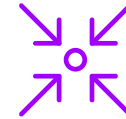
accenture

Index

1. Introduction

Background

The aim of this report is to address a common problem faced by most wind farm operators globally. According to conversations held with the Environment team of multiple utilities, there is a need to respond to the challenge of reducing bird and bat mortality on onshore wind farms though the technology.

The need

Search for a solution to **reduce bird and bat mortality due to impact against wind turbines (towers and, above all, rotating blades)** on wind farms.

The context

The **current solutions** implemented by wind operators to reduce the risk of bird and bat strikes have not achieved **the level of scalability or effectiveness necessary** for large-scale implementation and **have not reduced the penalties** imposed on wind farm operators.

The impact

Identification of solutions in the market that **minimize conflict with environmental considerations and reduce penalties** resulting from bird and bat mortality and injuries at wind farms to **ensure a path towards a more sustainable future.**

Market context

Avifauna and Chiroptera Mortality is an increasing problem for wind farms

The onshore wind market is growing globally	...Increasing exposure to Avifauna and Chiroptera ...	... and leading to losses

108 GW
Onshore wind power capacity added in 2020******

X2
Duplicating the onshore wind power installed in 2019

USA, EU and China lead the way but more is needed

The EU launched the REPowerEU plan to launch an investment of 86 Billion Eur in Solar and Wind energy totally deploying 480 GW by 2030*******

0.016%
Estimated population of birds killed per annum by Wind Turbines**

3
Estimated bats per turbine killed per annum by Wind Turbines***

5%
Of birds in Europe are Endangered or Critically Endangered ****

26%
Of bats in Europe are threatened or near threatened*****

US wind company fined millions after admitting 150 eagle deaths
Joshua S Hill   11 April 2022

The wind farm where turbines shut down 400 times a day when eagles approach
Sophie Vorrath   6 August 2021

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* Total projected capacity for 2030 based on industry trend analysis by Wind Europe.
** Source: https://abcbirds.org/blog21/wind-turbine-mortality/
***Source: https://edepot.wur.nl/518591#:~:text=The%20annual%20fatality%20rate%20in,is%20large%20(Rydell%20et%20al.
****Source: https://www.birdlife.org/wp-content/uploads/2022/10/BirdLife-European-Red-List-of-Birds-2022.pdf
*****Source: https://doi.org/10.3389/fevo.2016.00087
******Source: https://www.iea.org/reports/wind-power
******* Source: https://www.energias-renovables.com/eolica/aee-alerta-europa-solo-ha-instalado-un-20220521 and
 https://eur-lex.europa.eu/resource.html?uri=cellar:fc930f14-d7ae-11ec-a95f-01aa75ed71a1.0004.02/DOC_2&format=PDF

2. Survey

Survey overview

Between May – July 2022, Accenture surveyed multiple market leading companies operating wind farms, with the objective of identifying the solutions and main digital technologies used to reduce bird and bat mortality due to onshore wind farms operation in the international landscape, and verify their effectiveness when possible. The survey ranged from 6 – 24 questions depending on the answers. This report is based on this survey.

The survey covering a range of topics including:

1. Existing solutions for bird/bat mortality reduction
2. Future exploration of solutions for bird/bat mortality reduction
3. Fines and economic penalties due to bird/bat mortality

Find in this document the questions included in the survey ➡️

Survey - questions

Thank you to our participants:

IBERDROLA   **Naturgy**   **edp**   **+ other market leading companies that asked not to be mentioned**

ENGIE   **auren**

>
7

Overview of who answered the survey

The companies that answered the survey cover most of world´s geographies

▼

Total installed capacity:
+59 GW wind power.

Survey highlighted insights

Many operators are looking for a solution
- Most wind farm operators (85% of surveyed operators) are taking action to reduce bird or bat mortality on their wind farms.

Most operators are affected
- Most wind farm operators (71% of surveyed operators) are affected by this problem and by regulations. The problem is set to increase due to the expansion of wind power and the expansion of regulations across many different countries.

The market is not mature
- There are some companies trying to become market leaders with companies stablished +5 years ago but most of the market is compound of start-ups that have clients but not mature or deeply tested solutions.

A "one fits all" solution approach is not valid
- Many solutions are available in the market but each wind farm faces different birds / bat and different external conditions. Each solution works better under certain conditions. Combination of technological and non-technological solutions offers a high effectiveness.

Prevention is the best solution
- A preliminary study and definition of the aerial highways prevents most of the problems and the need of implementing additional solutions. There are solutions that allow to gather this data during the origination phase to reduce future issues.

The status of wind operators over the world

Who currently faces this problem?

No   **Yes**

We found that 71% of wind farm operators already identify this topic as a problem that affects them.

What problem they face?
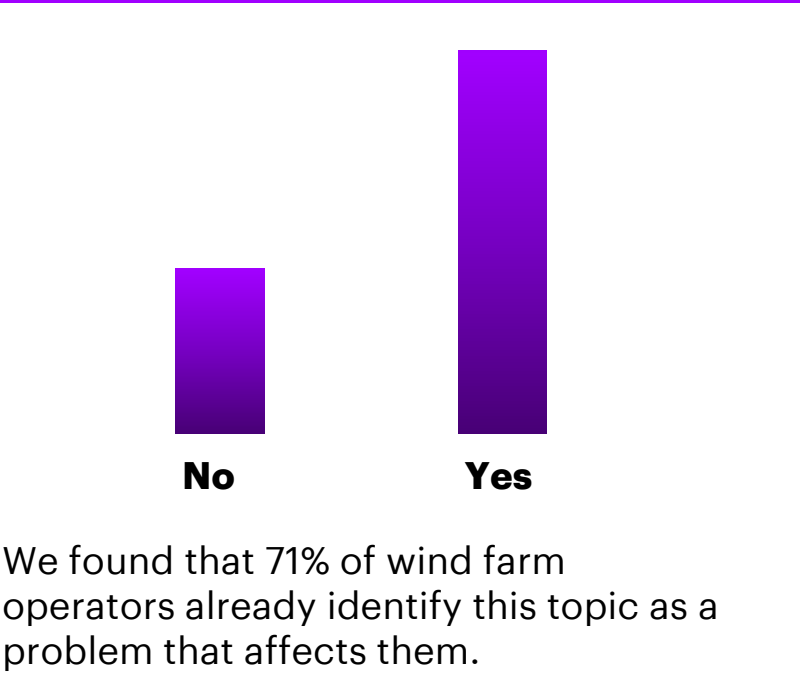
- 100% of the operators that already face a problem, identified bird mortality as one of the key issues.

- 57% of surveyed operators identified bat mortality as a problem.

- 50% of surveyed operators are suffering economic penalties and operation restrictions.

- 14% of the operators that answered face too many wind turbine stops.

Key solution elements

86% of wind farm operators have already started to implement solutions.

No   **Yes**
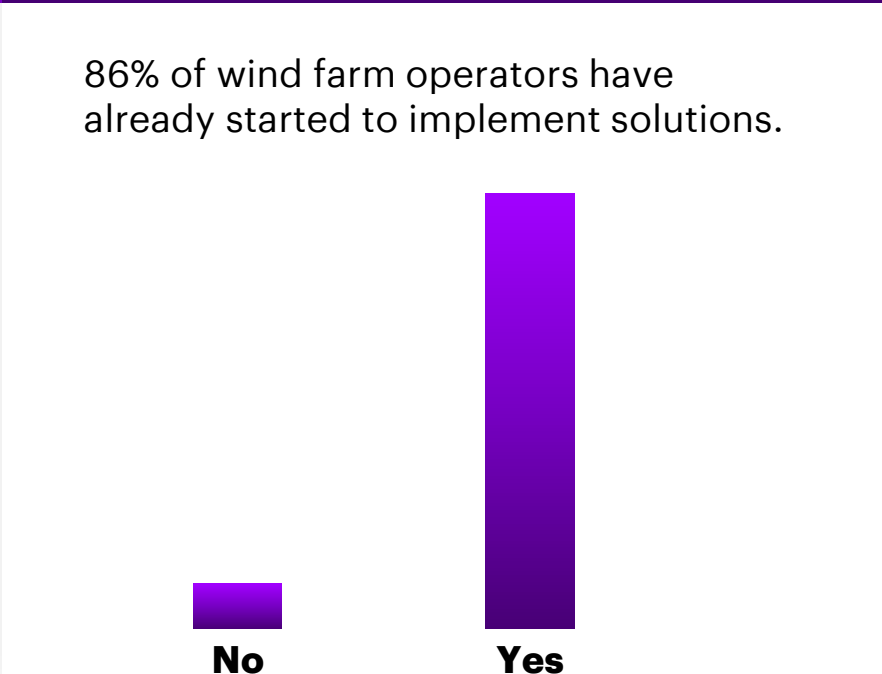
Meaning that the 14% that do not suffer this issue, are getting ready to solve it as they foresee it as a problem.

3. Benchmark (market solutions for bird/bat mortality)

Analysis strategy

As far as possible, we have tried to carry out the exercise of comparing market solutions under the following evaluation criteria:

Functional capabilities	**Technical perspective (hardware and software)**	**General aspects**
Key aspects related to the functionality of the tool based on general business requirements. This criterion will be essential when choosing which application to use, due to its direct impact on the scope of the initiative..	Technical specifications related to product architecture, data integration both inbound and outbound, elements used to create the solution and scalability. Technology, devices and technical flexibility are other key aspects to take into account within this criterion.	General aspects, such as vendor reliability, probed result statistics and comparative cost estimation.

Some background about the work done:
- 30-35 solution providers were analyzed based on public information
- 21 solution providers analyzed in detail
- 17 solution providers interviewed, conducting approximately 32 interviews
- 15 out of those 17 were chosen to appear in this final report

Solutions (technological and non-technological) review summary

The market is not mature yet

Wind farm operators are testing multiple solutions at the same time

Most solution providers have deployed units but not full wind farms

Most solution providers do not offer independent studies to verify the results and have little data of their improvement

Combination of technological and non-technological solutions offers the best results

Some solution providers offer solutions to be used during the origination phase to assess the situation and prevent issues in the future

Each solution that has been assessed, solves a specific problem that needs to be analyzed prior choosing the solution

Most solutions focused on birds/bats rely on stopping the wind turbine to reduce mortality

3.A. Functional capabilities

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Functional capability analysis* – 1º Group of companies (1 / 3)

Product Feature	Nvisionist	DTBIRD	DTBAT	Digisec	Identiflight	NRG Systems	The drone bird	RobinRadar
Long range bird detection (+2km)	Half circle	Empty	Empty	Empty	Empty	Empty	Empty	Full
Bird detection (big birds)	Half circle	Half circle	Empty	Three quarter	One quarter	Empty	Empty	Full
Bird detection (Medium/small birds)	Half circle	Half circle	Empty	Three quarter	One quarter	Empty	Empty	Full
Bird night detection	Full	Full	Empty	Full	Empty	Empty	Empty	Full
Bird identification	Full	One quarter	Empty	Full	Full	Empty	Empty	Half circle
Bird deterrence with sounds	Half circle	Full	Empty	Full	Empty	Empty	Empty	Empty

Product Feature	Full Circle	Three quarter circle	Half Circle	One quarter circle	Empty circle
Long range bird detection (+2km)	Detects birds at long distances and locate them in 3D	-	Detects birds at long distances and locate them in 2D	-	It doesn't do it
Bird detection (big birds)	Detects big birds, uses AI and locates in 3D several birds simultaneously	Detects big birds, uses AI and locates in 3D a single bird simultaneously	Detects big birds and uses AI	Detects big birds	It doesn't do it
Bird detection (Medium/small birds)	Detects small/ medium birds, uses AI and locate in 3D several birds simultaneously	Detects small/ medium birds, uses AI and locate in 3D a single bird simultaneously	Detects small/ medium birds and uses AI	Detects small/ medium birds	It doesn't do it
Bird night detection	It does it	-	-	-	It doesn't do it
Bird identification	Identify the species and uses AI to automate identification	-	Classify birds by size and uses AI	Allow to manually classify birds by size or species	It doesn't do it
Bird deterrence with sounds	Bird deterrence in the flight direction	-	Bird deterrence with sounds without considering bird location	-	It doesn't do it

* The information available in this slide has been completed based on the information shared and provided by the suppliers during meetings, emails and interviews with them

Functional capability analysis* – 1º Group of companies (2 / 3)

Product Feature	Nvisionist	DTBIRD	DTBAT	Digisec	Identiflight	NRG Systems	The drone bird	RobinRadar
Bird deterrence with lights or movement	Empty	Empty	Empty	Empty	Empty	Empty	Full	Empty
Bat detection	Empty	Empty	Half	Full	Empty	Empty	Empty	One quarter
Bat identification	Empty	Empty	Empty	Empty	Empty	Empty	Empty	Empty
Bat deterrence	Empty	Empty	Empty	Empty	Empty	Full	Empty	Empty
Reporting	One quarter	Half	Half	Full	Full	Empty	Empty	One quarter
Monitoring	Full	Full	Full	Full	Full	Empty	Empty	Full

Product Feature	Full Circle	Three quarter circle	Half Circle	One quarter circle	Empty circle
Bird deterrence with lights or movement	It does it	-	-	-	It doesn't do it
Bat detection	Detects bats using AI and knows the environment conditions	-	Detect bats using thermal cameras, radars or ultrasounds (exclusive)	Detects bats as small birds	It doesn't do it
Bat identification	It does it	-	-	-	It doesn't do it
Bat deterrence	It does it	-	-	-	It doesn't do it
Reporting	Customizable reports with SCADA information	Basic reports, customizable but without SCADA information	Basic reports, not customizable but with SCADA information	Basic reports, not customizable and without SCADA info.	It doesn't have it
Monitoring	Offers information in real time and has alarms	-	Offers information in real time	Offers information with some delay (no real time)	It doesn't have it

* The information available in this slide has been completed based on the information shared and provided by the suppliers during meetings, emails and interviews with them

Functional capability analysis* – 1º Group of companies (3 / 3)

Product Feature	Nvisionist	DTBIRD	DTBAT	Digisec	Identiflight	NRG Systems	The drone bird	RobinRadar
Turbine detention (soft stop / using the blade rotation)	●	●	●	●	●	○	○	●
Turbine derating (reduce speed)	●	○	○	○	○	○	○	●
Integration with systems such as SCADA	●	●	●	●	◖	◖	○	◖
Website access to data (for field employees or others)	◖	◖	◖	◖	◖	○	○	◖
Controls changes in the cut speed and operation limits	○	○	○	○	○	○	○	○
Wind farm lighting switch ON/OFF	○	○	○	○	○	○	○	○

Product Feature	Full Circle	Three quarter circle	Half Circle	One quarter circle	Empty circle
Turbine detention (soft stop / using the blade rotation)	Triggers soft turbine blade stop and restart activity automatically	-	Triggers soft turbine blade stop	-	It doesn't do it
Turbine derating (reduce speed)	Triggers turbine speed derating and restart activity automatically	-	Triggers turbine speed derating	-	It doesn't do it
Integration with systems such as SCADA	Send/ receives commands to/ from SCADA	-	Send commands to SCADA	-	It doesn't do it
Website access to data (for field employees or others)	Has web based and app solutions	-	Has web based or app solution	-	It doesn't have it
Controls changes in the cut speed and operation limits	It does it	-	-	-	It doesn't do it
Wind farm lighting switch ON/OFF	It does it	-	-	-	It doesn't do it

* The information available in this slide has been completed based on the information shared and provided by the suppliers during meetings, emails and interviews with them

3.B. Components and hardware

Component / Hardware analysis* - 1º Group of companies (1 / 3)

Product Feature	Nvisionist	DTBIRD	DTBAT	Digisec	Identiflight	NRG Systems	The drone bird	RobinRadar
Turbine stop control	●	●	●	●	●	○	○	●
Turbine slowing down control (reduce speed)	●	○	○	○	○	○	○	●
Painted patterns or drawings on the blades (turbines)	○	○	○	○	○	○	○	○
Painted patterns or drawings on the tower (turbines)	○	○	○	○	○	○	○	○
On field personnel	○	○	○	○	○	○	●	○
Change the use of the soil around the wind turbines	○	○	○	○	○	○	○	○

Product Feature	Full Circle	Three quarter circle	Half Circle	One quarter circle	Empty circle
Turbine stop control	It has it	-	-	-	It doesn't have it
Turbine slowing down control (reduced speed but not totally stopped)	It has it	-	-	-	It doesn't have it
Painted patterns or drawings on the blades (turbines)	It has it	-	-	-	It doesn't have it
Painted patterns or drawings on the tower (turbines)	It has it	-	-	-	It doesn't have it
On field personnel	There is onsite personnel with access to website or app.	-	There is onsite personnel without access to website or app.	-	It doesn't have it
Change the use of the soil around the wind turbines	It changes the soil use to reduce the presence of predatory birds	-	-	-	It doesn't have it

* The information available in this slide has been completed based on the information shared and provided by the suppliers during meetings, emails and interviews with them

Product Feature	Nvisionist	DTBIRD	DTBAT	Digisec	Identiflight	NRG Systems	The drone bird	RobinRadar
Changes in the operative limits of the wind turbines (I.E., don´t operate during the night)	○	○	○	○	○	○	○	○
Light pulses	○	○	○	○	○	○	○	○
Ultraviolet light pulses	○	○	○	○	○	○	○	○
Sound alarms	●	●	○	●	○	○	○	○
Cameras	No Data	◗	○	◗	●	○	○	○
Thermal cameras	●	●	○	●	○	○	○	○

Product Feature	Full Circle	Three quarter circle	Half Circle	One quarter circle	Empty circle
Changes in the operative limits of the wind turbines (I.E., don´t operate during the night)	It has it	-	-	-	It doesn't have it
Light pulses	It has it	-	-	-	It doesn't have it
Ultraviolet light pulses	It has it	-	-	-	It doesn't have it
Sound alarms	Has multiple speakers in rotor or tower	-	Has one speaker either in rotor or tower	-	It doesn't have it
Cameras	There are cameras that locate the bird in 3D (stereoscopic) and follows several birds	There are cameras that locate the bird in 3D (stereoscopic) and follows a single bird	There are cameras that locate the bird in 2D.	-	It doesn't have it
Thermal cameras	It has it	-	-	-	It doesn't have it

* The information available in this slide has been completed based on the information shared and provided by the suppliers during meetings, emails and interviews with them

Product Feature	Nvisionist	DTBIRD	DTBAT	Digisec	Identiflight	NRG Systems	The drone bird	RobinRadar
Mobile devices	●	●	●	●	●	○	●	●
Radar 2D	●	○	○	○	○	○	○	●
Radar 3D	○	○	○	○	○	○	○	●
Ultrasonic sensors (transmitter)	○	○	○	○	○	●	○	○
Ultrasonic sensors (receiver)	○	○	○	○	○	○	○	○
Wind farm lighting control	○	○	○	○	○	○	○	○
Drones	○	○	○	○	○	○	●	○

Product Feature	Full Circle	Three quarter circle	Half Circle	One quarter circle	Empty circle
Mobile devices	It has it	-	-	-	It doesn't have it
Radar 2D	It has it	-	-	-	It doesn't have it
Radar 3D	It has it	-	-	-	It doesn't have it
Ultrasonic sensors (transmitter)	It has it	-	-	-	It doesn't have it
Ultrasonic sensors (receiver)	It has it	-	-	-	It doesn't have it
Wind farm lighting control	It has it	-	-	-	It doesn't have it
Drones	Drone automatically operated	-	Drone manually operated	-	It doesn't have it

3.C. Software

Software analysis* – 1º Group of companies

Product Feature	Nvisionist	DTBIRD	DTBAT	Digisec	Identiflight	NRG Systems	The drone bird	RobinRadar
Analytics	Three quarter circle	Half circle	Half circle	Full circle	Three quarter circle	Empty circle	Empty circle	Half circle
Machine learning	Full circle	Empty circle	Empty circle	Full circle	Full circle	Empty circle	Empty circle	Empty circle
AI (artificial intelligence)	Half circle	Full circle	Full circle	Full circle	Half circle	Empty circle	Empty circle	Empty circle

Product Feature	Full Circle	Three quarter circle	Half Circle	One quarter circle	Empty circle
Analytics	Has extensive reporting, KPIs and possibility of customizing reports	Has reports available and are customizable.	Reports available include KPIs but are not editable.	-	It doesn't have it
Machine learning	It uses machine learning	-	-	-	It doesn't have it
AI (artificial intelligence)	Has AI and is ready to be used (plug & play)	-	Has AI but needs to be trained before use	-	It doesn't have it

* The information available in this slide has been completed based on the information shared and provided by the suppliers during meetings, emails and interviews with them

27

3.D. Solution detail overview

3D.Observer

About

- **Located / Contact:** Company stablished in Spain / rdolz@3dobserver.com & vcampos@3dobserver.com
- **Short relevant info:** This company has developed a system that uses stereoscope cameras to locate and track birds and control de wind farms operation.

Clients

- Iberdrola (15 units) **IBERDROLA**
- Enhol
- ENERFIN **enerfin**
- Brial **Brial**
- SAMCA **Grupo SAMCA**

Press

➢ Not available

Product

Website: https://3dobserver.com

Key features KPIs:

- **Purchase price :** 60k Eur per unit + 20k (high resolution camera in a robot)
- **Cost licence/limit:** No cost per licence or upgrade.
- **Cost maintenance:** No data (depends on location)
- **Maintenance freq.:** Once a year (it is minimum)
- **Deployed units**: 50-60 units
- **Wind power covered:** 340 (MW) estimated
- **Geographies covered:** Iberia
- **Units needed per wind turbine:** 0.6 units per turbine
- **Detection efficacy:** No data
- **False positive ratio:** N/A
- **Probed detection efficacy:** in progress.
- **Identification efficacy:** N/A
- **Probed Identification efficacy:**
- **Species identification:** N/A
- **Avg collision reduction:** Field experience 90% not probed by studies
- **Certified in:** In progress

3D OBSERVER.

Functional Capabilities	Status
Bird detection (big birds)	●
Bird detection (Medium/small birds)	●
Bird night detection	●
Bird identification	◐
Reporting	◐
Monitoring	●
Turbine detention (soft stop / using the blade rotation)	●
Integration with systems such SCADA	●

Solution hardware/software	Status
Turbine stop control	●
Cameras	●
Mobile devices	●
Analytics	◔
AI (artificial intelligence)	●

* 0.6 units per turbine -> 55 units -> 3,7MW per turbine   340 MW

3.E. Non-technological solutions

Paint patterns on the blades

About

- **Short relevant info:** The solution consist of patters or drawings painted on the blades to ease the visibility of the blades.

- Studies show a high effectiveness up to 72% but those results can not be extrapolated to all locations due to the weather conditions and the low number of deaths identified during the study. However, it showed effectiveness and+ in other to assess the results a comparison should be made with the original field of the study.

Context

- It has been used by 50% of the surveyed operators in combination with other technological solutions.

- Needs to be approved by the aerial authorities, in certain countries.

- This has shown effect in birds that do not see the blades and helps to attract their attention when they are not looking at them.

- Prior implementation, it needs to be checked which is the target bird to assess possible benefits.

Product

Key features KPIs:

- **Purchase price:** Depends on the country

- **Cost maintenance:** Depends on the country.

- **Maintenance freq.:** No data

- **Units needed per wind turbine:** 1 minimum

- **Avg. collision reduction:** Up to 72% (best case scenario)

- **Certified in:** No data

Studies

- https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.6592

- https://rewi.org/resources/paint-it-black/

- https://tethys.pnnl.gov/sites/default/files/publications/May_EcolEvol_2022.pdf

4. The Team

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Thank You