Confidential

bioseco
Innovation for bird monitoring

Fauna na Operação dos Ativos Eólicos

Lase 2026-11.11.2026



Bird Protection System for wind farms

Proven results from wind farms around the world

Bird protection at scale

Operational experience built across a growing international project portfolio

685

BPS installed and operating

272,246,200

detections collected

350

BPS envisaged for 2027

2,643,519

turbine stops

200 TB

data collected

Approx. 50 GB monthly

<2%

average FP rate

FIELD-PROVEN EXPERIENCE

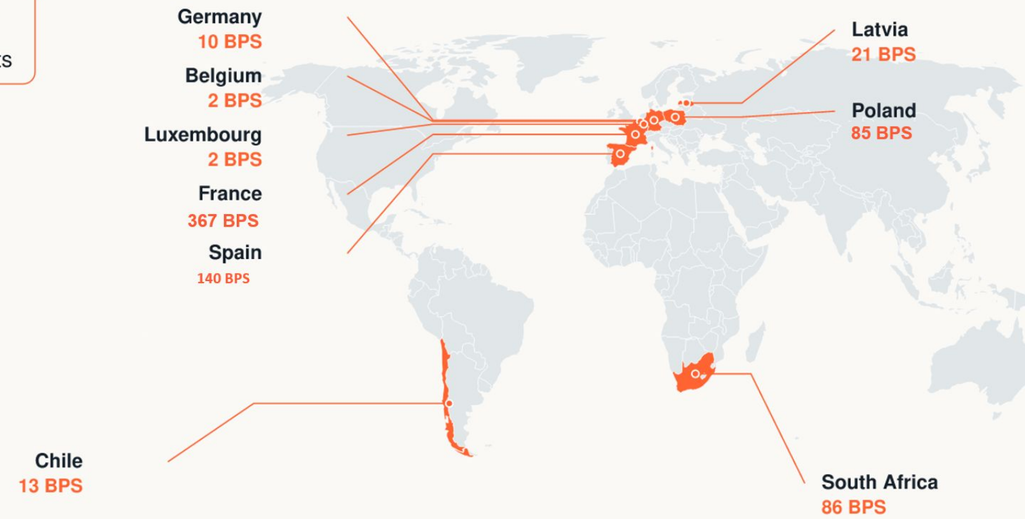
Operating data supports system development, performance verification and evidence-based bird protection at wind farms.

Bird Protection System - implementations

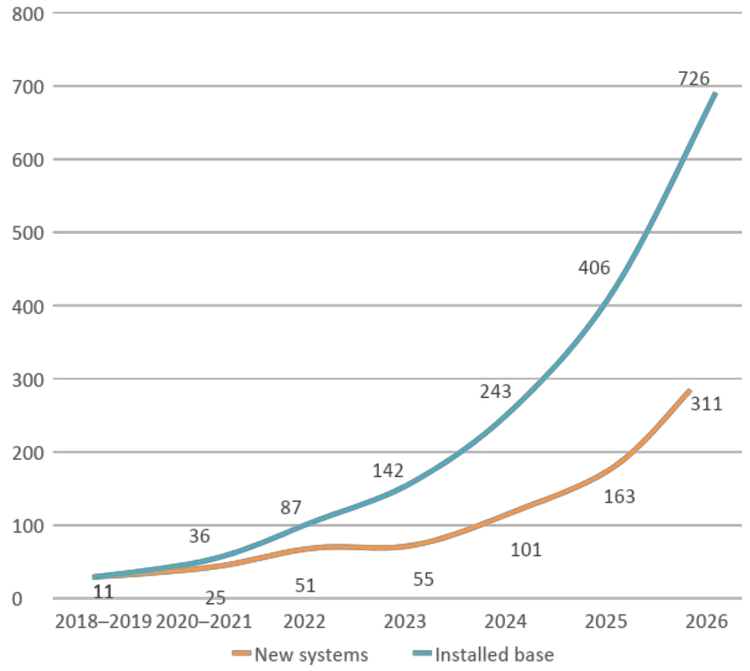
GLOBAL PRESENCE

BPS deployments by market

726 BPS
across 9 markets



BPS portfolio 2018 - 2026

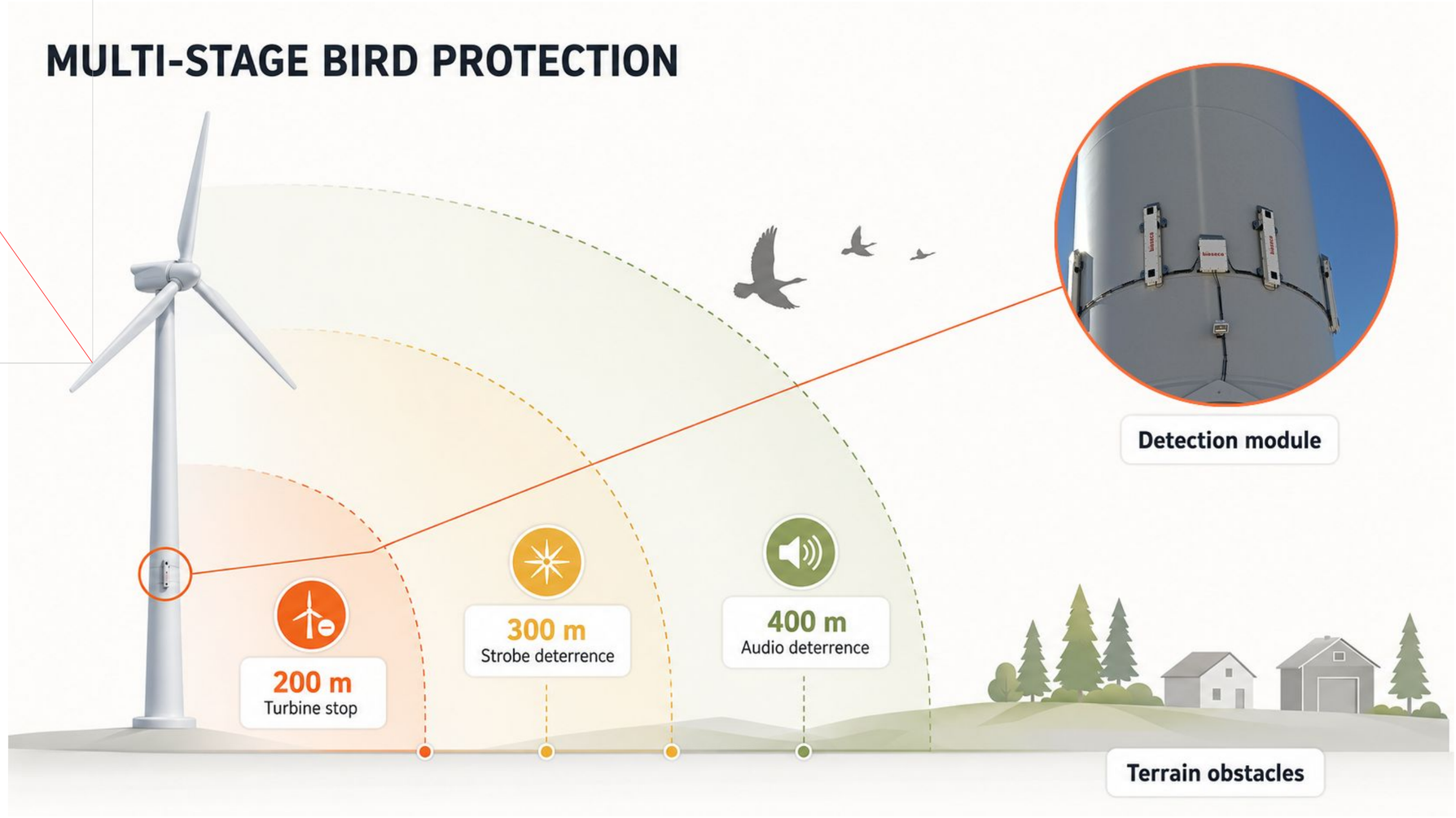


Equipped for:

Installed on:

Bird Protection System - concept

Thanks to use of stereovision Bioseco system allows to estimate the distance to the turbine and autonomously undertake various action depending on the bird distance and its flight path

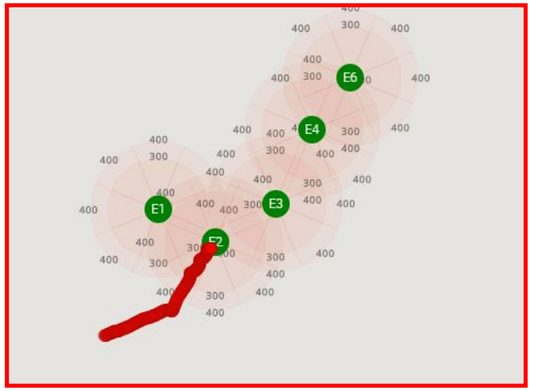


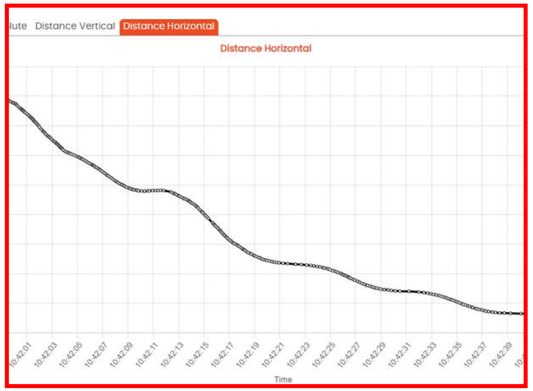
(detection distance depends on size of birds and BPS versions)

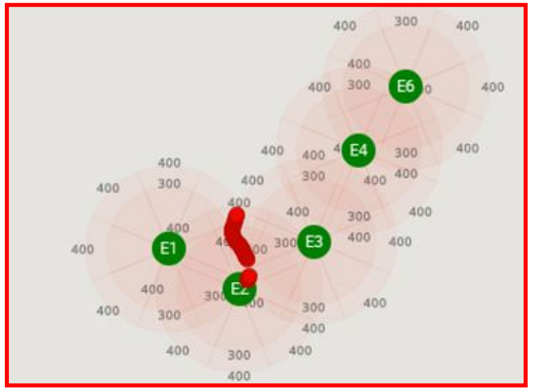
bioseco
Innovation for bird monitoring

Bird Protection System - example









Bird Protection System - example



Field validation: detection performance out to 700 m

Field campaigns in Germany and Poland document the evolution from Standard to Long Range.

Results of detection efficiency testing for Red Kite (milvus milvus) during the tests

FALSE POSITIVES

0 m · 200 m · 400 m · 600 m · 700 m



2019

STANDARD

NatForWINSENT · Germany [1]

97% · up to 200 m

67%

7% FP



2020

PREMIUM

PGE EO pilot · Poland [2]

>90% · up to 400 m

71%

4% FP



2022

LONG RANGE

PNE AG + BioConsult SH [3]
Germany

Red Kite

>83% · up to 530 m

White-tailed eagle

80% · up to 700 m

<5% FP

[1] Aschwanden, J. & F. Liechti (2019) Test of the automatic bird detection system BPS• [2] Report on ornithological monitoring performed at FW Lot (2020) • [3] PNE AG / BioConsult SH Bioseco Pilot Study Results Report Camera-Based Anti-Collision System Species Protection Assessment (2022)

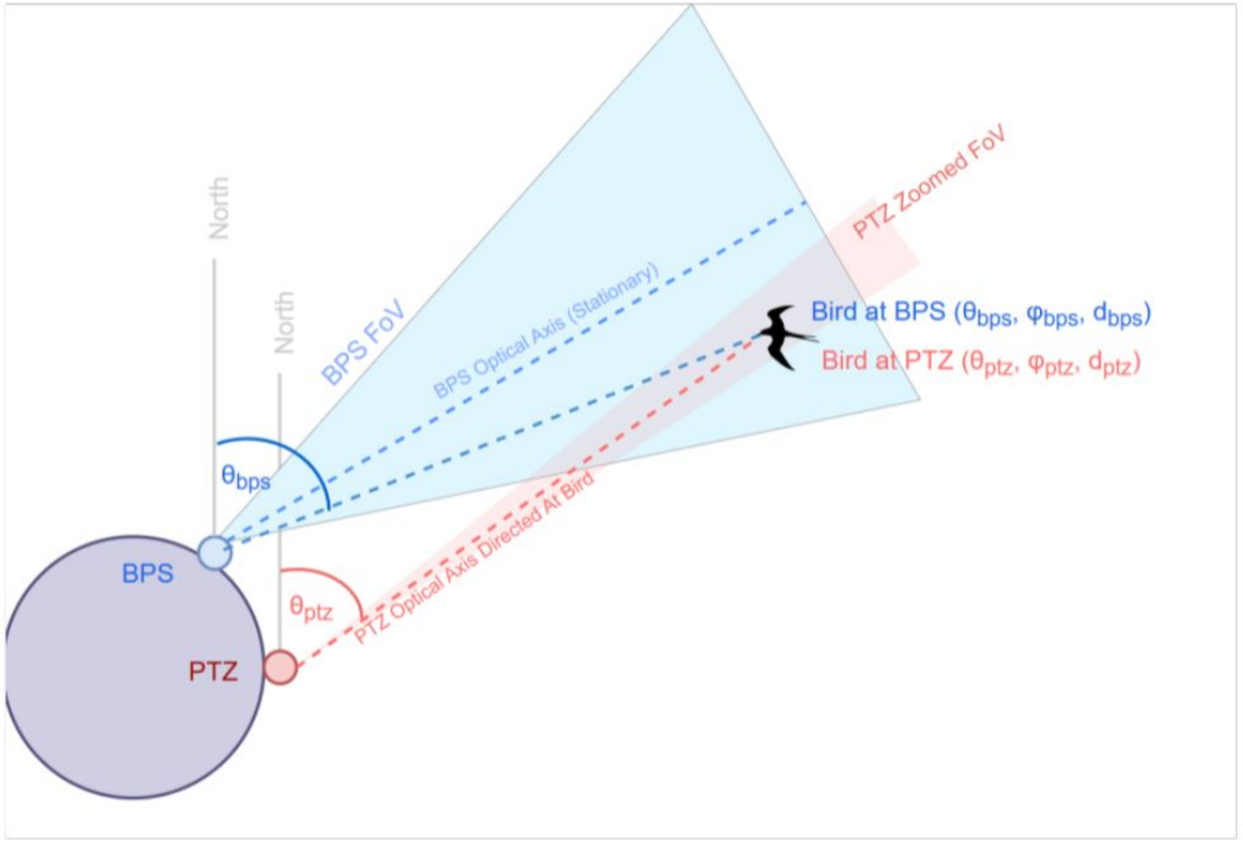
REAL-WORLD VALIDATION

PTZ AUTOMATED SPECIES RECOGNITION EXPECTED RESULTS



BPS stereo cameras

- constant 360° observation
- 3D localisation of the bird
- size and flight-path assessment





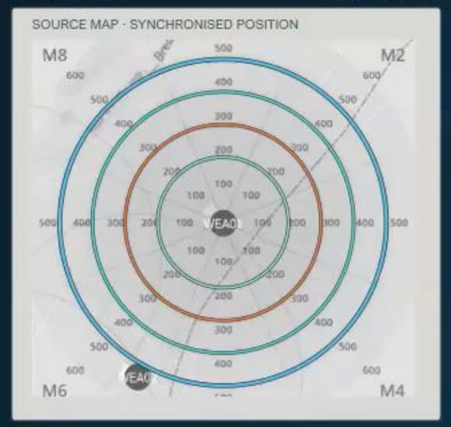
PTZ camera

- narrow, moveable field of view
- follows the bird pointed out by stereo
- zoomed HD recording for classification

The turbine stops only when the AI confirms a protected species inside the reaction zone. Common birds are ignored.

Selective bird protection

FLIGHT MAP STANDBY



PTZ READY

Awaiting BPS target



01

Continuous observation

HORIZONTAL DISTANCE 680 m

INBOUND · approaching turbine

SYSTEM ON THE TOWER



Fixed BPS modules

360° detection + 3D position

Pan–tilt–zoom cameras

Selected-target tracking

ROTOR ROTATING

— > 500 m DETECTION

— 400 m CLASSIFICATION

— 300 m STOP · INBOUND

— 200 m ROTOR STOPPED

— 300 m RESTART · OUTBOUND

PHASE 01 / OBSERVE

Fixed BPS modules watch the airspace in 360°.

Illustrative configuration · distances, timing and FoV are schematic · bird and equipment enlarged for clarity

Fewer shutdowns with species classification

Observed results across three operating modes

Size-based operation sets the reference

OPERATING MODE	MEDIAN SHUTDOWN TIME	MEDIAN DAILY SHUTDOWN INDEX
01 **Size-based** Reference operating mode		
02 **Species-based** Species classification enabled		
03 **Species-based +** reduced reaction zone		



Relative to size-based operation. Approximate values from one five-turbine installation in southern France.
Observed phase comparison; detection activity also changed over time. Shutdown index: reference = 100.

BPS-Go mobile monitoring concept

MOBILE BIRD MONITORING / SYSTEM CONCEPT

A self-contained platform for temporary monitoring campaigns at sites without power or communications infrastructure

DEPLOYABLE PLATFORM





OPTIONAL PTZ CAMERA



INDEPENDENT POWER

1

AUTONOMOUS DEPLOYMENT

Temporary installation with independent power and connectivity. Up to 30 days of operation without intervention, depending on site conditions and energy use.

2

360° LONG-RANGE DETECTION

Eight BPS Long Range modules use 4K optics to monitor the surrounding airspace. Estimated maximum range reaches 1 km for the largest birds under reference conditions.

3

EDGE ANALYSIS

On-site processing filters false positives and calculates distance, altitude and approximate flight path in 3D. An optional PTZ camera supports AI species classification.

4

REMOTE DATA ACCESS

The platform stores full-color video, event time and location, bird size class and environmental data. Users review results remotely through an independent data link.

360° coverage	UP TO 1 KM* detection range	UP TO 30 DAYS* autonomous operation	24/7 remote status

*Range and operating time depend on bird size, visibility, observation setup, site conditions and energy consumption.

Awards, recognition and certification

Awards

Industry and innovation recognition

- Leader of Intelligent Development Award (Poland, 2025)
- Polish–German Economic Award (Poland / Germany, 2023)
- Innovation Award(Poland, 2022)
- Polish Product of the Future (Poland, 2021)
- Green Eagle Award (Poland, 2021)
- Tech Tour Photonics (Europe, 2020)

Recognition (as of end of 2025)

Annual supplier evaluation by a global energy major rated Bioseco at 79% ("strong performance").

ISO Certifications

ISO-certified processes in 4 key areas:

1. Quality management
2. Environmental management
3. Information security
4. Occupational health & safety

ISO certifications confirm the maturity, reliability and scalability of Bioseco's operations.