# COMUNE DI BARDINETO

## Provincia di Savona

# PARCO EOLICO DA N. 2 AEROGENERATORI PER UN TOTALE DI 9 MW LOCALITA' "I GROPPI" - COMUNE DI BARDINETO (SV)



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Oggetto Elaborato :

- Bat Protection System General Description
- Bat Mitigation System

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# Vestas Bat Protection System

## Maximising turbine performance while minimising the environmental impact

### Bene ts of Vestas Bat Protection System

- Maximise energy production while adhering to local requirements
- Reliable and proven technology

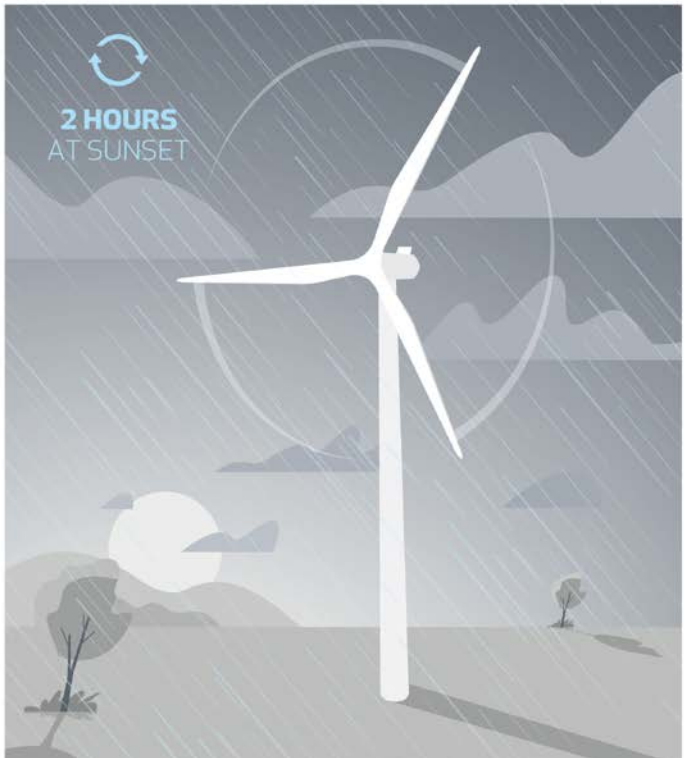
### Safeguard bat species

Vestas Bat Protection System is a software solution that responds to certain environmental factors related to the likelihood of bat presence. The highly predictive behavior of bats allows the turbine to respond to relevant environmental factors which impact the behavior of bats. By smartly pausing the turbine, performance can be maximised while minimising the environmental impact. Operational mitigation can reduce bat mortality by up to 78%*.

* Martin, C., Arnett, E. B., Stevens, R. D., & Wallace, M. C. (2017). Reducing bat fatalities at wind facilities while improving the economic ef ciency of operational mitigation. Journal of Mammalogy, 98(2), 387-385.

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## Availability of Vestas Bat Protection System

V90-2.0 MW™
V100-2.0 MW®
V110-2.0 MW®
V120-2.2 MW™

V105-3.45 MW™
V112-3.45 MW®
V117-3.45 MW®
V117-4.2 MW™
V126-3.45 MW®
V136-3.45 MW®
V136-4.2 MW™
V136-4.5 MW™
V150-4.2 MW™
V150-4.5 MW™
V155-3.6 MW™

V150-6.0 MW™
V162-6.2 MW™
V162-7.2 MW™
V172-7.2 MW™

Vestas Bat Protection System is available as retrofit option on all Vestas turbines running on VMP Global™ while the Bat Deterrent System is available as an after-sales solution on selected turbine types.

## Individual turbine evaluation of environmental conditions

The Bat Protection system evaluates the environmental conditions for each turbine and pauses them individually when needed. Bats are generally most active within two hours of sunset. Low wind speeds further increase the likelihood of bat activity, which also varies according to season.

## Optional precipitation sensor for optimised energy production

Rain considerably diminishes bats activity. Vestas Bat Protection System offers an optional rain sensor which allows the system to adapt to precipitation factors, further increasing accuracy of turbine pausing.

## Bat Deterrent System

Depending on site conditions, Vestas offers an additional after-sales solution to customers in U.S. and Canada to safeguard bat populations. The Bat Deterrent System features five acoustic panels and uses ultrasonic sound waves to dissuade bats from entering the rotor-swept area of a turbine. The solution protects bats while reducing Annual Energy Production lossess associated with bat activity and is seamlessly integrated with Vestas SCADA System.

## For more information

Please contact the local Vestas office for market specific availability and further information.

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# VestasOnline® Business

## Bat Protection System

General Description

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QMS 00082 V01



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Original Instruction: T05 0080-8992 VER 01

## Version history

| Revision | Date | Initials | Change Description |
|---|---|---|---|
| V00 | 2019-02-148 | SCRMD | First version |
| V01 | 2021-12-14 | MSS | Revised description of functionality after changed product requirements. |
| V01 | 2022-07-01 | MSS | Revised description of Brinkmann Procedure |

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# 1 Introduction

The VestasOnline® Business (VOB) and VestasOnline® Compact (VOC) SCADA systems feature optional modules for Environmental Control.

The Environmental Control suite of functions assist the power plant and its owners in protecting the environment from undesired side effects of the of the wind turbine generators in a wind power plant.

This document provides a high-level description of the Bat Protection System.

## 1.1 Abbreviations List

| Abbreviation | Explanation |
|---|---|
| WPP | Wind Power Plant |
| PPC | Power Plant Controller |
| VOB | VestasOnline® Business |
| VOC | VestasOnline® Compact |
| WTG | Wind Turbine Generator |

# 2 Bat Protection System Overview

The Bat Protection System is an optional module that aims to reduce bat mortality by automatically curtailing wind turbines during certain time periods and environmental conditions when the risk of bat mortality is considered high.

Bat Protection is achieved by configuring one or more curtailment schedules defining an exclusion range, that automatically curtails wind turbines when all conditions are fulfilled. These conditions can vary during the year and may depend on the actual bat species.

Environmental conditions that are configurable within the Bat Protection functionality are:

- Time of year (Bat Season)
- Time of day/night (can be based on calculated Sunrise and sunset with offset)
- Wind speed as measured by the WTG sensors
- Wind direction as measured by the WTG sensors
- Ambient temperature as measured by the WTG sensors
- Precipitation as measured by an optional sensor

The Bat protection functionality also comes with a user interface for monitoring as well as a function for generating reports for audit purpose and production loss calculations.

NOTE: Vestas Online® Compact server storage capacity is limited to a single year of operational data. Data retention for Bat Protection Compliance reporting therefore cannot be guaranteed beyond 1 year.



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# 3 Curtailment Schedules

The Bat Protection User Interface allows the user to assign curtailment schedules to individual wind turbines or to the entire WPP.

Each WTG can be assigned to one or more schedules at the same time.

All curtailment schedules are evaluated separately for all WTGs assigned to the schedule.

- If ALL measured environmental conditions fall within the configured exclusion range of the schedule, the Bat Protection control logic will curtail the WTG.
- If ANY of the measured environmental conditions fall outside the configured exclusion range of the schedule, the Bat Protection control logic will release the WTG.

## 3.1 Standard Schedules

A Bat Protection Curtailment Schedule defines the exclusion range parameters to be compared to currently measured values.

It is mandatory to define a Start date and End Date of the schedule but other exclusion range parameters can be enabled or disabled as needed according to local requirements.

- Time of day/night (can be based on calculated Sunrise and sunset with offset)
- Wind speed as measured by the WTG sensors
- Wind direction as measured by the WTG sensors
- Ambient temperature as measured by the WTG sensors
- Precipitation as measured by an optional sensor

## 3.2 Brinkmann Schedules

,WL V S R VW R EL PH S O H PS H Q E M H L Q N P D Q Q D X F K H G H X where the wind speed exclusion range varies over the course of the night.

This curtailment schedule automatically divides the night-time into 10 equally sized time intervals (each accounting for 10% of the time between sunset and sunrise) and adds a 11th time interval before sunset (15% of the time between Sunset and Sunrise). These time intervals have individual wind speed thresholds defined.

It is possible to define several sub-seasons (Start Date and End Date) within a Brinkmann Curtailment Schedule. Each sub-season is essentially a separate curtailment schedule.

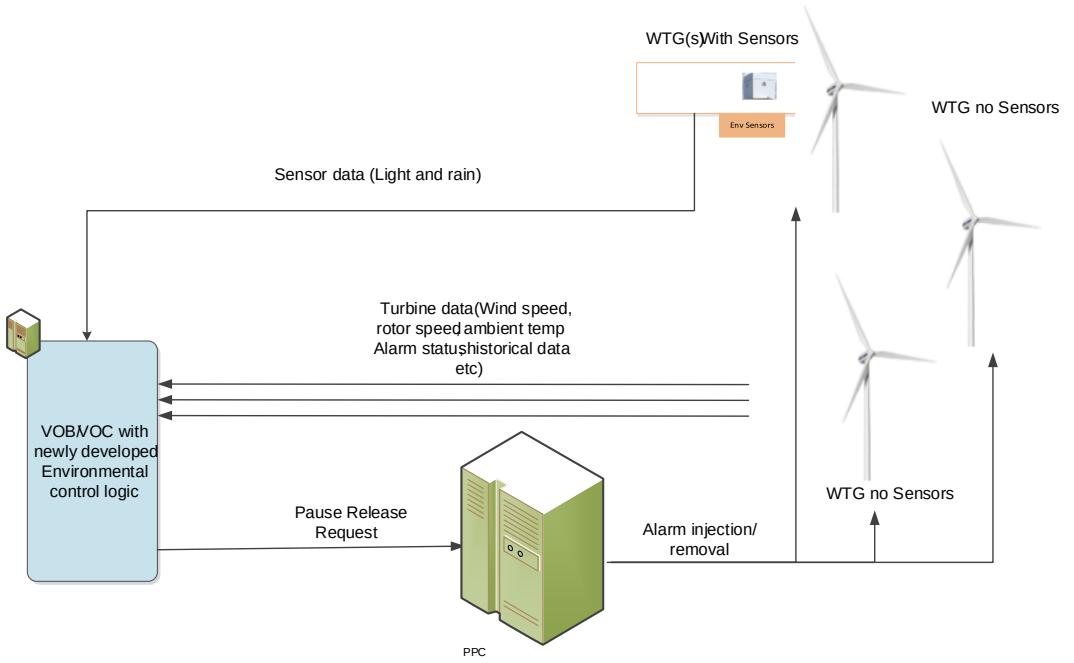
The remaining exclusion range parameters can be enabled/disabled as needed, similar to the standard schedule

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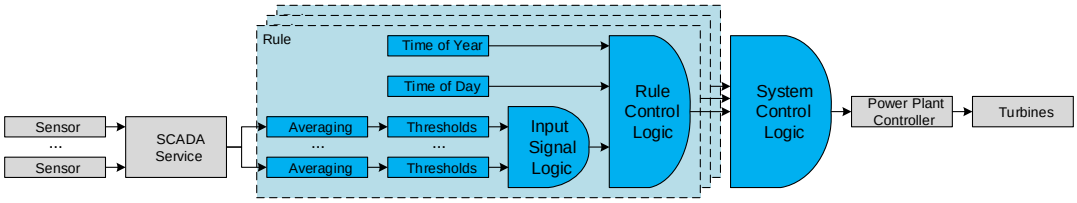
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# 4 System Architecture




## 4.1 Bat Protection

The Bat Protection System logic compares the configured schedules with the readings of the sensors.




When a schedule is active, the logic will use the sensory equipment information to evaluate whether bats are potentially in the area.

## 4.2 Environmental Control Logic

The environmental control logic is implemented to run on the VOB or VOC systems as software modules. The module relies on OPC connectivity for collection of data and command interface towards the PPC, while data is stored in the existing VOB database. This allows existing VOB database reporting functionality to be utilized.

Data collection: Data is collected from the turbine controllers and from sensors mounted on the turbines. Sensor values as well as sensor health status are logged with a timestamp.

Environmental control logic: The environmental control logic compares configuration data with the measurements from the sensors and turbine data.



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Based on the configured rules, the logic evaluates the needed actions to be taken by the WTG.

Environmental logic output: The actions to be taken by the WTG are sent to the Power Plant Controller (PPC) for prioritization and execution of WTG control commands. This ensure that the WTGs do not receive multiple commands which might be conflicting. All decisions are logged and can be presented in reports.

## 4.3 User Interface

The user interface contains the following main functionalities:

Monitoring: Information and status on the systems actuals and a command interface for users.

Reporting: Configuration and Performance Reports

Configuration: Configuration of the system variables

## 4.4 Sensors

Sensors utilized will consist of the following types:

| Sensor type | Amount needed |
|---|---|
| Wind speed | Embedded in each turbine |
| Wind Direction | Embedded in each turbine |
| Ambient temperature | Embedded in each turbine |
| Rotor speed | Embedded in each turbine |
| Precipitation | Optionally available upon request |

# 5 Compatible Systems

The Bat Protection System can be implemented on Vestas Power Plants fulfilling the following system requirements:

- Onshore Vestas Turbine variants with VMP Global SW version 2019.05.xx or higher
- VestasOnline® Business Mk5/ VestasOnline® Compact Mk4.2 with software version 3.27 or higher
- VestasOnline® Power Plant Controller Mk5 with software version 5.1.0 or higher
- VestasOnline® Power Plant Controller Mk4 with software version 3.3.0 or higher

# 6 Documentation

A configuration and user interface manual are part of the Bat Protection System option.

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