



Islandmore Wind Farm

Environmental Impact Assessment
Report

Annex 13.4: Planning-Stage
Shadow Flicker Monitoring Plan

Islandmore Wind Farm Limited

Contents

1.0	Introduction	1
1.1	Purpose of this Report	1
2.0	Roles & Responsibilities	1
2.1	Islandmore Wind Farm Limited	1
2.2	Shadow Flicker Consultant	1
3.0	Monitoring Plan	2
3.1	Monitoring	2
3.2	Ground Truthing	2
3.3	Monitoring Programme	2
3.4	Data Collection	3
3.5	Monitoring Records	3
4.0	Contact Details	3

DOCUMENT CONTROL

Stage	Date	Name
Content	10/03/2026	Simon Carleton
Approval	10/03/2026	Gavin Daly

RECORD OF CHANGES

Revision	Issue Date	Summary of Changes	Approved
00	10/03/2026	Content	Simon Carleton
01			
02			

DISTRIBUTION LIST

#	Purpose	Company	Name (Optional)
1			
2			
3			
Notes:			

© Copyright Galetech Energy Services Ltd. This report has been prepared by Galetech Energy Services Ltd. ("Galetech") for the sole use and benefit of the named recipient (the "Client"). Unless expressly agreed otherwise in writing by Galetech, no other person or entity is entitled to use the contents of this report. Galetech expressly disclaims all liability to any third party who may access or rely on this report, whether in whole or in part, and whether such access or reliance is authorised or unauthorised. No liability is accepted by Galetech for any use of this report other than for the specific purpose for which it was prepared. This report has been prepared by Galetech in accordance with the specific instructions, requirements, scope and limitations set forth in our agreement with the Client, as well as the project's timeframes, budgetary constraints, and in line with customary industry standards. The approach, methodology, assumptions, limitations and sources of information used by Galetech are outlined in this report (as appropriate). The scope of Galetech's services is strictly limited to the conditions described herein. Where conclusions and recommendations are based on information provided by third parties, including the Client or its agents, Galetech accepts no responsibility for the accuracy, validity, or completeness of such information. It is assumed that all relevant data and documentation requested have been provided in full, are accurate, and reflect the current situation. No independent verification of this information has been undertaken by Galetech unless explicitly stated otherwise. The conclusions presented in this report represent Galetech's professional judgement based on observations made during any site visit (if applicable), and the information available at the time of preparation. While Galetech has exercised reasonable skill, care, and diligence in preparing this report, no express or implied warranty, guarantee, or representation is made regarding its completeness, accuracy, or fitness for a particular purpose. Galetech is under no obligation to update this report or any of its findings or recommendations should additional information become available, or circumstances change after the report's date. All intellectual property rights, including copyright, in the content of this report are and shall remain the exclusive property of Galetech unless otherwise agreed in writing. The Client is granted a limited, non-transferable license to use this report solely for its intended purpose under the terms of the engagement with Galetech.

1.0 INTRODUCTION

This Planning-Stage Shadow Flicker Monitoring Plan has been prepared to establish the operational procedures and protocols to be followed in relation to the monitoring of wind turbine shut down measures for the avoidance of shadow flicker effects on receptors in the vicinity of the Islandmore Wind Farm.

The project is located in north County Roscommon; c. 2km north of Ballaghaderreen, c. 13km east of Charlestown (Co. Mayo) and c. 6km southwest of Gorteen (Co. Sligo); and is located in close proximity to the county boundaries between counties Roscommon, Sligo and Mayo.

A total of 125 no. dwellings are identified as being within 10-times the maximum overall tip height (1,850m) of a wind turbine and have been assessed for potential impacts from shadow flicker.

1.1 PURPOSE OF THIS REPORT

Where shadow flicker could potentially occur at dwellings, places of work or schools; developers are required to provide calculations to quantify the likely effect and, where appropriate, take measures to prevent the occurrence of shadow flicker by turning off a particular turbine at certain times.

Chapter 13 of the Environmental Impact Assessment Report (EIAR) provides an assessment of the likely significant impact of shadow flicker on all of the identified receptors within 10-times the overall tip height of a wind turbine. Two separate scenarios are examined - the first provides 'expected' hours per year of shadow flicker and the second provides the 'worst-case' minutes per day of shadow flicker.

Under a 'worst case' scenario, 84 no. receptors are predicted to experience shadow flicker with maximum effects ranging between of 6-minutes and 1-hour 9-minutes on any given day. In the 'expected' scenario, 84 no. receptors are, again, predicted to experience shadow flicker with effects ranging between 7-minutes and 19-hours 27-minutes per annum.

While technological measures will be implemented to avoid the occurrence of shadow flicker at dwellings, schools and places of work; monitoring of shadow flicker will be undertaken to verify the efficacy of the measures. The purpose of this Planning-Stage Shadow Flicker Monitoring Plan is, therefore, to set out the procedures for collecting the relevant data; the form that the relevant data will take; frequency that the data will be submitted to Roscommon County Council ('the Planning Authority'); and details of contact persons for dealing with any issues in respect of shadow flicker.

It should be noted that this Planning-Stage Shadow Flickering Monitoring Plan is a draft document only and will be subject to further post-consent agreement with the Planning Authority, as necessary.

2.0 ROLES & RESPONSIBILITIES

2.1 ISLANDMORE WIND FARM LIMITED

Islandmore Wind Farm Limited will be responsible for procuring and contracting a suitably qualified shadow flicker consultant to carry out the post-construction shadow flicker monitoring regime.

2.2 SHADOW FLICKER CONSULTANT

The Shadow Flicker Consultant, to be appointed by Islandmore Wind Farm Limited, will be responsible for verifying the application and implementation of this programme and associated procedures, supervision of the implementation of all agreed corrective measures, and for updating the programme when necessary. The Shadow Flicker Consultant will be suitably trained and qualified with respect to the environmental construction aspects of the project.

3.0 MONITORING PLAN

3.1 MONITORING

A detailed description of the sunlight and shadow flicker shut down technology utilised by Vestas¹ is provided at **Annex A**. Shadow flicker shut down is a function that is integrated into the control system of the wind turbines and is specifically activated where shut down due to shadow flicker is necessary.

The technology is based on software that computes three factors: the position of the sun, the distance of the wind turbine to any potentially affected properties, and the sunlight intensity. The light sensor to be installed at the Islandmore Wind Farm will measure the intensity of the sun's visible radiation. Using the results, the module determines whether the intensity of the visible direct sun radiation is capable of causing shadow impact. At the same time, the shadow impact module calculates whether shadow impact occurs in a place of immission i.e. at a sensitive receptor based on a predetermined set of times.

In case the intensity of the direct sun radiation is capable of causing shadow impact and shadow impact is detected in a place of immission, the counters for daily shadow impact are updated in cycles of 1-minute. If one of the limit value parameters set is exceeded (i.e. 30-minutes per day or 30-hours per year) in this place of immission, the sensor triggers the wind turbine responsible to automatically shut down for the duration of the shadow impact. As the calculations require the exact time, the shadow impact module is equipped with a radio controlled clock.

The data collected by the sensor module will be relayed offsite to the Islandmore Wind Farm's Supervisory Control and Data Acquisition (SCADA) system. This is a computer system which manages all of the data acquisition and control of all aspects of the wind turbines. This information will be stored within the SCADA system for analysis and can be made available for presentation to the Planning Authority, if required.

The implementation of this software will allow the wind farm owner to remotely, and automatically, curtail the operation of the turbines, thereby ensuring that instances of shadow flicker do not occur.

3.2 GROUND TRUTHING

As part of the monitoring plan, site visits will also be carried out by a specialist consultant during the first 12-months of operation at times where shadow flicker has the potential to occur in order to ground-truth actual conditions. This will ensure the accuracy and validity of the turbine shut down procedures and provide opportunities for any refinement, as necessary.

3.3 MONITORING PROGRAMME

¹ The turbines selected for the project are the Vestas V162-7.2MW and V136-4.5MW (see **Volume I, Chapter 3** for further details).

Shadow flicker monitoring will commence immediately upon commissioning of the wind turbines. The duration of the shadow flicker monitoring will be 12-months to allow for the consideration of all seasonal conditions. However, data will also be collected continuously throughout the proposed 35-year lifetime of the planning permission. In the event of a complaint from any third party, the data can be used to investigate the complaint and to make any modifications to the parameters for turbine sensor triggered curtailment mitigation, as are necessary.

3.4 DATA COLLECTION

The following data, at a minimum, will be recorded from the sensor module:-

- The date, time, location (turbine ID) and duration of the measurement;
- Sunlight intensity and direction;
- Wind speed and direction/rotor angle; and
- Time, date and duration of any sensor triggered curtailment.

In addition to the data produced by the sensor module, ground-truthing reports by the specialist appointed consultants will also be recorded. Information will also be logged in respect of any complaints received from third parties, follow up investigations and any required revisions made to the protocols.

3.5 MONITORING RECORDS

All shadow flicker monitoring data and records will be held in a dedicated file and will be made available to the Planning Authority, upon request, throughout the entire lifetime of the project.

A copy of the full monitoring survey to be undertaken within 12-months following the commissioning of the project will be provided to the Planning Authority in accordance with any relevant condition of consent.

4.0 CONTACT DETAILS

The owner can be contacted via the project website. Additional contact information will also be furnished to the Planning Authority in due course and will be provided on the project website.

ANNEX A – SHADOW FLICKER MODULE



Restricted
Document no.: 0080-8993 V02
2022-10-22

VestasOnline[®] Business

Vestas Shadow Flicker Control System

General Description

Table of contents

1 Introduction..... 3

1.1 Abbreviations List 3

2 Vestas Shadow Flicker Control System overview 3

3 Curtailment criteria 4

4 System architecture..... 4

4.1 Environmental control logic 5

4.2 User Interface 5

4.3 Sensors 5

5 Compatible Systems..... 6

6 Documentation..... 6

Original Instruction: T05 0080-8993 VER 02



T05 0080-8993 Ver 02 - Approved- Exported from DMS: 2023-10-03 by PIDEL

1 Introduction

Environmental Control are optional modules for the VestasOnline® Business and VestasOnline® Compact SCADA systems.

The Environmental control suite of functions assist the power plant and its owners in protecting the environment from undesired side effects of the rotation from wind turbine blades.

This document provides a high-level description of the Vestas Shadow Flicker Control System.

1.1 Abbreviations List

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

2 Vestas Shadow Flicker Control System overview

Environmental Control Options are needed in many power plants in order to comply with local legislation and building permits. The Shadow Flicker Control System is implemented as a part of the overall Environmental Control solution and shares some components with other Environmental Control Options such as Bat Protection System.

The Shadow Flicker Control System module is designed to reduce shadow impact of rotating wind turbine blades (also known as ‘shadow flickering’). This is done by automatically pausing the wind turbines in time periods with shadow impact on buildings or recreational areas. One or more light sensors measure the intensity of the sunlight and in combination with a calculation of the position of the sun, the wind turbine(s) are curtailed (set in Pause state) when the conditions for shadow control are met.

In addition, the Shadow Flicker Control System module can also handle country-specific rules that allow flickering for a specified amount of time daily and yearly per building. This is also referred to as ‘Allowed Flicker’ rules.

Each turbine can have several nearby houses that it can cast flickering shadow upon and if the allowed flickering time for any of these houses has been used the Shadow Flicker Control System will issue a recommendation to pause the turbine.

The Shadow flicker control 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 Shadow flicker control Compliance reporting therefore cannot be guaranteed beyond 1 year.



3 Curtailment criteria

The Shadow flicker control User Interface allows the user to import external calendar files generated in windPRO to define the curtailment schedules for the individual wind turbines of the WPP regarding shadow flicker control.

The Shadow flicker control Interface also allows the user to map the wind turbine names included in the windPRO files and the wind turbine names defined in the wind farm to ensure the correct configuration of the system.

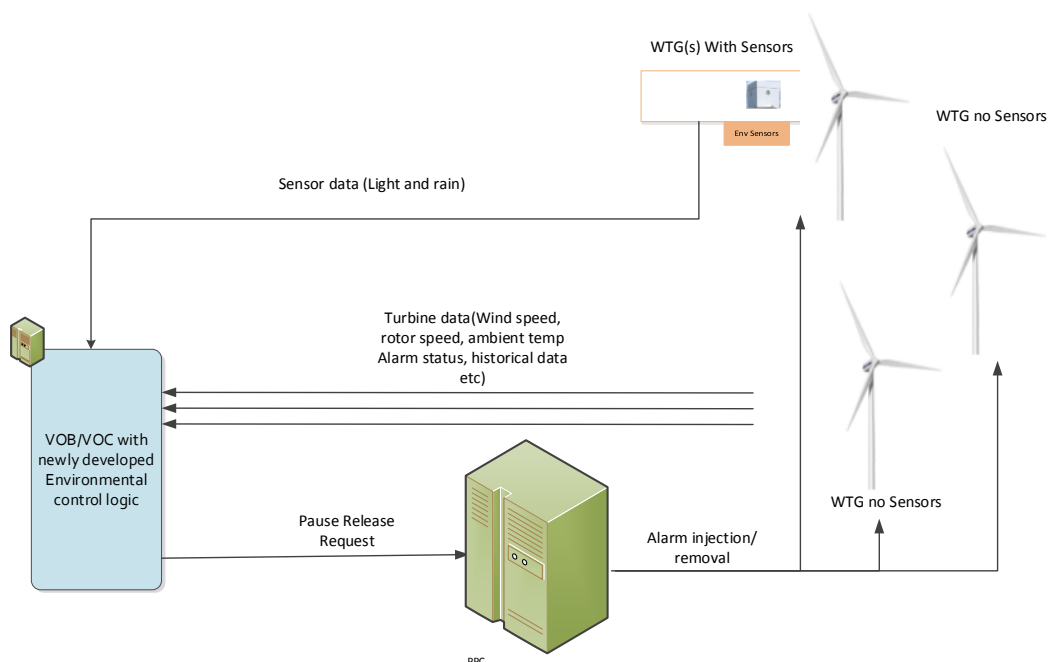
There are a total of three criteria evaluated for each configured building and each WTG to assess on the risk of shadow flickering:

- Date/Time (as per defined in the imported schedules in windPRO calendars)
- Light intensity measured in the configured light sensor (compared with the configured light intensity threshold value)
- Allowed flickering time available in each building (both daily and yearly)

On that regard:

- If ALL criteria fall within the configured exclusion range, the Shadow flicker control logic will curtail the WTG.
- If ANY of the criteria fall outside the configured exclusion range of the schedule, the Shadow flicker control logic will release the WTG.

4 System architecture



4.1 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. 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.

4.2 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

4.3 Sensors

Sensors utilized will consist of the following types:

Sensor type	Amount needed
Light intensity	Depending on site layout

NOTE: Shadow flicker may occur when the direct sunlight is above a predefined threshold. The level of direct sunlight is measured as the difference between the east and the west light sensor. In this way, turbines will not be curtailed in diffuse sun light conditions e.g., due to cloud coverage or fog.

5 Compatible Systems

The Shadow Flicker Control 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 Shadow Flicker Control option.



GALETECH
ENERGY SERVICES

