Regione Autonoma della Sardegna	Provincia di Sassari	Comune di Ittiri (SS)	Comune di Villanova Monteleone (SS)

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Firmato il 21/12/2023 13:18
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Titolo del Progetto:

PARCO EOLICO "ALAS 2"

- Comuni di Ittiri e Villanova Monteleone (SS) -

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OPERE DI MITIGAZIONE E COMPENSAZIONE

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iat CONSULENZA E PROGETTI
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REGIONE SARDEGNA

COMUNE DI VILLANOVA MONTELEONE e ITTIRI (SS)

PROGETTO PER LA REALIZZAZIONE DI UN PARCO EOLICO DENOMINATO ALAS 2

Committente: RWE RENEWABLES ITALIA S.R.L.

OPERE DI MITIGAZIONE E COMPENSAZIONE

SOMMARIO

1. INDIVIDUAZIONE E DESCRIZIONE DELLE MISURE DI MITIGAZIONE

Disposizione e caratteristiche degli aerogeneratori

Un numero contenuto di turbine di grandi dimensioni, distanziate tra loro, è preferibile, ai fini della mitigazione degli impatti, rispetto a un numero considerevole di turbine di piccole dimensioni tra loro molto vicine (May, 2017).

***Il nostro progetto è perfettamente coerente con tale misura di mitigazione*!!!!**

La tipologia degli impianti, di nuova generazione, la disposizione rispetto al rilievo e la distanza reciproca degli stessi, oltre alla visibilità e alla capacità di evitare gli aerogeneratori da parte di molte delle specie presenti, costituiscono, quindi, una prima efficace misura di prevenzione e mitigazione dell'incidenza del Parco Eolico Alas 2 sugli elementi naturali di pregio presenti nella ZSC.

Arresto a richiesta per gli uccelli

Sarà adottato un sistema video di rilevazione e arresto a richiesta denominato Dt Bird.

È un sistema autonomo per il monitoraggio degli uccelli e per l'attenuazione della mortalità presso i siti onshore e offshore di turbine eoliche.

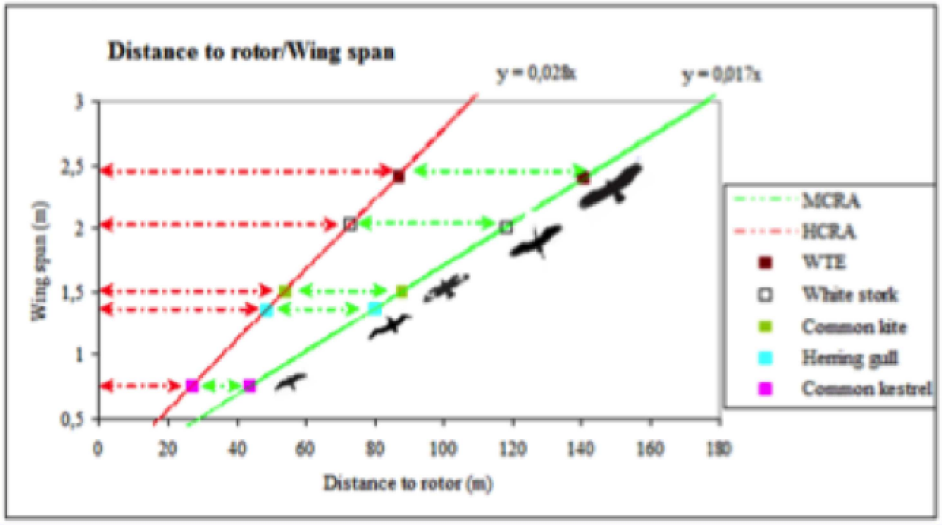
Il sistema rileva automaticamente gli uccelli e può adottare due soluzioni indipendenti per mitigare il rischio di collisione cui questi sono esposti: attivazione di segnali acustici di avvertimento e/o arresto della turbina eolica. In particolare, il sistema è composto da diversi moduli, di seguito descritti, che se attivati in sequenza portano a una riduzione quasi del 100% del rischio di collisione.

- ⇨ *Modulo di rilevazione*. Le telecamere ad alta definizione controllano un'intorno di 360° dalla turbina, rilevando gli uccelli in tempo reale e memorizzando video e dati. Nei video con audio, accessibili via Internet, sono registrati i voli ad alto rischio di collisione. Le caratteristiche specifiche di ogni installazione e il funzionamento si adattano alle specie bersaglio e alla grandezza della turbina eolica.
- ⇨ *Modulo di prevenzione delle collisioni* emette in automatico dei segnali acustici per gli uccelli che possono trovarsi a rischio di collisione e dei suoni a effetto deterrente per evitare che gli uccelli si fermino in prossimità delle pale in movimento. Il tipo di suoni, i livelli delle emissioni, le caratteristiche dell'installazione e la configurazione per il funzionamento si adattano alle specie bersaglio, alla grandezza della turbina eolica e alle normative sul rumore. Non genera perdite di produzione energetica ed è efficace per tutte le specie di uccelli.
- ⇨ *Modulo di controllo dell'arresto* esegue in automatico l'arresto e la riattivazione della turbina eolica in funzione del rischio di collisione degli uccelli misurato in tempo reale. Adattabile a specie/gruppi di uccelli bersaglio. La piattaforma online di analisi dei dati offre un accesso trasparente ai voli registrati, tra cui: video con audio, variabili ambientali e dati operativi della turbina eolica. Grafici, statistiche e report automatici sono disponibili per i periodi richiesti.

***Table1.** Technical specifications of the DTBird system.*

Performance	
Daily service	*light >200 lux*[1]
Target Species	*White Tailed Eagle - WTE*
Target Species Maximum Detection Distance	*200-300 m, depending on bird body position at the detection frame.*
High collision risk area (HCRA) calculation	*Area around a wind turbine between the rotor and a radius X, calculated according to the function X=Y/0,027, where X is the distance to the rotor, and Y is the wing span of the bird.*
Moderate collision risk area (MCRA) calculation	*Area around a wind turbine, between the high collision risk area and a radius X, calculated according to the function X=Y/0,017, where X is the distance to the rotor, and Y is the wing span of the bird.*
Observations: [1] 400 lux corresponds to sunrise and sunset light on a clear day.	

Graphical example of the relation between the wing span of 5 bird species, and radius of moderate and high collision risk areas (MCRA and HCRA), producing warning and dissuasion signals, respectively.



Species (example)	*Wing span (m)*	*HCRA radius (m)*	*MCRA radius (m)*
WTE (Haliaeetus albicilla)	*2,4*	*0-90*	*90-140*
White stork (Ciconica ciconia)	*2,00*	*0-70*	*70-120*
Common kite (Milvus milvus)	*1,50*	*0-55*	*55-90*
Herring gull (Larus argentatus)	*1,35*	*0-50*	*50-80*
Common kestrel (Falco tinnunculus)	*0,75*	*0-30*	*30-45*

Limiti all'operatività per i Chirotteri

Nell'area delle turbine sarà monitorata la presenza dei Chirotteri nella fase ante, in e post operam, secondo le metodologie di rilevamento definite da EUROBATS.

Nel caso di rilevazione della presenza di specie sensibili saranno posti limiti all'operatività delle turbine nei periodi di massima attività dei chirotteri: periodi migratori (agosto-settembre) o nelle fasi di attività rilevate durante il monitoraggio di campo ante-operam.

Un'ulteriore misura potrebbe essere il *curtailment*, ovvero la sospensione delle attività delle turbine per velocità del vento <7 m/s, rivelatasi una misura di mitigazione efficace (Arnett 2005; Horn et al. 2008) dato che anche piccole variazioni nell'operatività delle turbine portano a una evidente riduzione della mortalità in un sito (Baerwald et al. 2009; Arnett et al. 2011).

Studi successivi hanno mostrato che il *curtailment* è efficace anche a velocità del vento <5 m/s (e.g. Arnett et al. 2011).

Nel Parco Eolico Alas 2 si ritiene possibile, qualora il monitoraggio dovesse evidenziare la presenza di specie sensibili, l'adozione del *curtailment* secondo quest'ultima soglia di velocità del vento.

Non appare verosimile, per quanto detto sopra, ma se il monitoraggio in operam dovesse verificare una mortalità che superi la soglia di allarme di 5 animali/anno per turbina (Rydell et al. 2012) (nel nostro caso 55 carcasse/anno), il Proponente applicherà le misure di mitigazione indicate dal Doc.EUROBATS.AC17.6, 2013, ovvero il blocco delle turbine per velocità del vento inferiori a 5 m/s (Arnett et al. 2011).

In definitiva questa misura sarà adottata se:

- Il monitoraggio ante operam rilevasse la presenza, nell'area vasta, di specie di chirotteri sensibili;
- Il monitoraggio in operam evidenziasse la presenza di almeno 5 carcasse per aerogeneratore per anno (nel nostro caso 55 carcasse anno).

Nella remota ipotesi che questa misura dovesse essere attuata si applicherà per tutte le turbine nel periodo limitato dal tramonto all'alba e nei periodi di massima attività dei chirotteri.

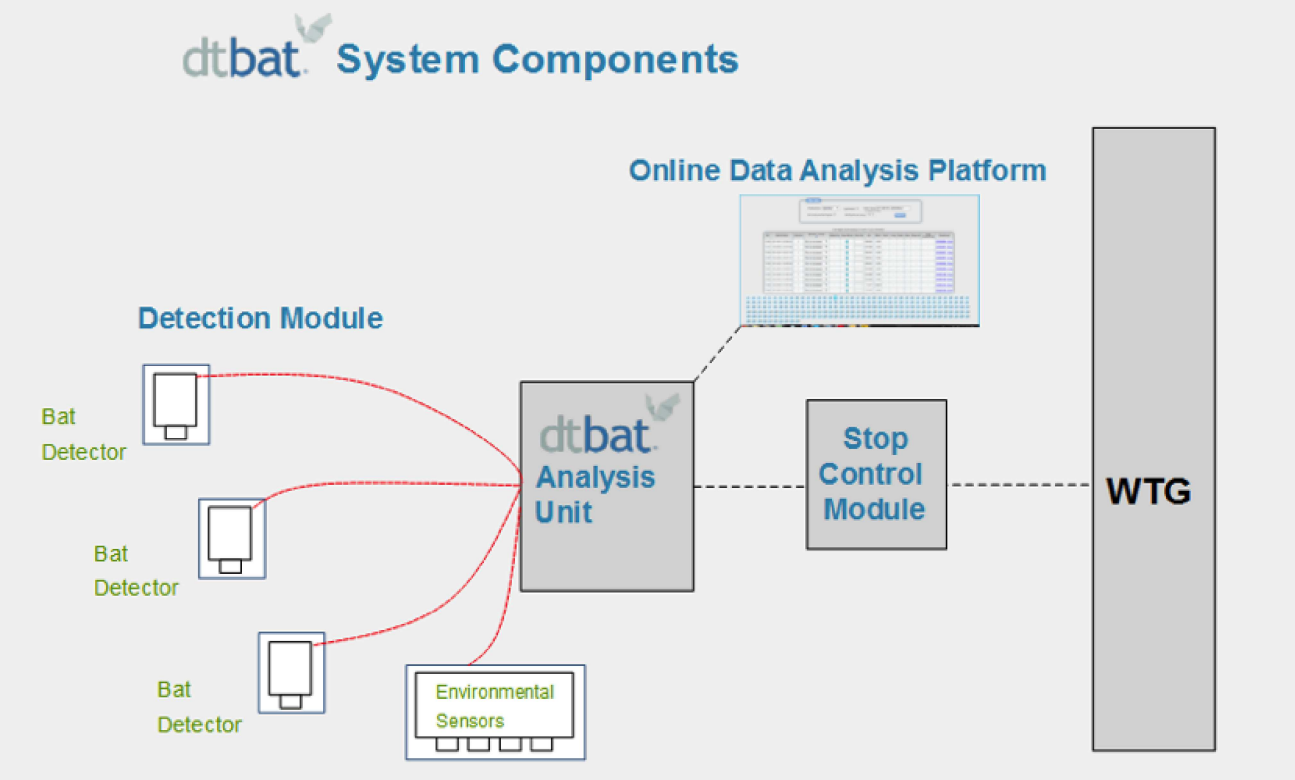
Arresto a richiesta per i Chirotteri

Analogamente a quanto possibile per la protezione degli uccelli possono essere attivati sistemi di rilevazione e arresto a richiesta anche per minimizzare il rischio di collisione con le pale dei Chirotteri.

Il sistema che sarà adottato è denominato *DT Bat.* Si tratta di un sistema automatico di rilevamento in tempo reale della presenza dei Chirotteri nell'area degli aerogeneratori e dell'attivazione di misure automatiche di mitigazione del rischio.

Il sistema è articolato nei moduli, che si attivano in successione, descritti di seguito.

- *Il modulo di rilevazione* esplora lo spazio aereo con registratori per i chirotteri (*bat detector)*, individuando e registrando il passaggio dei Chirotteri in tempo reale. Il tipo di installazione e le modalità operative sono messe a punto e tarate in funzione delle specie target e delle dimensioni degli aerogeneratori. Il modulo è equipaggiato con 1 – 3 registratori installati sulla torre o sulla navicella, in punti specifici per avere la migliore sorveglianza possibile nell'area di rotazione delle turbine.
- *Il modulo di arresto delle pale* provvede automaticamente a fermare e riavviare le turbine, in funzione del rilevamento della presenza dei Chirotteri in tempo reale e/o delle variabili ambientali, quali la velocità del vento. Il modulo è messo a punto e tarato sulle specie target o per garantirne il funzionamento per una soglia rilevata di attività dei Chirotteri, ovvero le pale si fermano quando l'attività rilevata dei Chirotteri supera una determinata percentuale della rilevazione.


dtbat System Components
Online Data Analysis Platform
Detection Module
Bat Detector
Bat Detector
Bat Detector
dtbat Analysis Unit
Stop Control Module
WTG
Environmental Sensors

Siepi arboree in prossimità dei siti di Pubusattile e Puttu Cudinu

Per annullare l'impatto visivo da questi due beni per i quali la matrice di valutazione ha individuato un impatto visivo Alto e Molto alto verranno realizzate delle siepi arboree con essenze già alte 3 metri al fine di annullare qualunque impatto sulla percezione visiva dei frequentatori di questi beni.

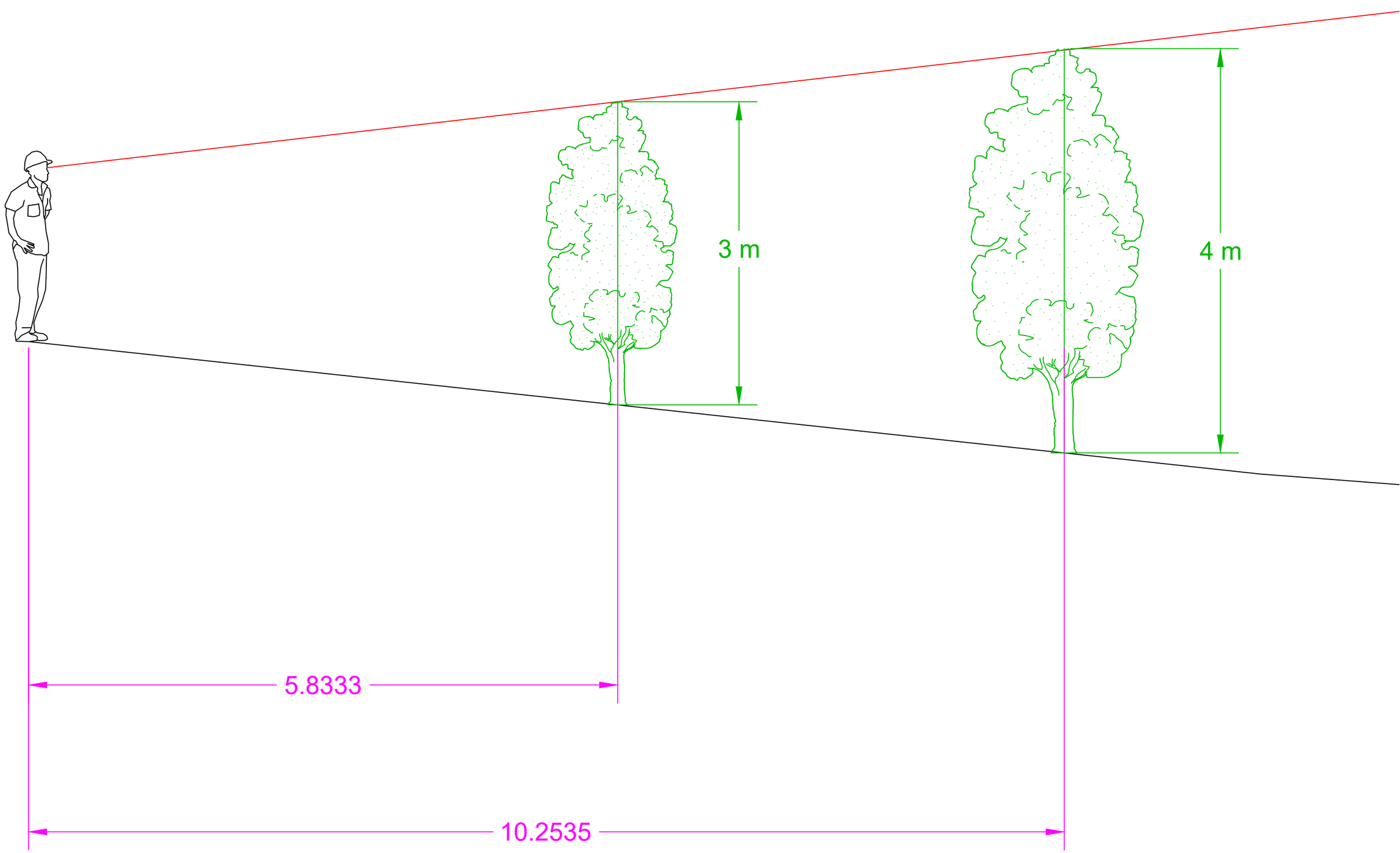
Opere di mitigazione relative alla Biodiversità

Dallo studio effettuato supportato da rilievi in campo di tipo puntuale e conseguenti prodotti fotografici, si è effettuato il censimento delle specie arboree insistenti sulle superfici su cui verranno realizzate le opere civili a supporto degli impianti eolici.

Complessivamente, le operazioni di espianto riguarderanno:

Comune	Foglio	Particella	Unità vegetali	Quantità n.
Villanova Monteleone	18	202	*Quercus suber*	11
Villanova Monteleone	18	202	*Pirus Pyraster*	8
Villanova Monteleone	18	193	*Quercus suber*	2
Villanova Monteleone	18	193	*Pirus Pyraster*	3
Villanova Monteleone	40	186	*Quercus ilex*	8
Villanova Monteleone	40	186	*Quercus ilex*	3
Villanova Monteleone	40	186	*Pyrus pyraster*	11
Villanova Monteleone	30	1	*Quercus suber*	21
Villanova Monteleone	30	1	*Pyrus pyraster*	9
Villanova Monteleone	30	64	*Quercus suber*	3

fascia arborea perimetrale per la mitigazione dell'impatto visivo dal sito di Pubusattile verso il PE ALAS 2 (WTG 7)



Villanova Monteleone	40	7	*Quercus suber*	5
Villanova Monteleone	18	9	*Quercus suber*	42
Villanova Monteleone	18	9	*Pyrus pyraster*	5
Villanova Monteleone	18	5	*Quercus suber*	11
Villanova Monteleone	18A	25	*Pyrus pyraster*	3
Villanova Monteleone	18A	17	*Pyrus pyraster*	3
Villanova Monteleone	18A	19	*Quercus suber*	2
Villanova Monteleone	18A	15	*Quercus suber*	7
Villanova Monteleone	18	11	*Quercus suber*	7
Villanova Monteleone	18	11	*Pyrus pyraster*	9
Villanova Monteleone	10	13	*Quercus suber*	22
Villanova Monteleone	10	13	*Pyrus pyraster*	9

Al fine di mantenere inalterata la consistenza arborea dell'area in esame in fase di cantiere per gli individui arborei sopra elencati verranno previste contestuali operazioni di espianto e reimpianto in situ.

Saranno inoltre piantumate, come compensazione e contributo alla riduzione di CO_2, un numero di individui di Sughera e Roverella corrispondente a 20 per ogni aerogeneratore in un'area degradata che ci sarà indicata dal comune di Villanova Monteleone (in questa prima fase è stata indicata dal Comune l'area del ex tiro a volo) dove sarà realizzato un progetto di Restauration Ecology.

Inoltre considerato un grosso problema legato al fatto che la Malacosoma e la Lymantria attaccano le Sugherete nell'area del Comune durante il periodo della piantumazione, nonché la presenza di un ulteriore specie di batterio fungino di cui non si conosce la natura e che compromette la stagione dell'estrazione di quest'attività fondamentale nell'area si propone

il finanziamento di uno all'università locale che ha già attivato alcune ricerche in merito per salvaguardare lo stato delle sugherete simbolo della Regione

Su tutto il territorio, inoltre, si manterranno in uso le sorgenti da adibire anche alla funzione di abbeveratoi per la fauna.

Sulla base dell'assetto del territorio anche al fine di mitigare i processi erosivi ed a salvaguardare le risorse idriche superficiali e sotterranee è previsto il recupero e il restauro, tra gli abbeveratoi sopra descritti, di quelli che versano in stato di abbandono.

È noto che la presenza di abbeveratoi, lungo i camminamenti del pascolo brado, posti strategicamente a distanza dell'alveo dei diversi ruscelli riduce il danno sugli argini decrementando la velocità dei processi erosivi.

La ristrutturazione degli abbeveratoi è inoltre funzionale al rispetto della batracofauna. In particolare, potranno essere previsti interventi di pulizia selettiva manuale dell'area attorno alla sorgente per una fascia di almeno 10 metri dalla sorgente stessa al fine di delimitare la zona di rispetto assoluta e la ricostruzione dell'abbeveratoio.

Per garantire la risorsa idrica alla fauna immediatamente a valle si potranno realizzare, contestualmente alle opere di captazione, delle piccole zone umide.

Le azioni di sotto descritte saranno mirate a ripristinare gli equilibri biologici alla base dei processi naturali (ecologici ed evolutivi).

Sarà necessario pertanto favorire, nelle aree in cui la vegetazione ripariale dei corsi d'acqua è scomparsa, il ristagno delle acque e lo sviluppo naturale della vegetazione ripariale.

Gli interventi riguarderanno piccoli movimenti di terra e la

reimmissione delle stesse essenze vegetali preesistenti.

Si prevede anche il recupero di muretti a secco al fine di creare un ambiente favorevole alla nidificazione ed all'incremento del numero degli esemplari.

Si precisa, inoltre, che gli unici impatti ipotizzabili in fase di cantiere sono determinati dalla modificazione degli habitat e dall'incremento del disturbo antropico; ovvero dalla presenza di personale, dal passaggio di mezzi di trasporto, dalla realizzazione dei lavori di scavo e dalla generazione di rumore ed alle polveri prodotte dagli scavi.

Nel primo caso l'unico effetto potrebbe essere quello di allontanare temporaneamente la fauna dal sito di progetto, ma vista la modesta intensità del disturbo e la sua natura transitoria e reversibile si ritiene l'impatto non significativo; infatti, come si è già verificato in altri siti, si assisterà ad una graduale riconquista del territorio da parte della fauna, con differenti velocità a seconda del grado di adattabilità delle varie specie anche poiché l'eventuale sottrazione di habitat sarà minima rispetto all'estensione del territorio disponibile (caratterizzato dagli stessi aspetti ecosistemici e naturali).

In particolare la sottrazione di habitat trofico sarà non significativa per le specie con un ampio home range, come i grandi rapaci.

L'intervento di ripristino delle aree non più utilizzate dalle opere, determinerà nel breve tempo la ricomposizione delle coperture vegetali preesistenti e il ripristino degli habitat riducendo, quasi completamente, il disturbo iniziale determinato dalla riduzione e frammentazione di questi.

Si ritiene utile ai fini della conservazione degli ecosistemi l'attivazione di interventi pianificati di tutela degli alberi cavi e vetusti, presenti nelle cenosi forestali, in particolare nelle sugherete, per preservarne il loro significato

ecologico storico e culturale e la loro capacità di ospitare sia vertebrati che invertebrati, articolato nel censimento, monitoraggio e indicazione dei vincoli necessari alla conservazione e sensibilizzazione della popolazione locale.

Si approntera inoltre un programma di monitoraggio e lotta alle specie patogene potenzialmente pericolose (*Lymantria dispar*) presenti nelle cenosi forestali.

Un contributo interessante alla biodiversità del paesaggio di steppa, foresta e dehesa, può anche derivare dalla creazione di praterie alternate a macchie e filari prevalentemente di arbusti esclusivamente per la flora e la fauna, in particolare nelle aree contigue alle zone di maggiore interesse naturalistico, attraverso la conservazione e ripristino degli elementi naturali tradizionali dell'agroecosistema e l'incentivazione della messa a riposo a lungo termine dei seminativi.

Altre opere di mitigazione

Altre opere di mitigazione previste dal progetto sono:

- ⇒ la vegetazione esistente sia nell'area del campo eolico che della sottostazione sarà mantenuta integra e le essenze di pregio che dovranno essere estirpate saranno reimpiantate all'interno dello stesso sito;
- ⇒ si eviterà che i mezzi rimangano accesi quando non utilizzati;
- ⇒ si utilizzeranno macchinari moderni dotati di tutti gli accorgimenti per limitare il rumore e le emissioni in atmosfera;
- ⇒ si utilizzeranno sistemi di abbattimento delle polveri durante le fasi di carico, scarico e lavorazione;
- ⇒ si manterranno sempre umide le aree di transito dei mezzi in cantiere;
- ⇒ si utilizzeranno sistemi di copertura con teloni dei cassoni durante il trasporto di inerti.

Nella fase di realizzazione dell'opera, saranno attuate opportune misure di prevenzione e mitigazione al fine di garantire il massimo contenimento dell'impatto:

- ❖ il contenimento, al minimo indispensabile, degli spazi destinati alle aree di cantiere e logistica, gli ingombri delle piste e strade di servizio;
- ❖ al termine dei lavori, avverrà l'immediato smantellamento dei cantieri, lo sgombero e l'eliminazione dei materiali utilizzati per la realizzazione dell'opera, il ripristino dell'originario assetto

vegetazionale delle aree interessate da lavori;

- ❖ al termine dei lavori sarà rimossa completamente qualsiasi opera, terreno o pavimentazione adoperata per le installazioni di cantiere, conferendo nel caso il materiale in discariche autorizzate.

Si procederà inoltre al ripristino vegetazionale, attraverso:

- ✓ raccolta dei semi autoctoni;
- ✓ asportazione e raccolta in aree apposite del terreno vegetale;
- ✓ individuazione delle aree dove ripristinare la vegetazione autoctona;
- ✓ preparazione del terreno di fondo;
- ✓ inerbimento con la piantumazione delle specie erbacee;
- ✓ piantumazione delle specie basso arbustive;
- ✓ piantumazione delle specie alto arbustive ed arboree;
- ✓ cura e monitoraggio della vegetazione impiantata.

In tal modo, la riqualificazione ambientale sarà tesa a favorire la ripresa naturale della vegetazione innescando i processi evolutivi e valorizzando e potenziando la potenzialità del sistema naturale.

L'intervento di ripristino delle aree non più utilizzate dalle opere, determinerà nel breve tempo la ricomposizione delle coperture vegetali preesistenti e il ripristino degli habitat riducendo, quasi completamente, il disturbo iniziale determinato dalla riduzione e frammentazione di questi.

Per quanto riguarda la mitigazione degli impatti in fase di cantiere saranno adottate le seguenti precauzioni:

- ⇒ selezione di macchine e attrezzature omologate in conformità alle direttive della Comunità Europea e ai successivi recepimenti nazionali;
- ⇒ impiego di macchine movimento terra ed operatrici gommate piuttosto che cingolate;

⇒ installazione di silenziatori sugli scarichi, in particolare sulle macchine di una certa potenza;

⇒ utilizzo di impianti fissi schermanti;

⇒ utilizzo di gruppo elettrogeni e di compressori di recente fabbricazione ed insonorizzati.

⇒ eliminazione degli attriti attraverso operazioni di lubrificazione;

⇒ sostituzione dei pezzi usurati soggetti a giochi meccanici;

⇒ controllo e serraggio delle giunzioni;

⇒ bilanciamento delle parti rotanti delle apparecchiature per evitare vibrazioni eccessive;

⇒ verifica della tenuta dei pannelli di chiusura dei motori;

⇒ svolgimento di manutenzione alle sedi stradali interne alle aree di cantiere e sulle piste esterne, mantenendo la superficie stradale livellata per evitare la formazione di buche;

⇒ orientamento degli impianti che hanno una emissione direzionale in posizione di minima interferenza (ad esempio i ventilatori);

⇒ localizzazione degli impianti fissi più rumorosi alla massima distanza dai ricettori critici;

⇒ utilizzo di basamenti antivibranti per limitare la trasmissione di vibrazioni al piano di calpestio;

⇒ imposizione di direttive agli operatori tali da evitare comportamenti inutilmente rumorosi (evitare di fare cadere da altezze eccessive i materiali o di trascinarli quando possono essere sollevati, ecc.);

⇒ divieto di uso scorretto degli avvisatori acustici, sostituendoli quando possibile con avvisatori luminosi;

⇒ divieto di tenere accesi i mezzi quando non utilizzati;

⇒ utilizzare macchinari moderni dotati di tutti gli accorgimenti per limitare il rumore.

⇒ evitare che i mezzi rimangano accesi quando non utilizzati;

⇒ utilizzare macchinari moderni dotati di tutti gli accorgimenti per limitare il rumore e le emissioni in atmosfera;

⇒ utilizzare sistemi di abbattimento delle polveri durante le fasi di carico, scarico e lavorazione;

⇒ mantenere sempre umide le aree di transito dei mezzi in cantiere;

⇒ utilizzare sistemi di copertura con teloni dei cassoni durante il trasporto di inerti.

2. OPERE DI COMPENSAZIONE

Proteggere l'ambiente è una delle più grandi sfide globali che l'umanità sta affrontando; per farlo è necessario ridurre costantemente le emissioni di CO_2, che è la principale responsabile dell'aumento delle temperature.

Per questi motivi, la società RWE intende implementare una serie di azioni che mirano ad una ulteriore riduzione delle emissioni di gas serra negli anni futuri.

In particolare, la società proponente intende investire sull'ambiente in sinergia con le amministrazioni locali, proponendo iniziative ecologiche parallele e rivolte alle comunità locali.

L'obiettivo sarà raggiunto attraverso le seguenti proposte:

- ⇒ **Monitoraggio delle sorgenti individuate dalla relazione geologica nella fase di realizzazione degli aerogeneratori e realizzazione di opere atte a migliorarne la fruizione e per creare aree umide a beneficio della biodiversità.**
- ⇒ **Impianti fotovoltaici sugli edifici pubblici**: *gli edifici pubblici (Comune, scuole, ecc.), saranno dotati di impianti per la produzione di energia elettrica da energia solare che, insieme ad un sistema di accumulo, garantiranno la completa autonomia delle strutture.*
- ⇒ **Dotare i comuni di auto elettriche per la mobilità della polizia locale e per il trasporto scolastico**: *la mobilità pubblica, anche in relazione agli obiettivi della direttiva "Clean Vehicles Directive", sarà affidata ad un parco veicoli a trazione elettrica*

e saranno installate centraline per la ricarica anche a servizio della comunità locale.

IL DIRETTORE TECNICO
Dr.ssa Marino Maria Antonietta

IT & Communication Solutions for Energy Services

Internet&Idee
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I&I Exclusive Distributor for Italy

powered by Public Power Corporation

adds value to the green energy

We have been awarded by

WITSA
World Innovation, Technology and Services Alliance

World Innovation, Technology and Services Alliance

WITSA 2022
Global ICT Excellence Awards
Winner for Emerging Digital Solutions (private sector)

WITSA 2021
Global ICT Excellence Awards
Winner for Emerging Digital Solutions

We are honored to be a member of the United Nations (UN) Global Compact, the world's largest voluntary corporate sustainability initiative.

Our distinctions

2 platinum, 11 gold, 1 bronze, 2 wind Europe technology workshop, 2 national

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05/06/2023
Document number 2023-166-01

Dear,

RWE Renewables Italia S.r.l.
Via Andrea Doria, 41/G
00192 – Roma

We really appreciate your interest in the nvbird® system.
We submit below, our offer, technical and financial proposal for the installation of nvbird® on the Wind Turbines requested.
Please consider all information in our offer as confidential.
If you may need any additional details or clarification, please do not hesitate to contact us.

Yours Sincerely,

Francesco Zumpano

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ABOUT US

Since 1998, Internet & Idee (I&I) is a consolidated high-level player in IT consultancy and in the provision of IT services.

Since its date of birth, I&I has been more and more specializing in designing and implementing end to end solutions. Nowadays, I&I stands out as a technological partner always capable of supporting companies in their digital transformation process with a complete proposal combining technology, specific skills and strategic consultancy.

Over the years, I&I has gained a solid position within the Italian ICT landscape, in particular for IT Consulting, System Integration, E-commerce Management, Quality Assurance (QA) & Test Management, Credit Management & Credit Collection, Cyber Security. The company has proven to be capable of ensuring the complete and effective management of complex projects, counting on distinctive skills and by relying on a deep knowledge of each step of all the processes which are necessary for the correct execution of all the activities related to the different business area of the different specific market sectors.

The company is experiencing a phase of growth: it can count on over one hundred and twenty professionals, three headquarters and two next one's openings in Italy.

I&I industrial short and medium term development plans forecast an increasingly widespread distribution in its reference territory, supporting customers in a faster and more flexible way in order to strengthen and provide continuity to relationships.

Our mission is Developing cutting-edge ICT solutions with quality levels exceeding customer expectations is the primary objective pursued by I&I.

The constant is to show up on the market with high professional standards, overseeing the development of projects and relationships with clients and customers, promoting their growth in terms of quality.

Our vision is Progress pushes towards a digital society connected by services capable of improving quality of life. I&I aims at contributing to this change process by becoming a technological center of excellence, enhancing the role of people and their ideas, which constitute the development towards innovation
engine.

Passion and Union of a determined team with which to share objectives and vision are the two components that will give I&I the possibility to reach ambitious and important goals.

Integrity, professionalism, transparency represent the guiding principles that drive every single choice and decision made by I&I.
They are just a part of the shared values that strengthen the corporate culture, which puts ethics at the hearth of each decision so as to foster a working environment based on respect, collaboration and internal and external cooperation within the company.

A strong value system that has allowed I&I to build continuous and meaningful relationships with all the stakeholders.

I&I aims at standing out as an IT player always targeting at excellence by offering
advanced digital and technological solutions that are modeled according to specific and particular clients and customers needs.

In I&I Quality Certifications together with the continous training of management

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and technical company personnel have a high strategic value, since they are evidences that certify how products and services and I&I know-how respect high quality standards which are recognized by third parties and authorities, that can guarantee quality assurance for clients and customers.

I. ABOUT NVISIONIST

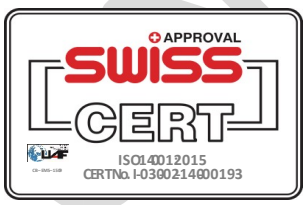
At nvisionist we design, create and offer innovative solutions and services that contribute to the quality of life and conservation of resources.
The shareholders and key personnel of nvisionist carry a long track record of successfully completed special projects in various areas and markets mainly in the ICT and renewables industry in Greece and abroad. Our know-how covers the areas of developing, permitting, engineering, project managing, implementing, operating and maintaining of ICT, Bird Detection & Monitoring and sustainable energy projects.

Our vision is to become a reference name in doing business and creating innovative solutions for sustainable production that benefit organizations, communities and the environment. In nvisionist we are experts at designing applied Artificial Intelligence and Machine Learning solutions. Based on advanced Machine Learning algorithms we provide applied solutions that really work, comply with our customers requirements and goals and return the initial investment quickly.

We have a thorough knowledge of the Renewable Energy market and we work with Energy providers. We understand their needs and we design innovative solutions that help them protect the environment and at the same time increase their profits.

At nvisionist we have the goal to continuously improve the quality of our products and services and consistently meet our customers' expectations

We adhere to the ISO 9001:2015 quality management system that helps us ensure that our customers get consistent, excellent-quality products and services. nvisionist is also implementing an effective environmental management system.
ISO 14001:2015 helps us improve our environmental performance through more efficient use of resources and reduction of waste.
Both standards have been certified by Swiss Approval Technische Bewertung.



International Presence and Awards

nvisionist has been the only company presenting a bird detection & monitoring system in the most important international trade fair for the wind industry **"HUSUM WIND - THE GERMAN WIND TRADE FAIR AND CONGRESS"** that took place in Germany during the 14th and 17th of September 2021 in Husum, the wind energy mecca. (It has been the first international trade fair with exhibitors and visitors presence following the Covid-19 pandemic). Hundreds of visitors from all over the world have visited the nvisionist stand and have been impressed by the features of the nvbird® system.

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Presenting **nvbird®** at the Electric City Fair, held in Copenhagen in 2021.
Among our special guest were foto up left:
EU Deputy Director - General, Mr Patrick **CHILD**

CEO of Wind Europe,
Mr Giles **DICKSON**

nvisionist has developed a very close cooperation with ENV D3 (nature protection) of European Commission.

Middle foto:
Secretary General for Energy & Mineral Resources at Ministry for the Environment and Energy,
Mrs, Alexandra **SDOUKOU**
Mr. Panagiotis Ladakakos, President of BoD of HWEA ELETAEN
Mr. Panagiotis Papastamatiou, CEO of HWEA ELETAEN

Bottom foto: presentation of nvbird® at the innovation park, during the Electric City Fair.

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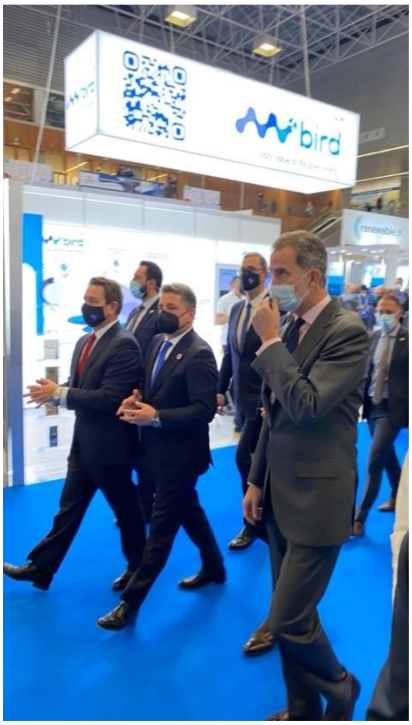

Within the context of its participation (Hall 3, Stand D30) **in the leading Annual European Wind Energy Exhibition, organised by Wind Europe (Pan-European Wind Energy Association)** between 5-7 April in Bilbao, Spain, **Nvisionist** has joined the upcoming session **"Technology for mitigating and ensuring positive biodiversity impacts"** organized by **Wind Europe** which was held on **Wednesday 6th April 2022 at 16:15-17:15**, **WindTalks Stage for Innovation (Exhibition hall 1).**

Alexander Vandenberghe, Sustainability Manager at WindEurope, was moderating the session while highly esteemed experts on wind energy will also participate: **Hywel Roberts, Senior Lead Strategic Specialist, Ørsted, Ibon Galparsoro, Prinicpal Researcher, AZTI, Tassos Alefantos, CEO, Nvisionist and Cristina Simioli, Senior Manager - Energy and Policy Systems, Renewables Grid Initiative. Mr Tassos Alefantos, CEO of Nvisionist,** presented for **the first time nvbird®- offshore, Nvisionist's new product. Nvbird®- offshore is a unique & innovative product** designed especially for **offshore Wind Turbine Generators, adding value to the wind energy** by almost eliminating the erroneous shutdown of offshore wind turbines, maximizing their productivity, while safeguarding protected birds from colliding with wind turbines' blades.

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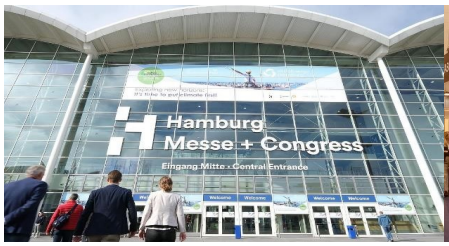

This year's WindEnergy Hamburg ended on Friday, 30 Sept 2022 with the entire wind energy and hydrogen industry signalling a strong sense of optimism and anticipation. On Hamburg's exhibition campus more than 1,400 international exhibitors showcased the full range of innovations and solutions the onshore and offshore wind industry has to offer.

Our company has participated at Hall A4 stand 282 and managed to concentrate attention from a wide area of visitors including the biggest China's news channel CGTN, which they had mentioned us in their review.

Also, our company has recently participated at 12e Colloque National Eolien in Paris-France during 12-13 October 2022.

Wind EUROPE Technology Workshop

Rome, September 2021

Another confirmation of the international recognition of the technological innovation of nvbird® is its selection and presentation at the **Technology Workshop of Wind Europe** that took place on the 8th to 10th of September 2021. nvbird® was evaluated by a committee of Wind Europe, which consists of top wind energy executives, and **was presented as the second solution out of 109. Our abstract was entitled** "Use of artificial intelligence and machine learning algorithms to accurately detect, classify and deter birds maximizing wind turbines operating time and saving bird lives".

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PO.002

Use of Artificial Intelligence and Machine Learning algorithms to accurately detect, classify and deter birds maximizing wind turbines operating time and saving bird lives

Tassos Alefantos
nvisionist

Abstract

In this abstract we describe an innovative solution that helps save birds lives and at the same time helps Energy Provider companies maximise their profits by securing more running time for their wind turbines. The system is built using state of the art cameras as well as inhouse developed Artificial Intelligence and Machine Learning Algorithms and can manage not only to detect and deter birds but also to recognize and classify them in order to take accurate decisions.

Objectives

Thousands of birds, domestic and migrating, fly through the wind parks and face risk of a collision with the wind turbines blades. Some of the birds are endangered and the life of each one of them is valuable to the ecosystem. EU legislation has enacted environmental protection rules and energy providers are often required to install bird deterrent systems especially in "Natura" areas.
Existing Bird Deterrent Systems are based on outdated motion detection algorithms, that trigger the system to stop the turbines too often, since in many cases they cannot distinguish birds from airplanes, clouds, turbine blades, even insects flying close to the cameras.
Another challenge is that Motion detection technology needs to cover (masking) certain areas to improve its detection results, creating blind spots.
The result of the above is that energy providers lose a substantial amount of money when the turbines shutdown.
As more and more wind parks are built around the world, low-conflict areas for wind turbines become scarce, the global need for bird protection is rising and there is also a clear need for more accurate systems.

Methods

Using state-of-the-art ICT and software development technologies, we manage to deter the birds from the wind turbines, while at the same time maximizing the operating time, almost eliminating shutdowns and minimizing noise pollution. The development of this innovative system, unique in functionality by using artificial intelligence and machine learning technologies, adds value to the global wind energy market.
The hardware of the System consists of a powerful server, capable of processing and rendering high resolution images quickly. Ultra-high-definition cameras with star-light technology, enable the system to capture high-resolution colour video and images as far as 1.000 meters. Additional thermal cameras help the system detect birds even at complete darkness. Powerful acoustic modules emitting a special directional sound that targets the acoustic reflex deter the birds without harassing them.
The solution has been built around a unique machine learning algorithm designed and developed inhouse. It uses advanced classifiers and large databases to achieve its performance. It has been deployed in a few wind parks and has been working with outstanding results in terms of recognising birds promptly and successfully deterring them, eliminating false positives and shutting down the turbines only when it is absolutely necessary. The bird detection system is continuously self-improving its detection capabilities using the Machine Learning video content analysis algorithms and a dataset that gets continuously better with the support of a team of ornithologists that classify birds unidentified by the algorithm.

Results

Table 1: Number of nvBird detections and false positives per camera.

nvBird System	Numbers of detections	Numbers of false positives	Percentage of false positives
Camera 1	16	0	0,00%
Camera 2	12	2	16,67%
Camera 3	97	2	2,06%
Camera 4	23	0	0,00%
Total	**148**	**4**	**2,70%**

97,3% of the detections made by the nvbird system are species of interest. We have run a procedure to test the detection accuracy of the system. During the assessment period (24/5/2021 – 4/6/2021) the system made a total of 148 detections. Most flights were detected on the northern side (camera 3 – 97 detections), followed by flights detected in the east (camera 4 – 23 detections), south (camera 1 – 16 detections) and west (camera 2 – 12 detections). The results of the analysis showed only 4 false positive cases out of the 148 total detections made (2 by camera No2 and 2 by camera No3). The false positives cases included 2 cases of sky artifacts, 1 case of airplane and 1 case of no object. It should be noted that the three cases of sky artifacts and no object were detections where the sun was reflecting at the sensor. The system does include algorithm that decreases the effect of sun rays pointing straight at the camera but in some cases, it is not possible to avoid sky artifacts. The number of detections and the false positives per each camera for the assessment period are presented in table 1.

Conclusions

The system has made use of Artificial Intelligence and Machine Learning current technological advances in a real-world application in the area of birds biodiversity conservation. It manages to protect the birds, stopping the WTG only when it is necessary. It is very accurate and has the ability to continuously improve its performance, offering reliable data to companies and researchers that can be accessed in real time from the cloud.

References

1. Journal Article, *Wind Turbines Interactions with Birds (nature.com)*
2. European Environmental Agency , https://natura2000.eea.europa.eu/#

Watch this presentation
Download the poster

Wind EUROPE TECHNOLOGY WORKSHOP 2021 8-10 SEPTEMBER ONLINE

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Brussels, June 2022

The nvbird® system has been selected once more by Wind Europe to be presented during the Technology Workshop 2022 that took place in Belgium on the 23-24 June 2022. Mr Alefantos, nvisionist's CEO was one of the four speakers at the "Environmental aspects of wind farms" session.

Join the WindEurope's Technology Workshop, 23-24 June 2022:
https://lnkd.in/enQQES2q
▶ Register here: https://lnkd.in/eeKE9EyB

Session speakers:
- Brian Boye, Semco Maritime
- René M. M. Slot, EMD International A/S
- Tassos Alefantos, nvisionist
- Kester Gunn, RWE Renewables

#WindEurope #windpower #windispower #windindustry #windfarm #windindustry #renewables #renewableenergy #cleanenergy #climatechange #environment #sustainability

nvisionist and the innovative nvbird® bird detection & monitoring system were honored with three awards at the annual **Impact BITE Awards 2021.** The triple distinction of nvisionist and **nvbird®**, consists of an additional

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confirmation of the value and the top level of digital & technology solutions and innovative thinking that we provide worldwide, in the field of Energy and Environment.

- **Platinum Award**

In the category of top awards **of the year**, nvisionist and nvbird® - Bird Detection & Monitoring System, were awarded as the project that received the highest rating from the judges.

- **Gold Award**

Category - Specialized industry applications, nvisionist and nvbird® - Bird Detection & Monitoring System were honored in the field of **Energy**.

- **Gold Award**

Category - New Technology Trends in applications and services, nvisionist and nvbird® - Bird Detection & Monitoring System were honored in the **(AI) Artificial Intelligence** category.

WITSA 2021 Global ICT Excellence Award
Winner "Emerging Digital Solutions Award (Private Sector)"

nvbird® technology has been declared a **WINNER** and won the Global ICT Award, in the "Emerging Digital Solutions Award (Private Sector)" category, at the World Congress organized by **WITSA** (World Information Technology and Services Alliance).

WITSA, founded in 1978, is a leading consortium of ICT industry association members from over 80 countries/economies around the world. WITSA's members represent more than 90 percent of the world ICT market.
The award was presented by the Greek Prime Minister Mr Kyriakos Mitsotakis

All nvisionist team is proud that for the second consecutive time we received the top distinction, 1st prize, in the category "Emerging Digital Solutions Award (Private/NGOSector)" with the nomination of nvbird® offshore, exclusively for offshore wind farms, at the Global Innovation and Tech Excellence Awards 2022, which took place in Malaysia on Wednesday,
September 14th, in the framework of the Global IT Conference "WCIT 2022".

It is the second consecutive global distinction of nvisionist in the global innovation and technology awards organized by WITSA (World Innovation, Technology and Services Alliance), which makes nvisionist the first and only worldwide "back to back" award-winning company in the Global ICT Excellence Awards 2022.

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II. THE CHALLENGE

Wind Parks are often installed in locations, where wildlife flourishes. Thousands of birds, both domestic and migrating fly through the wind parks and some of them collide on the blades of the turbines and die. Many of them are endangered and each one of them is valuable to the ecosystem.

EU legislation has enacted environmental protection rules that all energy providers are required to adopt. Energy providers when installing wind parks in areas designated as Natura 2000, are obliged to install systems that monitor the skies around the parks for birds and deter them by emitting special sounds when they are on a collision course with the blades. If for some reason birds keep their collision course, the system must shut down the Wind Turbine Generator. Once the turbine is shut, it stops producing energy. Moreover, once it starts again, it takes time to reach full capacity. As a result, energy providers lose a substantial amount of money when the turbine is shut down.

Most of the other bird deterrent systems in the market, are based on outdated motion detection algorithms, producing a lot of "false positives" that trigger the system to stop the turbines very often. Since they cannot accurately distinguish birds from other moving objects as airplanes, clouds, blades of nearby turbines, or insects that fly close to the cameras they cause a significant decrease in the total amount of energy each turbine is producing.

SOLUTION ARCHITECTURE

Operation Principle

1. DETECTION PHASE

The system is installed on each Wind Turbine Generator and covers its surrounding area for long distances.

In case of a bird approaching, the flight trajectory is recorded through HD cameras.

2. IDENTIFICATION PHASE

Edge AI and Machine Learning algorithms are applied in order to identify the bird and categorize it in critical or not critical species according to the environmental impact assessment of the wind park.

3. COLLISION AVOIDANCE - DETERRENCE PHASE

When the identified bird belongs to the critical species and enters the critical zone, an ASR sound is enabled to deter it.

4. SHUTDOWN PHASE

In case the bird remains in the critical zone or further approaches the RSA (Rotor Swept Area) the system sends a direct signal to the SCADA to stop the Wind Turbine Generator.

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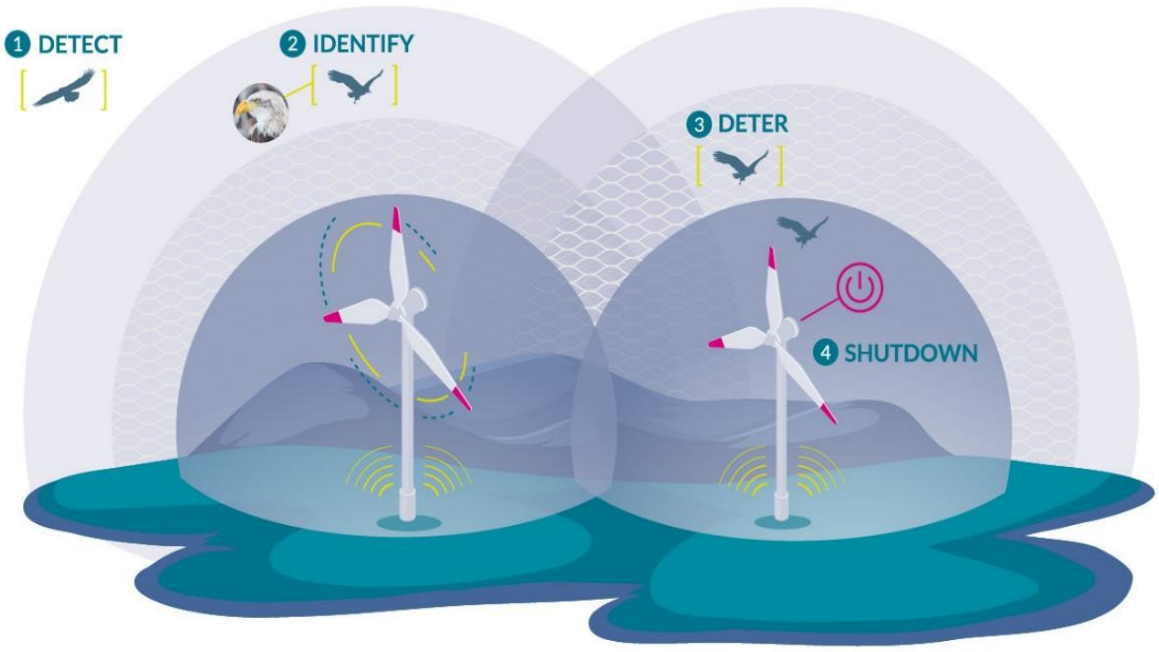
How it works

We use state of the art Artificial Intelligence algorithms to detect birds in risk zones. Our system can continuously improve its detection capabilities using Machine Learning technology.
Our High Definition cameras in combination with Thermal vision technology cameras achieve 24 hours all weather detection and operation. Our system can detect and classify flying objects in long distances.
The classification of the birds depends on the quality of the dataset the system has been fed. The more data we have on a specific bird of interest, the better. Following the installation, the system collects photos and videos of every incident (bird detections, bird deterrences, shutdowns). All the info gets uploaded in the cloud and our ornithologists classify the birds that have not been classified automatically. Then, the system algorithms get "retrained" and the quality of detections and recognitions improves. nvbird® is modular and scalable. Depending on the reason one wants to monitor and whether it should monitor at night as well, the system can be built to order with one to four optical cameras as well as thermal cameras respectively. Furthermore, it can be built with or without the option of stopping the turbine when birds are not deterred.

Based on the process of detection and classification, we use state of the art acoustic driver modules with adjustable volume to deter birds entering the turbine risk zone. Our system uses directional sound emission, minimizing sound pollution. The special sound emitted, is evoking the Acoustic Startle Response of the birds, making them change course. The sound does not harass the birds and they do not get used to it.
In the extreme scenario that a bird enters the critical impact zone, the turbine can receive signals in various formats, in order to stop its operation and prevent the collision.



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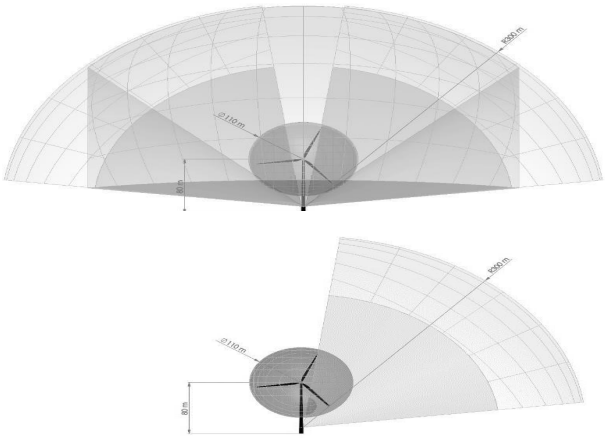

ex. Configuration for V90

o

Four (4) bases with cameras for
360 horizontal coverage per WTG

Hub height = 80m

Cameras installation height = 10m

Shutdown zone, D = 110m

Deterrence - Slow down zone, R
=
300m

Regarding Bats protection, the nvbird® system will automatically stop and restart the WTG depending on bat activity detected by the thermal cameras in real-time and/or environmental and seasonal variables.

The nvbird® system adapts perfectly to the environmental assessment requirements which we have studied carefully in order to offer the most appropriate solution.
Our system's unique capability of two way communication through each nvbird® OPC client with the respective WTG manufacturer opc servers in each and the SCADA system, enables the nvbird® systems to send commands and receive information to and from any required WTG in each park.

Whenever the system detects bat activity, increases the cut in speed to 4,5m/sec (EUROBATS guidelines) or any other speed it is decided. This measure will be in effect, according to the environmental requirements, only during the April to October time period and only if the temperature is over 15 degrees Celsius. nvbird® is fully adaptable to your requirements and can be tuned to implement any risk rule sets that will be agreed between the Operations and the Environmental teams during the calibration period with the primary goal of protecting bats while at the same time maximize energy production.

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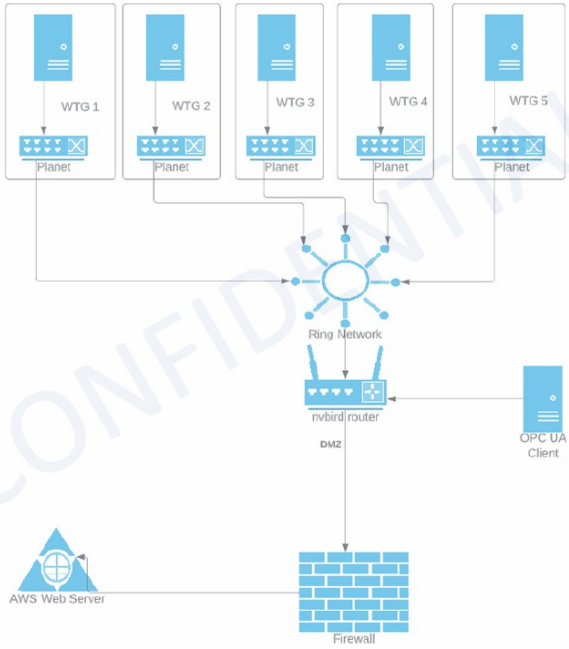
NETWORKING INFRASTRUCTURE

The typical network architecture of the proposed system is displayed in the following diagram:



Network diagram

For nvbird® to be functional and effective, a TCP/IP network is required**. nvbird® requires one ethernet port connection per WTG.**

Nvisionist has invested and created its own OPC client, the nvbird® OPC UA client in order for the systems to communicate with the SCADA, send commands to any WTG in the park and receive useful data for the functionality of the system and the reporting.

An nvbird® OPC client will be installed in each control building. The purpose of the nvbird® OPC client is to establish the communication between the nvbird® and the SCADA system, which is responsible for the function of the wind turbines. The established communication will be two-way. First, the nvbird® client is able to acquire measurements about the environmental conditions, by reading certain tags from an OPC UA server provided by the WTG manufacturer. Second, it is able to submit interrupting signals, by writing to an appropriate tag of the same server.

If necessary, the nvbird® OPC client supports communication with more than one OPC UA server, and it can also be configured with redundant servers. In any case, a single nvbird® client is required, which is placed in the control room. Another important feature is that all reading and writing events are logged in a database. More specifically, there is one database for each wind turbine. Finally, the nvbird® OPC UA client supports encrypted and secure communication with the OPC UA server.

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nvisionist

unique & innovative

nvbird OPC

- Decision making based on data received
- Control WTG operation with Scada communication – tags
- Two way communication
- Control WTG according to environmental risk rules set
- Reporting

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INTELLIGENT REPORT GENERATOR SCREENSHOTS – BIG DATA ANALYSIS

nvisionist

Big Data Analy cs

Uncover trends, pa erns, and correla ons in your data
Take data-informed decisions to the ne t level

Integra on with OPC gives the opportunity to collect of a vast amount of opera onal data from both the Wind Turbine and nvbird.

- **Data Mining**
- **Predic ve analy cs**
- **Deep learning**

Analyzed by our specialized ornithologist and data scien sts teams to iden fy, trends, upcoming risks, improvement opportuni es and pa erns incorpora ng AI & ML

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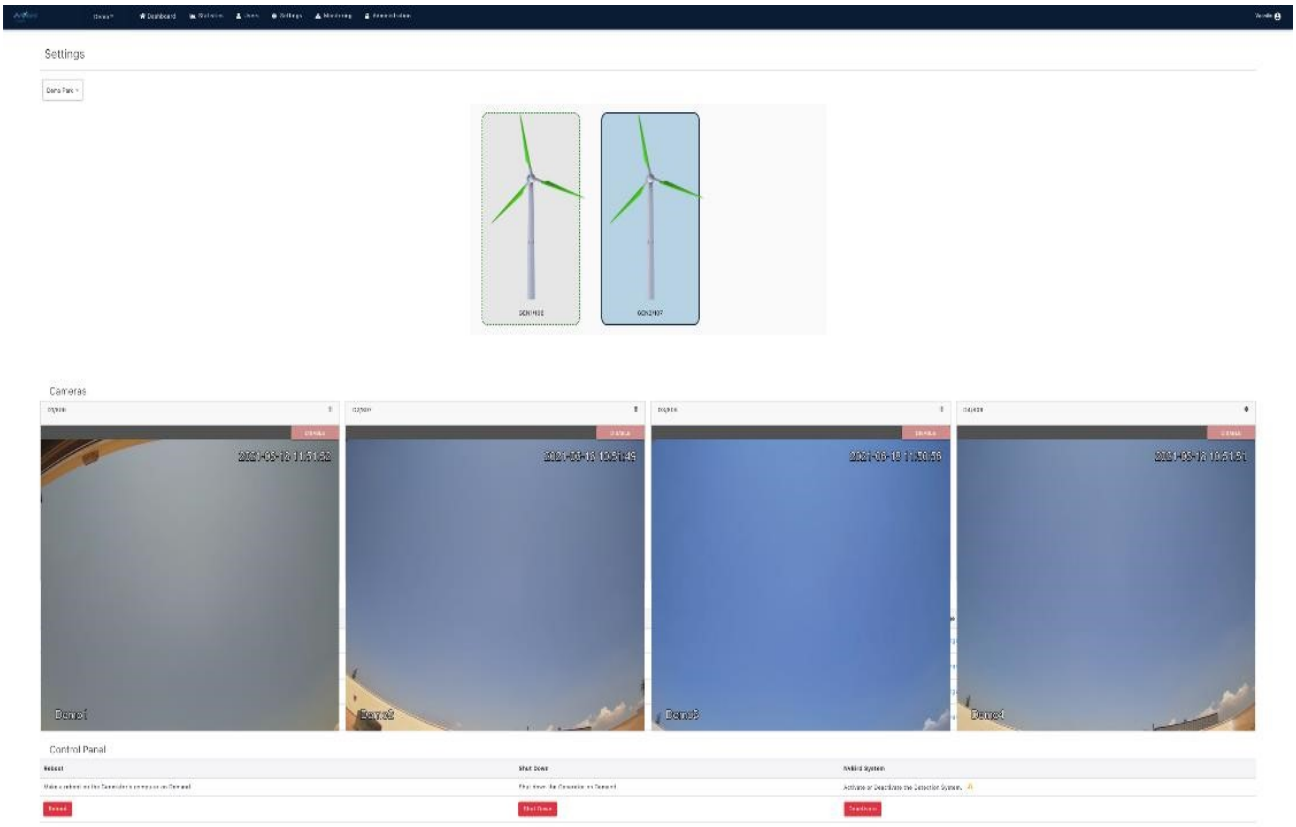

INSTALLATION OF MODULAR NVBIRD® SYSTEMS

The innovative nvbird® system has been granted Patent no 20210100503 from OBI, the Greek National Patent Register.

The nvbird® system has been designed and manufactured using high quality materials (eg external system made of inox 316L) taking into account a wind farm project's 20+ year life time.
nvbird® external backplate system can be installed in all types of WTGs either during their erection or after. Two (2) metal wire ropes are responsible to hold the back plate of each base on the outer perimeter of the WTG tower. Each wire creates a vertical force (towards the surface of the tower) and is tensioned at approximately 900kN (certified). A special protective rubber mat is placed between the tower and the back plate both to prevent the two metal surfaces to be in contact but also to increase the friction coefficient to prevent sliding in a case of impact (i.e. ice fall from nacelle, ice sliding on tower's surface). All external metal parts are made of stainless steel 316L and they do not need maintenance or retensioning (systems that are installed with magnets and polyester straps need periodic checks). As you can imagine nvbird® cannot be compared with other systems as all of its components are made by high quality materials and made it to withstand in whole lifetime of a Wind Park.

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External fixed backplate, wire ropes and mounted system

After the back plate is attached to the tower the stainless-steel cover that holds the camera, speaker and electrical/network wiring is attached to the back plate. Installation and deinstallation is very easy and does not require deinstallation of the whole external system and steel wire ropes.

Stainless steel cover with cameras and speaker installed

In each Wind Turbine, the following equipment must be installed:

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- 1 control unit that is installed inside the base tower.

Control unit installed

- Four stainless steel modular bases that are attached on the outer perimeter of the WTG tower at a height between 8-12m from the ground. Each base carries at at least one camera and the speaker.

System installed.

How we differ

- Advanced Deep Learning Algorithm – can identify bird types, sizes, direction, speed.

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- **For WTGs over 70m height, there is no need for 2nd, 3rd row of speakers as we install a special 120db omnidirectional 360° speaker on the top of the nacelle. For this unique and innovative solution Patent 20210100536 has been granted by OBI, the Greek National Patent Register.**
  The nacelle speaker is very effective as it is placed in the middle of the Rotor Swept Area and provides easier installation and maintenance.

- Significantly less false positives, more running time for the turbines, less noise pollution, less strain to the generators caused by unnecessary shutdowns that cause extreme loads.
- **Tailor-made design for each Park** – our team of engineers and ornithologists surveys the Park and designs the solution considering legal environmental requirements, the landscape, height, winds direction etc
- Ideal Hardware setup – we use state of the art cameras, powerful servers, targeted sound deterrence.
- External systems designed to withstand tough weather conditions.
- Online cloud reporting – you can access our cloud platform anytime and see the reports. You can have a report sent on a daily, weekly monthly basis.
- 24/7/365 service desk – We are always online.
- Flexible Service Level Agreement (or spare parts)

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TECHNICAL REQUIREMENTS FOR

CLIENT NAME:	RWE
WTG MANUFACTURER / MODEL:	SGRE
PARK NAME:	SAN SEVERO
TOTAL NUMBER OF WTG's:	12
NUMBER OF nvbird® SYSTEMS:	12
COUNTRY:	ITALY
LOCATION:	SAN SEVERO (PUGLIA)

This document provides information about the installation requirements of nvbird® System.

CONTROL UNIT CABINET

Control Unit Technical Requirements	
Power Requirements:	Stable Single Phase, 230 V, 16A, 50Hz
Cable specifications:	SiHF 3 X 1,5 mm
Dimensions:	120cm(H) X 60cm(W) X 25cm(D)

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Base for the Control Unit	60cm(H) X 60cm(W) X 25cm(D)
Weight:	40Kg
Connection to mains power:	TBD

Mounting method:	TBD
Power Consumption:	Minimum: 4.1 A @ 230 V Maximum: 8.8 A @ 230 V
Installation Location	Installation Location has to be provided by the manufacturer
Communication	Ethernet port

WTG CABLING ENTRY POINT

Please specify the entry point of the cables for the above-mentioned WTG.

MISCALLANEOUS CONNECTIONS

A tag list is needed so that our nvbird® OPC UA Client can receive the following information and give/receive the following commands

A. Environmental conditions:

1. Wind speed
2. Wind direction
3. Ambient temperature

B. Wing turbine generator status:

4. Rotor speed
5. Nacelle position
6. Maintenance (Note: announce that the WTG is in maintenance mode, therefore the nvbird system should stop emitting sounds in case that technicians are working near the cameras or the nacelle)

C. Wing turbine generator control:

7. Shutdown
8. Start (Note: return to regular operation after shutdown)
9. Slowdown (Note: reduce the speed of blades)

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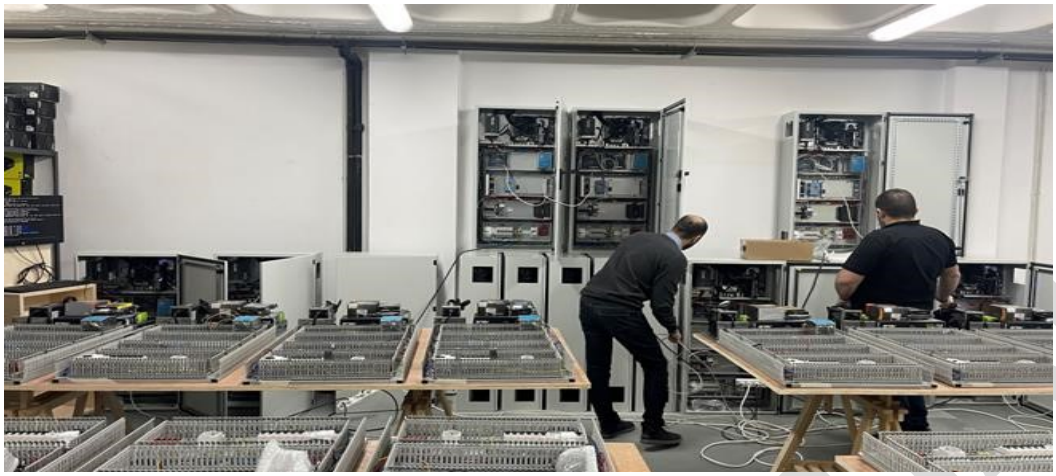
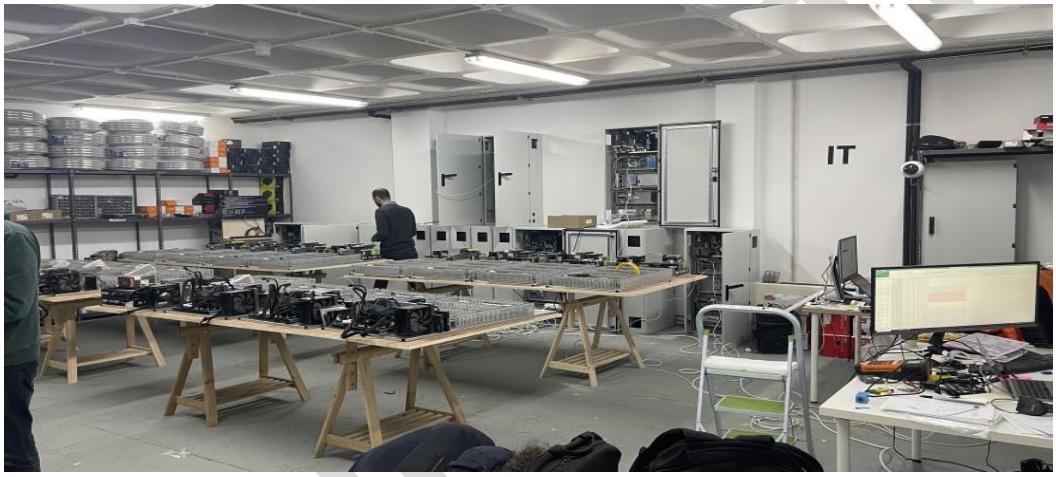
PRODUCTION LINE OF NVBIRD SYSTEM





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SYSTEM PERFORMANCE DATA

Flying Objects Detection

The system automatically detects and classifies birds excluding other flying or moving objects during daytime using high-definition cameras. Optionally can detect birds and bats at night using thermal cameras. nvbird® is not using Motion Detection technology that needs to mask parts of the view of the cameras. It is based on Artificial Intelligence and Machine learning.

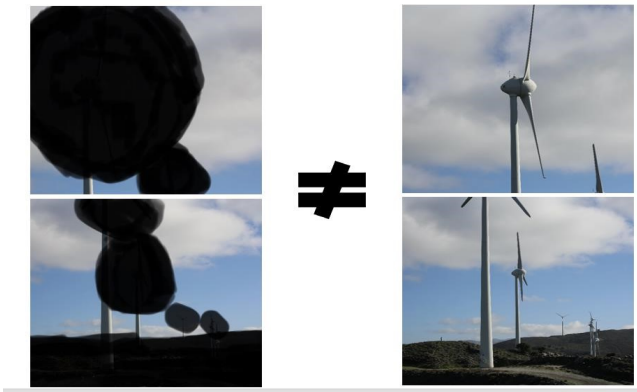

Figure 1 On the left view with masking on the right without

During the detection phase the system first localizes the position of the birds in the video frames. Our detection approach is based on deep neural networks and the detection algorithm already supports multiple targets per frame.

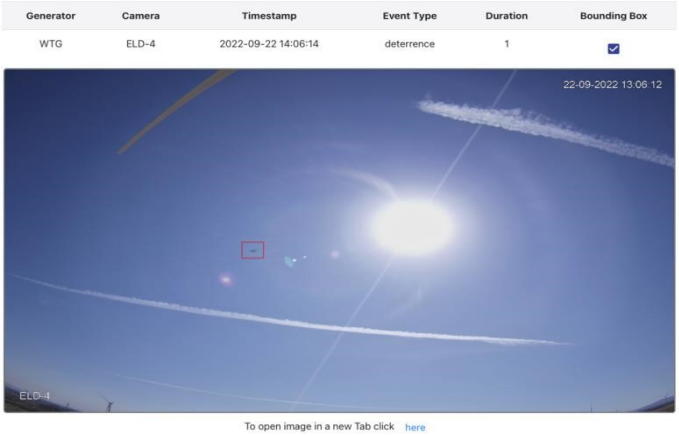

Figure 2Detection in very difficult conditions

Then with the classification phase, our system has the capability to recognize the species of the detected birds. The classification of the birds is based on a deep neural network that is already trained to a good extent for big raptors. The classification performance will improve as the model is retrained with new data recorded on site and can also be extended to support multiple species or classify birds in size classes based on wingspan. Following classification, the system can take actions according to risk rules and local guidelines imposed by authorities. It can slow down the speed of the rotor, emit acoustic or light signals or shut down the wind turbine.

This flexibility is based on the nvbird® OPC UA client of nvbird®. OPC UA is a special protocol the wind turbines use to communicate with other systems.

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Perimeter Security (optional)

Although wind farms offer a green solution to energy issues, some people object to them due to a perceived impact on the historic and scenic value of the wind plants locations, or due to their expected noise and impact on birds. Because of this unwillingness to accept wind-power plants, they are sometimes sabotaged, endangering the system's operations and efficiency. Integrating surveillance and security systems thus becomes of primary concern to protect these investments. nvisionist has integrated into nvbird® a dedicated security surveillance system which consists of four starlight (0.005 Lux@F1.6) cameras per WTG, network video recorder offers a excellent performance and high recording quality for IP video surveillance applications. For applications where details are critical for identification, this professional Nvisionist Video Recorder provides a powerful processor with up to 4K resolution. Additionally, the **Nvisionist Video Recorder** features a mouse shortcut operation menu, remote management and control, storage for 10 days.

Perimeter Security Functions (optional)

Fisheye Dewarping The nvisionist Video Recorder features multiple fisheye dewarping modes to make viewing video easy whether its live or during playback.
4K Resolution The NVR supports 4K ultra HD resolution (3840 x 2160) for recording, live viewing and playback.
Easy4ip You can monitor at anytime and anywhere with Easy4ip. There are 2 modes Easy4ip web client and mobile app. With this function, you can manage your devices more conviently Intelligent Video System (IVS) With built-in intelligent video analytics, the NVR has the ability to detect and analyze moving objects for improved video surveillance. The NVR provides optional standard intelligence at the edge allowing detection of multiple object behaviours such as abandoned or missing objects. IVS also supports Tripwire analytics, allowing the camera to detect when a pre-determined line has been crossed, People Counting, ideal for business intelligence, and Face Detection, for searching or identification of individuals.
Heat Map The NVR's Heat Map option highlights the areas with the highest concentration of people. This information can then be exported into a customized report to assist in business or forensic analysis.
ANPR Automatic Number Plate Recognition available for convenient entrance/ exit management. Support plate recognition, black/whitelist import/ export, add/delete B/W list number, search result from recorded video.
ANR (Automatic Network Replenishment Technology) Video record in SD card in IP cameras when the network breaks down, and after the network recovered, the video will be transferred to NVR and then recorded in it.

The whole security solution runs in a separate software platform in order to be distinguished from nvbird® platform.

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III. nvbird® DATA ANALYSIS & REPORTING PLATFORM (DARP)

With the annual **nvbird® Data Analysis & Reporting Platform**, your company will have access to the birds activities reports.
Our Platform will provide you reports regarding nvbird® systems profile, bird flights, all birds detection and deterrence incidents as well as WTG shutdowns. For every detection and deterrence incident the system records photos and videos.
You are also able to monitor the nvbird® systems proper operation and relative operation statistics. Central management of more than one wind park can be done with DARP management platform. Also runs from mobile phones and tablets. nvbird® actions and registered data are uploaded daily to our online (**Data Analysis & Reporting Platform** - **DARP**). Internet access is mandatory and bandwidth requirements will be calculated depending on video resolution.

Furthermore, through the **Network Monitoring Platform (included in DARP)**, the offered system will be operationally (24x7) monitored. Periodically, we will send you reports about systems functionality (i.e. failures, down time, any repair needed, other malfunctions) For example, whenever we realize any malfunction (from nvbird® IP address) we will send you the problem's category and the possible – suggested solution.
Note: Network Monitoring Platform, S/W updates, new versions, bug fixing, new patches will be monitored from our company and are included in the annual price of "Management Application (DARP) Annual Service".

More specifically, for the first (1) year, we offer you twenty (20) hours of telephone support, regarding your questions (open *service tickets*).
Support can be offered by email requests as well. Our multichannel support operates in working days and hours.
Furthermore, we will also give you access to the specific system **Service Desk.**
Therefore, you will have all *service tickets* required information. (from the opening of the tickets, till resolution – closure).
In addition, for the cases - tickets, that your technicians *(in case you don't have the Service Level Agreements offered below) can't* provide a solution despite our remote support through telephone and emails, we offer you two (2) on site visits (travel expenses and accommodation will be covered by your company) of our company's specialized field engineers, in order to investigate further the problems.
Telephone support for your tickets is included as you renew the annual **DARP Service.** Note: **DARP Service,** S/W updates, new versions, bug fixing, new patches will be monitored by our company and are included in the annual price**.**

Clarification: The above-mentioned supporting system:

Data Analysis & Reporting Platform*, Service (DARP)* *are included in our offer.*

Starting date for the offered services is considered the first day of operation.

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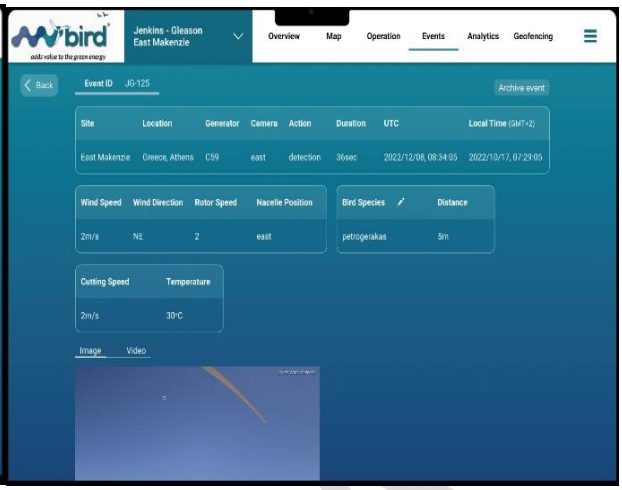

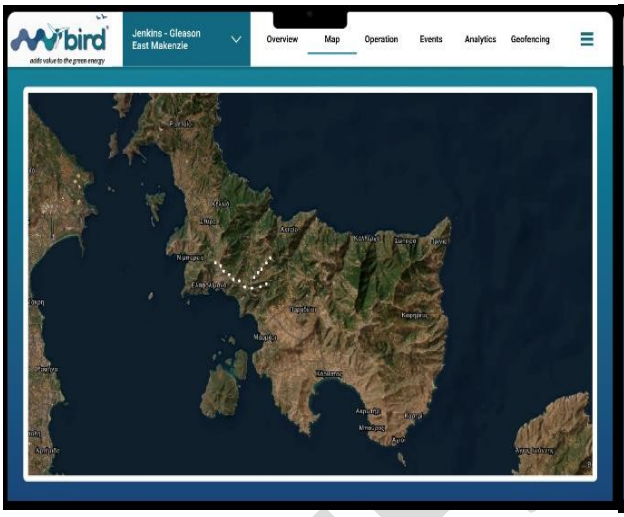

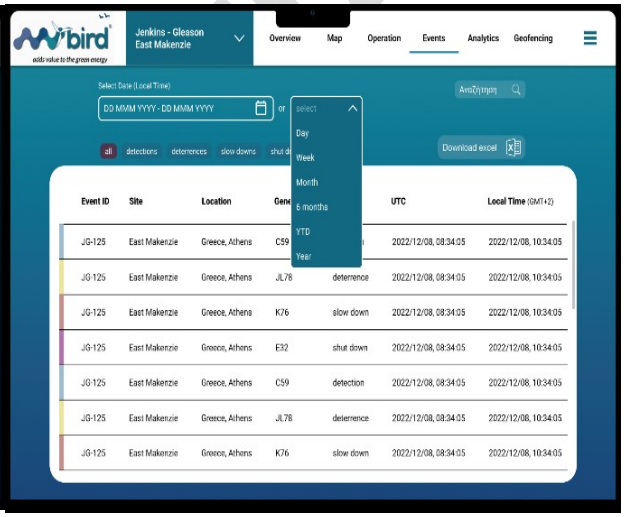

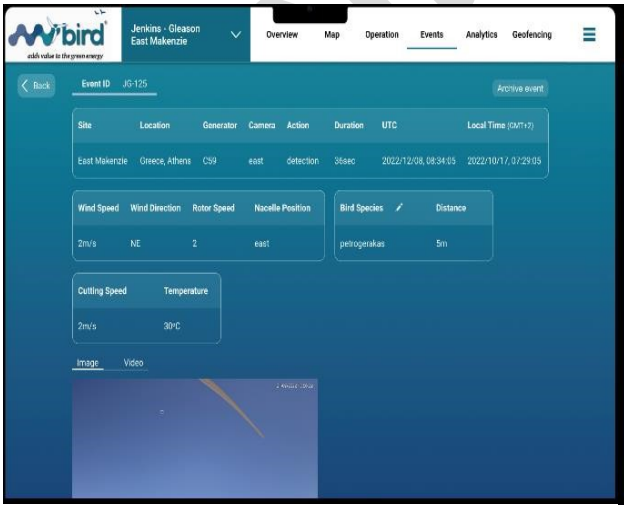

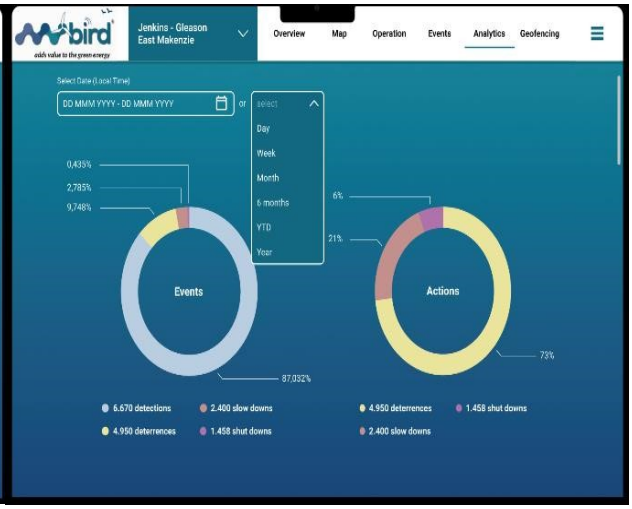

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IV. SLA WITHIN WARRANTY AND AFTER THE 2 YEARS WARRANTY (OPTIONAL)

Additionally, we can offer to you our SLA maintenance services.
Starting date is the first day of nvbird® operation.
The SLA that you will enjoy during the two (2) years maintenance in parallel to the two (2) years nvbird® Warranty period but also after the Warranty period, will be according to the below Service Level Agreement:

✓ *Response time:* within 2 working hours.
✓ *Fix time: 2-4 working days (if weather conditions permit so).*
Including all spare parts. (Malicious actions and ice falls damages are not included)

For maintenance needs – repairs, on site visits which require more than 200 km travel from Madrid, 0,7€/km, travel expenses, food, beverages, and accommodation will be covered by the customer.

Notes: ○ In case you don't want us to provide you the specific maintenance service (SLAs), you will be responsible to remove-uninstall any faulty spare part and send it to our company. Our company will try to fix the problem or replace the spare part. **(Warranty Coverage in on a best effort basis)**
Then, you will pick up the spare part from our company and install it back for operation, in the nvbird® System.

- **Telescopic crane/lift service is not included in our offer.** ○ **Weather conditions may influence relevant Response / Fix Time.**

We can also offer onsite spare parts if you need faster repair times or if your team can execute the repairs.

V. WARRANY TERMS

- nvbird® **guarantees** the products purchased by you to be free from defects resulting from the use of faulty parts or poor workmanship during its manufacture.
- Any claim will have to be made within the warranty period.
- nvisionist will repair or replace any defective part in a best effort basis.
- Warranty does not cover:

○ Cracked or broken products
○ Plastic parts ○ Defects or damage caused due to virus attack. ○ Products or product parts which have been (a) repaired or altered by any party other than manufacturer unless such repair has been specifically approved in writing by manufacturer, (b) subjected to misuse, negligence, or accident, or (c) used in a manner or in an application other than that recommended by the manufacturer. ○ Damage or loss of any programs, data or removable storage media including any consequential loss or damage. ○ Damages caused due to acts of God & force majeure.

Customer must send defective spare parts to nvisionist offices and then he will receive them respectively from our offices.

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VI. ENVIROMENTAL SERVICES (OPTIONAL)

a) Bird monitoring

Systematic monitoring of the bird presence and activity in the vicinity of the wind turbines through Vantage Point surveys. Vantage point surveys are essential for the recording of the Bird movements around the wind turbines and the estimation of collision risk of protected species during the wind farm operation. Experienced ornithologists will record bird flight activity in the vicinity of the wind farms. The data on bird presence, flight routes and flight characteristics are recorded on tablet computers and managed spatially and statistically in a specially designed database in order to monitor birds' activities, in association with the data recorded by the nvbird® Systems. For recording nocturnal species such as the Eagle Owl, thermal cameras and bio-acoustic devices are used. Collision risk estimation is produced using the Band model.
A special mobile interface has been developed to achieve that goal. The app includes all spatial information needed for the adequate record of bird presence and flights. Field ornithologists can track bird activity through visual observation using binoculars and telescopes and then record all information in the app in real-time. All fieldwork data is then stored to a geodatabase and used for cross referencing with the detections of the nvbird® systems.

b) Carcass search survey

Carcass search surveys are necessary for detecting any possible collision victims related to the operation of the wind turbines. Birds fly through the site of an installed wind farm and are likely to collide with the rotating blades of a wind turbine or other parts such as the nacelle or the tower. Carcass search surveys should be implemented every 10-15 days at the WT site and around the area of the installed wind turbines in 0-120 meters distance from the WTG. The surveys are carried out by experienced ornithologists who scan the area based on best practices and commonly used methodology.

NVISIONIST'S ECOLOGICAL CONSULTANCY TEAM

Nvisionist's ecological consultancy team is very well organized and experienced, focusing on the conservation of nature and biodiversity. The team is active in a variety of fields related to the study and protection of nature and biodiversity, extending from the implementation of conservation actions for the improvement of protected species state within or outside Natura 2000 network sites, in the framework of large conservation projects such as the European LIFE projects, the preparation of management plans for protected areas and the implementation of biodiversity monitoring projects in protected areas, to the elaboration of Appropriate Assessments for the environmental licensing of small and major infrastructure.

Our team is among the most specialized consultancies in organizing and implementing extensive field research projects. It holds significant expertise and professional experience in the study and management of avifauna, as birds are considered to be among the most important and well-studied indicators of the state of natural ecosystems worldwide.

Our team is leading in the field of Bird Monitoring Programs, Ecological and Appropriate

Assessment Studies for major plans and project implemented within the Natura 2000

Network. We have conducted ecological surveys and Appropriate Assessments for the Trans Adriatic Gas Pipeline (TAP) project, the IGI Poseidon pipeline and is [presently collaborating with HELPE company in a number of biodiversity Baseline Studies at the hydrocarbons research plots in Greece.

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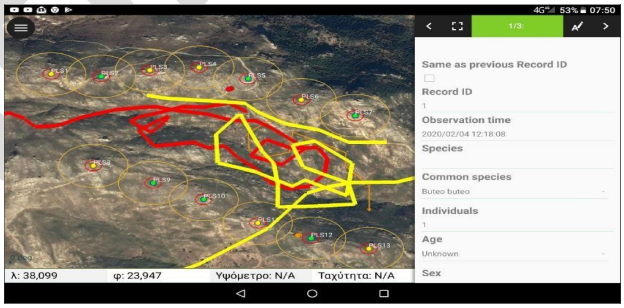
Our staff and the external experts with which the consultancy collaborates have higher education holding Bachelor, MSc or PhD titles in their field or expertise and have long experience in working on biodiversity conservation related projects.

The Team Manager, holds 25 years of experience in coordinating projects that involve the implementation of biodiversity monitoring and conservation activities and participation of multiple experts and teams over a long period of time, such as:

- The program “Monitoring and assessment of the conservation status of invertebrate species of EU interest in Greece” (2014-2015)
- the program “Reassessment of 69 Greek IBA sites for their designation as Special Protection Areas of the Natura 2000 network” (2008-2009).
- the program “Determination of compatible activities in relation to the SPA trigger bird species of the Greek Special Protection Areas” (2008-2009).
- the program "Determination methodology and drafting specifications for assessing areas for their characterization as Special Protection Areas for birds, with pilot application in 10 areas" (2004-2005).
- The LIFE Projects LIFE09 NAT/GR/000323, LIFE07 NAT/GR/000285, LIFE03 NAT/GR/000091

Nvisionist’s ecological consultancy team, has extensive experience on the subject and unique bird survey equipment in Greece, including marine surveillance radars, thermal cameras, drones, bio-acoustic survey equipment, telescopes, tele-zoom cameras to carry out any requested tasks. We own adequate 4x4 cars and vans to operate at the hard mountain terrain and can established a permanent basis for our experienced field team wherever required.

Application Developed to record bird flight paths



VII. CONSTRAINTS, LIMITATIONS, ASSUMPTIONS, EXPECTATIONS

We expect cooperation from the WTG manufacturers to establish the best ways and places to connect and install our SYSTEM.

We expect cooperation with client or WTG manufacturer’s staff in the parks that will take all necessary actions to give us access to the WTGs internally and externally whenever required.

Also, electrical power given to our systems from wind park, must be stable and protected from power spikes, to ensure that nvbird® can operate normally and avoid unnecessary malfunctions.

XIII. FINANCIAL PROPOSAL

PRODOTTI NVBIRD		LISTINO	WTG	OFFERTA	
A/A	Descrizione	Costo EURO/WTG	QTY	Sconto	Prezzi (euro)
1	Bird Detection and Identification Module (Bird Detection and Identification Module night and day including bat detection, all camera and standard deterrance and OPC module)	65.000,00	12	14%	670.800,00
2	Deterrance Module Nacelle Speakers	5.000,00	12	15%	51.000,00
3	System Maintenance (data analisys and reporting platform, full reporting per year/WTG) Network monitoring and desk service, All spareparts are included for first two years, manpower is excluded. After the second year is available a separately contract SLA that including manpower.	30.000,00	3 year		90.000,00
4	Site visits during Construction & Operation (The pricing including the installation, site visiting and delivering and commissioning)	25.000,00	1		25.000,00
5	Training (The price including 10 hours of training, includiing 5 free hours)	500,00	10h		500,00
6	Waiting time (x Technician)	50,00	1h		50,00

Note: Cost for telescopic crane is not included.

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General Terms & Payment Terms

- ✓ Offer is valid until one (1) month from its submission date.
- ✓ Delivery time within four (4) months from agreement signature.
- ✓ All prices do not include VAT.

Payment terms :

- 50% of the total amount, payment in advance upon agreement signature.
- 30% of the total amount, upon Project's Installation starting day.
- 20% of the total amount upon Commissioning & S.A.T. (Site Acceptance Test).
- Management Application and relevant nvbird® supporting systems. Invoice for the yearly amount will be issued at the beginning of each year and will be totally settled within 30 days.

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International Software Testing Qualifications Board

RINA CERTIFIED MANAGEMENT SYSTEM ISO 9001

RINA CERTIFIED MANAGEMENT SYSTEM ISO/IEC 27001