Wind4Bio

Increasing the Social Acceptance of Wind Energy

PROMEA

APRIL 2023

GOOD PRACTICE REPORT

Activity (A I.1): "Identification, collection, and sharing of good practices, case studies, and technologies for increasing biodiversity protection at all stages of wind farms' lifecycle"

Supported by:

Federal Ministry for Economic Affairs and Climate Action

European Climate Initiative EUKI

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Wind4Bio

Report on good practices for increasing biodiversity protection at all stages of wind farms' lifecycle

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Project: WIND4BIO

Activity: A I.1

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Table of Contents

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Summary

This report documents the findings of the survey conducted within the context of Wind4Bio Activity I.1, titled 'Identification, collection, and sharing of good practices, case studies and technologies for increasing biodiversity protection at all stages of wind farms' lifecycle'. Project partners collected good practices and new technologies for increased biodiversity protection in wind farms from their respective territories, as well as cases to avoid. The report presents and analyses the survey results and elaborates on key findings that emerged throughout the analysis, providing recommendations for increasing biodiversity protection during the lifecycle of wind farms. The report is structured as follows:

- The Introduction provides an outline of the project, the Activity, and the purpose of the report.
- Section 2 describes the survey and the methodology used for data collection.
- Section 3 presents the results in three subsections: a) good practices, b) cases to avoid, and c) good practice assessment.
- Section 4 discusses the main key findings of the survey and offers policy recommendations.

The conclusion of the report will be used, among other findings, by University of Patras (UPAT) to develop a biodiversity risk management framework addressed to public administration and energy and environmental agencies on how to assess possible biodiversity risks in wind farms and adopt suitable mitigation measures.

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1. Introduction

Accelerating the deployment of wind farms across Europe is necessary to deliver the Green Deal and achieve carbon neutrality by 2050. To meet the EU target of reducing emissions by 55% by 2030, the European Commission has set a goal for the overall energy mix to comprise at least 40% renewables, which means that around 68% of Europe's electricity should come from renewables (Fit for 55 package). This necessitates a massive scale-up of renewable energy production, including offshore wind energy production, which has the highest potential in the EU. Nevertheless, reaching this objective necessitates an increase in public acceptance of wind energy projects and rebuilding trust within local communities.
In this context, protecting biodiversity and alleviating social concerns, while maintaining the economic viability of wind farms remains a key challenge for the wind energy industry. Although mandatory environmental impact assessments have made biodiversity considerations an important part of the permitting process, the possibility of cumulative effects on vulnerable species is likely to increase, particularly in countries where clusters of wind projects are located near areas of importance for threatened (migratory or resident) bird and bat populations. Energy planning has yet a long way to go before defining a standardized European framework for biodiversity risk mitigation that would be highly beneficial for both the deployment of wind farms and the protection of local ecosystems. The present report aims to enhance the knowledgebase of public authorities, environmental agencies, and NGOs regarding biodiversity risk mitigation measures and good practices promoting biodiversity protection in wind farms projects, thus contributing to the knowledge sharing within the Wind4Bio partnership and beyond.

1.1 The Wind4Bio project: Increasing social acceptance of wind energy

The Wind4Bio project, funded under the European Climate Initiative (EUKI) brings together 4 partners from three countries (EL, PL, LV) to address one of the main barriers to the proliferation of wind farms, namely biodiversity concerns related to the installation, operation, and retirement of wind turbines. To that end, the project will develop and share with the project target groups a multi-stakeholder approach aiming at the harmonisation of biodiversity and wind energy policies in the participating countries and particularly involving civil society in the identification and mitigation of biodiversity risks related to the deployment and operation of wind farms, while, ensuring a harmonious balance between renewable energy expansion and biodiversity conservation. This is expected to increase public acceptance and support for wind energy and reduce opposition and reactions to the proliferation of wind turbines, ultimately facilitating an accelerated expansion of wind energy capacity.

1.2 Activity I.1

Activity I.1 is the first Activity of WP1, titled 'Develop the capacity of public authorities to identify and mitigate biodiversity threats pertaining to the deployment and operation of turbines and wind farms, ensuring a harmonious balance between renewable energy expansion and biodiversity conservation'. As part of the Activity I.1, UPAT, Green Liberty and WiseEuropa conducted research to collect: i) good practices (including tools, operating procedures, land rehabilitation plans) that have increased biodiversity protection throughout wind farm's lifecycle, ii) model examples regarding practices that have led to harmonious coexistence between increased biodiversity protection and financially sustainable wind farm

operations, iii) cases to avoid, where an environmentally uncritical wind energy planning led to detrimental effects on

biodiversity and iv) technologies (e.g., ornithological radars, bat detectors) and technical characteristics (e.g., turbine blade profile, rotation speed, size) that can lower bird and other animal fatalities without a major impact on energy output. PROMEA developed the Survey Methodology report (DI.1), which included a thematic elaboration on wind farms' impact on biodiversity as well as data collection tools and guidelines. Data collected are analysed in the present Report including recommendations, addressed to the project's target groups.
The study will increase the target groups' knowledge base through the sharing of practices, tools, procedures, and technologies to mitigate biodiversity threats related to the deployment, operation, and temporary immobilization of wind turbines. The added knowledge will bolster the capacity of public authorities to make policy interventions to promote improvements in biodiversity risk mitigation measures adopted by future and existing wind farms.

1.3 The Good Practice Report

The Good Practice Report documents the findings of the survey conducted in the context of Wind4Bio Activity I.1, titled 'Identification, collection, and sharing of good practices, case studies and technologies for increasing biodiversity protection at all stages of wind farms' lifecycle'. The survey was addressed to project partners and aimed to document a) good practices for increased biodiversity protection in wind farm projects; b) cases to avoid and c) impact assessment of good practices according to a) their capacity to mitigate biodiversity threats, b) their impact on the wind farm's economic activity and c) their transferability potential.

The main findings are:

- Through the survey, partners documented a range of successful practices related to biodiversity risk mitigation that are still being employed in their respective countries. However, there seems to be a lag compared to other European countries. Available technological solutions already being exploited elsewhere have not been introduced in the countries of the Wind4Bio consortium.
- There is a great lack of quantitative data, which shows that monitoring and assessment practices are not applied and could provide evidence-based knowledge about the need and potential for biodiversity risk mitigation.
- The partners value the same or higher good practices related to processes and the existence of a regulatory framework that is applicable in terms of effectiveness to solve biodiversity threats.

UPAT will valorize the above-mentioned results to develop a biodiversity risk management framework to be addressed to public administration and energy and environmental agencies, providing instructions and an evidence-based tool that will allow them to identify, evaluate and mitigate threats to biodiversity.

2. Survey design and methodology

To identify and collect good practices for increased biodiversity protection in wind farms, a survey has been carried out by the three project partners in their respective territories. The survey followed a qualitative research approach that aimed to gain a comprehensive understanding of the measures implemented so far in existing wind farm projects. It was implemented through two questionnaires, both hosted on the EU surveys platform. As part of the qualitative survey partners were also requested to evaluate the effectiveness of the identified good practices.

2.1 Methodology

To guide and assist partners' data collection efforts, PROMEA developed a methodological framework based on relevant primary literature assessment, desk research, and a questionnaire made available via the EU surveys platform to support data collection. The methodology provided:

- Thematic background on the potential impacts of both onshore and offshore wind farms on biodiversity.
- Examples of good practices for increased biodiversity protection and cases to avoid from across Europe.
- Detailed guidelines for the data collection.

Moreover, it defined the objectives of the survey and set Key Performance Indicators.

The questionnaire was split in two for the purposes of the survey to simplify the process. Both questionnaires were addressed to project partners and were made available to be completed via the EU survey platform in the following links:

- QUESTIONNAIRE A – Identification of good practices, model examples, and novel technologies for increased biodiversity protection
  https://ec.europa.eu/eusurvey/runner/WIND4BIO_Activity_I_1_GoodPractices
- QUESTIONNAIRE B – Identification of cases to avoid for increased biodiversity protection.
  https://ec.europa.eu/eusurvey/runner/WIND4BIO_Activity_I_1_CasesToAvoid

2.2 Survey objectives & scope

The survey had three objectives:

1. The identification of good practices for increased biodiversity protection at all stages of wind farms' lifecycle in Wind4Bio territories
2. The identification of cases to avoid for increased biodiversity protection at all stages of wind farms' lifecycle in Wind4Bio territories.

3. The evaluation (impact assessment) of the identified good practices with regards to a) their capacity to mitigate biodiversity risks, b) their impact on wind farm's economic activity, and c) their transferability potential.

For the third objective, partners were asked to award the good practices identified on a basis of 0 to 3, taking into consideration any available quantitative data measuring impact (e.g., bird casualties before and after the application of the 'good practice', energy generation loss due to turbines shut-down, duplication rate of the good practice in other regions). However, in the absence of available quantitative data, partners were asked to follow their judgment for the assessment.

2.3 Key Performance Indicators (KPIs)

Minimum targets were set for the data collection. The following table presents the KPIs set for each partner and those reached.

Partner	KPIs for good practices	KPIs achieved	KPIs for cases to avoid	KPIs achieved
UPAT	4	6	1	2
WiseEuropa	4	4	1	1
Green Liberty	4	4	1	1

3. Survey data and results

All consortium partners contributed to data collection with cases from their territory, demonstrating a high level of commitment and reaching the collection targets set in the Methodology. A total of 14 practices and 4 cases to avoid were identified and reported by the partners providing illustrative and practical examples that have proven to be successful. The short descriptions accompanying the good practices also highlight the circumstances under which these practices could be transferred to other EU regions. This section provides a detailed presentation of the data gathered, including an analysis of the criteria and evaluation method defined in the Methodology and used for the assessment of good practices.

3.1 Overall findings

Out of the 14 identified practices, 6 good practices were in Greece, 4 in Poland, and 4 in Latvia (Table 1). Additionally, 2 cases to avoid were identified in Greece, 1 in Poland, and 1 in Latvia (Table 2). The 14 good practices were categorized into 6 categories related to 'technology', 2 related to a 'model of civic participation', 1 related to a procedure (e.g. monitoring), 1 related to a 'management/governance' practice, and the remaining 4 related to a combination of 'management/governance' practice and monitoring (1), a combination of 'management/governance' practice, monitoring and a model of civic participation (2), and a combination of 'management/governance' practice and 'landscape planning and management' (1) (Table 3).

Out of the 14 practices, 11 referred to onshore wind farms, while 3 had potential applications in both onshore and offshore wind farms (Table 4). No good practice has been identified to specifically mitigate biodiversity risks in offshore wind farms. As to the stage of the wind farm's lifecycle, 4 good practices have been employed during the operation phase, 1 during the planning phase, 2 during both planning and operation, 3 during both construction and operation, 3 across all planning, construction, and operation phases and 1 during planning, operation, and wind turbines' end of life phase (Table 5).

Finally, regarding the implementing entity, out of the 14 practices, 5 involved a national authority (4 of which were implemented solely by a national authority while 1 involved a mix of national authority and an NGO); 4 involved an NGO (2 of them were exclusively implemented by an NGO, while the other 2 involved a combination of private initiative and an NGO as well as a combination of a grassroots initiative and an NGO); 3 practices involved a company or private initiative, 1 involved a university faculty and 1 implementer was not specified (Table 6).

The following tables and the corresponding pie charts offer a visualization of the above-mentioned overall findings, indicating the exact number of responses as well as the percentage of specific characteristics associated with each practice.

Table 1 – Chart 1: Geographical distribution of identified good practices

Country	Good Practices
Greece	6
Poland	4
Latvia	4

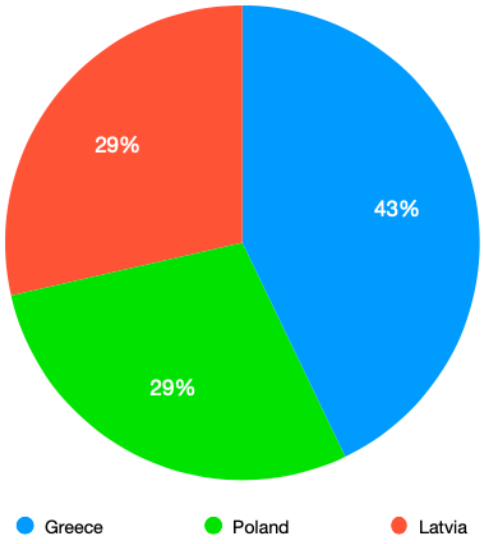

Table 2 – Chart 2: Geographical distribution of identified Cases to avoid

Country	Cases to avoid
Greece	2
Poland	1
Latvia	1

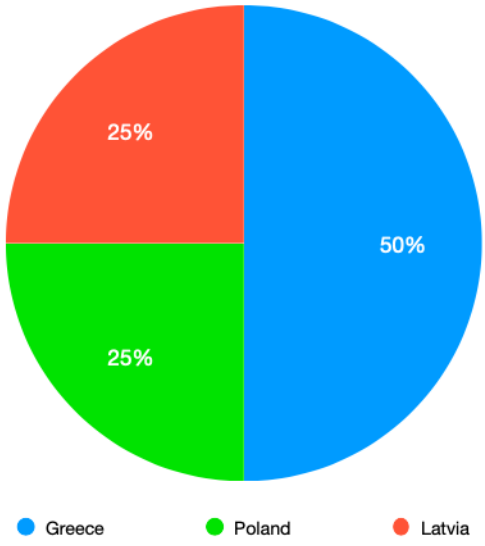

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Table 3 – Chart 3: Good practices by type and frequency

Type of Good Practice	Good Practices
Technology	6
Model of Civic Participation	2
Monitoring	1
Management/ Governance	1
Management/ Governance & Monitoring	1
Management/ Governance, Monitoring & Model of Civic participation	2
Management/ Governance & Landscape planning	1

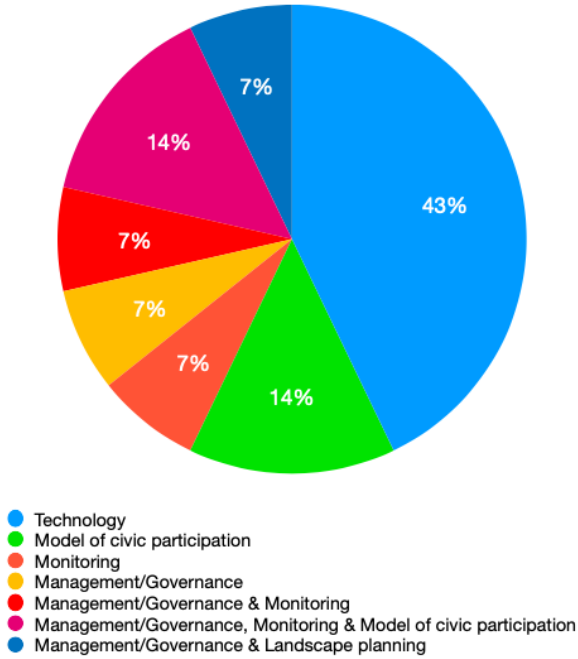


Table 4 – Chart 4: Good practices in onshore and offshore wind farms

Location of the wind farm	Good practices
Onshore	11
Onshore & Offshore	3

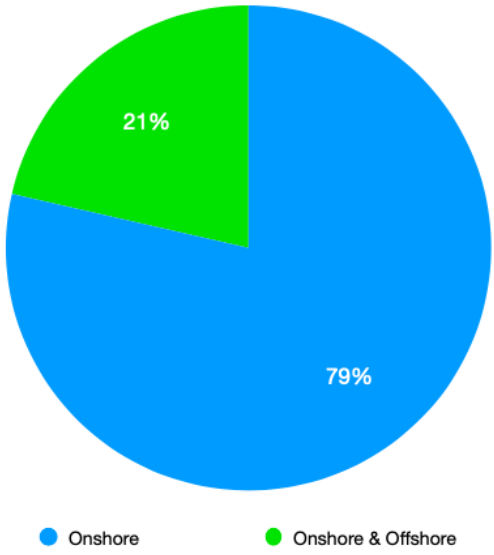


Table 5 – Chart 5: Good practice distribution in stages of the wind farm's lifecycle

Stage of the wind farm's lifecycle	Good practices
Operation	4
Planning	1
Planning & Operation	2
Construction & Operation	3
Planning, Construction & Operation	3
Planning, Operation & Decommissioning	1

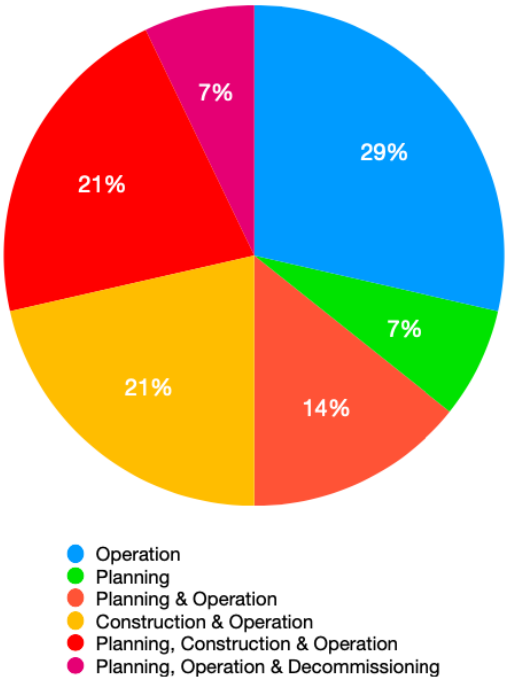
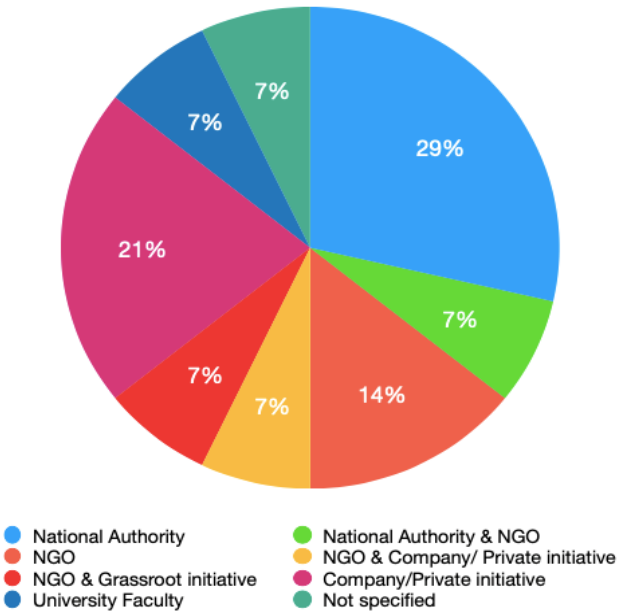


Table 6 – Chart 6: Categorisation of Good practices according to implementing entity

Implementing entity	Good practices
National Authority	4
National Authority & NGO	1
NGO	2
NGO & Company/ Private initiative	1
NGO & Grassroot initiative	1
Company/Private initiative	3
University Faculty	1
Not specified	1



3.2 Good Practices

This subsection presents the good practices that were gathered by project partners using the questionnaire, both in text and table.

3.2.1 Good practices from Greece – UPAT

1. **Radar ornithology and thermal simulator**

Type: Technology
Implementer: Not specified
Location: Florina, Onshore
Phase: Operation
Description: During the 06/2013-08/2014 period, ornithological recordings were made to investigate the use of space by the birds (especially silver pelicans and rose pelicans) and the reaction of the birds to the deterrent sounds while a computer-based process called thermal simulation was developed to estimate the use of space from birds in specific areas. The system was installed on nine wind turbines, covering the entire wind park to warn, prevent and temporarily immobilize the wind turbines when necessary to protect birds.

2. **Autonomous video surveillance and birds' collision avoidance system**

Type: Technology
Implementer: Centre for Renewable Energy Sources & Saving (CRES) & Nature Conservation Consultants (NCC), National Authority
Location: Keratea, Attica, Onshore
Phase: Operation
Description: The system detects and records the flight of fly objects in the area in real time, evaluates them, and makes decisions about activating methods to prevent bird collisions (emission of sounds, temporary immobilization of wind turbine), depending on the risk. The warning sound for birds approaching the wind turbine was activated in 30% of flights, the repelling sound in 30% of flights, and the temporary wind turbine shutdown routine in 17% of flights.

3. **Automatic ultrasonic bat recording system**

Type: Technology
Implementer: Centre for Renewable Energy Sources & Saving (CRES) & Nature Conservation Consultants (NCC), National Authority
Location: Keratea, Attica, Onshore
Phase: Operation
Description: Three different models of bat detectors were installed in order to examine the recording of the activity of bats and determine the necessity of adjusting the wind turbines in case of significant risk of collision. The microphone of each system was placed at the base of the spindle of the wind turbines.

4. **Naval radar adapted to the recordings of birds and Field ornithologists**

Type: Technology
Implementer: Centre for Renewable Energy Sources & Saving (CRES) & Nature Conservation Consultants (NCC), National Authority
Location: Keratea, Attica, Onshore
Phase: Planning, Operation
Description: The radar system is used to locate birds and track their flight paths, while field ornithologists visually determine the species of birds and their flight height.

5. **Autonomous video surveillance and birds' collision avoidance system**

Type: Technology
Implementer: Centre for Renewable Energy Sources & Saving (CRES) & Nature Conservation Consultants (NCC), National Authority
Location: Thrace, Onshore
Phase: Operation
Description: The video surveillance system automatically monitors the daily movements of the birds near the wind turbine with four (4) high definition cameras, while ten loudspeakers emit warning and deterrent sounds when birds are detected near the wind turbine in order to reduce the risk of collision.

6. **Map of sensitive areas for the construction of wind farms**

Type: Model example of civic participation
Implementer: WWF Greece, NGO/Non-profit organisation
Location: Thrace, Onshore
Phase: Planning
Description: The site selection proposal includes a map of sensitive areas with updraft birds, which divides the region into two distinct categories based on the distribution of highly vulnerable bird species: "exclusion zones" (the installation of wind parks should be prohibited) and "enhanced protection zones"(parks could be installed with the appropriate mitigation measures in place).

3.2.2 Good practices from Poland - WiseEuropa

7. **Ornithological monitoring system (advanced tools)**

Type: Technology
Implementer: PGE Polska Grupa Energetyczna (Polish Energy Group) and BIOSECO, Company/Private initiative
Location: Kisielice and Lotnisko, Onshore
Phase: Construction & Operation
Description: Designed by Bioseco, the monitoring system is made up of the software that works with 24 HD cameras mounted in eight modules on the windmill tower. It can detect birds approaching the turbine

within two seconds, and then automatically selects an adequate action to minimize the risk of collision. This can be a warning light signal, an audible signal, or an automatic short term stop of the turbine.

8. Monitoring and protection

Type: Monitoring
Implementer: Polenergia, Company/Private initiative
Location: Montagu's harrier, Lower Silesia, Onshore
Phase: Construction & Operation
Description: Polenergia partnered with the Environmental Protection Department and hired an ornithologist to perform monitoring. A long-term contract was concluded with him, which provides for observations of wind farm areas and neighbouring areas during the breeding season to locate and protect bird nests.
Birds were ringed, protective pens for bird nests were installed, and repellents (safe for humans, animals, and the environment) were used to protect the birds from potential predators

9. Environmental & Social Action Plans

Type: Management/Governance
Implementer: Polenergia, Company/Private initiative
Location: Szymankowo and Dębsk, Onshore
Phase: Construction & Operation
Description: Polenergia conducted environmental supervision on the site and in the vicinity of two wind farms, which included: training on environmental and nature protection carried out by naturalists during ground works, training on how to install herpetological fences and the principles of handling trapped amphibians and other protected animals, ongoing field supervision.

10. Guidelines for assessing the impact of wind power plants on birds

Type: Model of Civic Participation, Management/Governance & Monitoring
Implementer: Polish Wind Energy Association, Polish Society for the Protection of Birds NGO/ Non-profit organisation
Location: National level, Onshore & Offshore
Phase: All phases
Description: Guidelines for environmental monitoring and investment preparation of wind farms to provide actors with the appropriate tools for the assessment of the impact of wind farms on the environment.

3.2.3 Good Cases from Latvia – Green Liberty

11. Sensitivity mapping and standardized guidelines: impacts on birds

Type: Management/Governance
Implementer: University of Latvia, Faculty of Biology

Location: National level, Onshore
Phase: Planning, Construction & Operation
Description: Ornithologists from the University of Latvia are developing a standardized methodology for experts working on new wind park assessments – the goal is to define thresholds of significance and anticipate cumulative effects. The study will also present the first risk zoning of Latvia – a map of sensitivity areas for different bird species. It should improve the decision-making for both public authorities and developers. The draft will be discussed with a wider expert community in autumn 2023.

12. Net positive impacts on biodiversity communities

Type: Management/Governance & Landscape planning and Management
Implementer: International wind park developers (Vattenfall, Orsted), Company/Private initiative and NGO/Non-profit organisation
Location: Baltic Sea Region, Onshore & Offshore
Phase: Planning, Construction & Operation
Description: As Latvia's wind parks are still few, the companies will be expected to introduce new practices to the national context. In addition to the principles of mitigation hierarchy in siting, several international developers have adopted commitments to invest in measures that contribute to broader ecological values of wind park landscapes (Vattenfall and Orsted in the Nordics). Efforts to restore or enhance ecosystems coupled with offsets should result in net positive impacts on biodiversity.

13. Data portal for nature observations

Type: Model example of civic participation
Implementer: Latvian Fund for Nature, Grassroot initiative/Community, NGO/Non-profit organisation
Location: National level, Onshore
Phase: Planning, Construction & Operation
Description: Nature data portal dabasdati.lv collects observations from experts and the wider public. ~80% of observations are about birds. Dabasdati.lv is a key data source for environmental assessments about the occurrence of different bird species in different regions. It is especially relevant for understanding the patterns of migratory routes where data from the official platforms is lacking. The portal will be upgraded in 2023 based on the Ornitho platform (already in use in several other countries).

14. National Guidelines for assessing wind parks' impacts on bats

Type: Management/Governance & Monitoring
Implementer: Bat Research Society of Latvia, National Authority, NGO/Non-profit organisation
Location: National level, Onshore & Offshore
Phase: Planning & Operation
Description: In 2022, Nature Conservation Agency and Bat Research Society published the national guidelines to standardize experts' assessments of wind parks' impacts on bats. Their goal was to provide a common reference for data collection, species-specific siting decisions, and threshold values for mortality.

The authors concluded that most wind parks in forested areas will require temporary operational curtailment to prevent high bat mortality and recommended how to design effective monitoring systems.

Table 7: Compilation of Good practices

GOOD PRACTICE	TYPE	IMPLEMENTER	LOCATION	PHASE	LINK
1. Radar ornithology and thermal simulator	Technology	Not specified	Florina, Greece, **Onshore**	Operation	https://www.windfarms-wildlife.gr/download_file.php?file=download_0_1_0_88.pdf
2. Autonomous video surveillance and birds' collision avoidance system	Technology	Centre for Renewable Energy Sources & Saving (CRES) & Nature Conservation Consultants (NCC) National Authority	Keratea, Attica, Greece, **Onshore**	Operation	https://www.windfarms-wildlife.gr/download_file.php?file=download_0_1_0_88.pdf (in Greek)
3. Automatic ultrasonic bat recording system	Technology	Centre for Renewable Energy Sources & Saving (CRES) & Nature Conservation Consultants (NCC) National Authority	Keratea, Attica, Greece, **Onshore**	Operation	https://www.windfarms-wildlife.gr/download_file.php?file=download_0_1_0_88.pdf
4. Naval radar adapted to the recordings of birds and Field ornithologists	Technology	Centre for Renewable Energy Sources & Saving (CRES) & Nature Conservation Consultants (NCC) National Authority	Keratea, Attica, Greece, **Onshore**	Planning - Operation	https://www.windfarms-wildlife.gr/download_file.php?file=download_0_1_0_88.pdf
5. Autonomous video surveillance and birds' collision avoidance system	Technology	Centre for Renewable Energy Sources & Saving (CRES) & Nature Conservation Consultants (NCC) National Authority	Thrace, Greece, **Onshore**	Operation	https://www.windfarms-wildlife.gr/download_file.php?file=download_0_1_0_88.pdf
6. Map of sensitive areas for the construction of wind farms	A model example of civic participation	WWF Greece NGO/Non-profit organisation	Thrace, Greece **Onshore**	Planning	https://ec.europa.eu/environment/nature/natura2000/management/docs/win d_farms_el.pdf
7. Ornithological monitoring system (advanced tools)	Technology	PGE Polska Grupa Energetyczna (Polish Energy Group) and BIOSECO	Kisielice and Lotnisko, Poland, **Onshore**	Construction Operation	https://pgeeo.pl/aktualnosci/ sukces-pilotazu-systemu-chroniacego-ptaki-przed- kolizja-z-lopatami-turbin-wiatrowych

		Company/ Private initiative			
8. Monitoring and protection	Monitoring	Polenergia Company/ Private initiative	Montagu's harrier, Lower Silesia, Poland, **Onshore**	Construction Operation	https://odpowiedzialnybiznes. pl/dobre-praktyki /ochrona-blotniaka- lakowego-na-terenie-farm- wiatrowych-oraz- w-ich-sasiedztwie-polenergia/
9. Environmental & Social Action Plans	Management/ Governance Monitoring	Polenergia Company/ Private initiative	Szymankowo and Dębsk, Poland, **Onshore**	Construction Operation	https://esg.polenergia.pl/ dobre-praktyki/ nadzor-przyrodniczy -na-budowach/
10. Guidelines for assessing the impact of wind power plants on birds	A model example of civic participation/ Management/ Governance Monitoring	Polish Wind Energy Association, Polish Society for the Protection of Birds NGO/ Non-profit organisation	Poland, National level **Onshore & Offshore**	All phases	https://otop.org.pl/ uploads /media/ wiatraki_ otop_psew.pdf
11. Sensitivity mapping and standardized guidelines: impacts on birds	Management/ Governance	The University of Latvia, Faculty of Biology	Latvia, National level **Onshore**	Planning Construction Operation	https://lvafa.vraa.gov.lv/projects/1-08_74_2022
12. Net positive impacts on biodiversity communities	Management/ Governance Landscape planning and management	International wind park developers (Vattenfall, Orsted) Company/ Private initiative NGO/Non-profit organisation	Baltic Sea Region, Latvia, **Onshore & Offshore**	Planning Construction Operation	https://group.vattenfall.com/press-and-media /pressreleases/2022/vattenfall-once-again-number-one-in-biodiversity-ranking https://orsted.com/en/sustainability/nature/net-positive-biodiversity-impact#explore-some-of-our- biodiversity-projects-and-partnerships https://onlinelibrary.wiley.com/doi/10.1002/bse.2379 https://portals.iucn.org/library/sites/library/files /documents/Rep-2015-007.pdf
13. Data portal for nature observations	A model example of civic participation	Latvian Fund for Nature Grassroot initiative/ Community NGO/Non-profit organisation	Latvia, National level **Onshore**	Planning Construction Operation	https://dabasdati.lv/en/cat/2?links=en/cat/2
14. National Guidelines for assessing wind	Management/ Governance Monitoring	Bat Research Society of Latvia	Latvia, National level **Onshore &**	Planning Operation	https://lvafa.vraa.gov.lv/projects/1-08_171_2020 https://www.latvijassiksp

parks' impacts on bats		National authority NGO/Non-profit organisation	**Offshore**		arni.org/post/lspb-vadlinijas-veja-parku-ietekme https://lvafa.vraa.gov.lv/faili/materiali/petijumi/2020 /171/Vadlinijas_VES_siksparni_fin.pdf https://conbio.onlinelibrary.wiley.com/doi/full/10.1111/csp2.12805

3.3 Cases to avoid

This subsection presents the cases to avoid that were gathered by project partners using the questionnaire, both in text and in a table.

3.3.1 Cases to avoid from Greece – UPAT

1. **Lack of monitoring**

Implementer: Not specified
Location: Thrace, Onshore
Phase: Operation
Description: Wind turbines can be threatening to endangered species when there is a lack of sufficient monitoring. During the 2009-2010 period, in Thrace, three out of the five birds of prey species found dead were listed as “endangered” (Black Vulture), “vulnerable” (Western Marsh Harrier), or “near threatened” (Short-toed Eagle) in the Red Data Book of Threatened Animals of Greece. Thus, the nonexistence of proper monitoring had a serious impact on the biodiversity of the area.
Lessons learnt: Surveys and intensive monitoring of effects on bird/bat population and the implementation of different technology measures to mitigate collisions and deaths should be firstly considered during the operation phase of wind turbines.

2. **Failure to comply with the Habitats Directive for Natura 2000 areas**

Implementer: Ministry of Environment
Location: National level, Onshore
Phase: Planning
Description: WWF has petitioned the European Commission on the basis that Greece’s Environment Ministry has made inadequate progress toward the protection of threatened species in designated areas. The European Commission has sent a reasoned opinion to Greece over alleged failures to comply with the Habitats Directive when authorising the construction of wind farms affecting Natura 2000 areas without accompanying impact assessment.
Lessons learnt: Greece, or any other country, should be working on a new framework for the special planning of renewables projects by taking into consideration the necessity to halt biodiversity loss and protect as much as possible Natura 2000 area.

3.3.1 Case to avoid from Poland – WiseEuropa

3. **Non-compliance of municipal authorities in Poland regarding guidelines and regulations related to the development of wind farms (specifically, their locations)**

Implementer: Public (municipal) Authorities

Location: National level, Onshore
Phase: Planning
Description: Municipal authorities may sometimes place wind farms in areas that are off-limits according to regulations designed to protect biodiversity. This action puts biodiversity at risk and indicates that the authorities have not taken sufficient measures to safeguard it.
Lessons learnt: Wind farm regulation should be more strictly enforced by tighter monitoring and anti-corruption measures (in many cases, the municipal authorities were bribed by wind farm operators in less or more direct ways). Moreover, wind farm regulation must be unambiguous, as leaving room for interpretation may lead to decreased biodiversity protection.

3.3.1 Case to avoid from Latvia – Green Liberty

4. Prohibition of wind parks in intensive agricultural areas

Implementer: Ministry of Agriculture
Location: Zemgale region, Onshore
Phase: Planning
Description: "Farmland of national importance" is a land use category characterized by high soil fertility and large field size (>50 ha) located in the Zemgale region, Latvia. The regulation prohibits wind park development in these areas despite that there is grid infrastructure and protected nature sites are mostly absent. This restriction redirects wind park planning to mixed-cover or forest landscapes where biodiversity risks are higher.
Lessons learnt: The wind park restriction in large-scale farmlands is currently being revised at the Ministry of Agriculture. The government has considered proposals from environmental organisations and wind industry. The case is not unique for Latvia, there have been similar restrictions in other countries (Romania). There has not been a major opposition from farmers' associations. This formal restriction explains why developers explore forested areas when other economic uses pose barriers in open landscapes.

Table 8: Compilation of Cases to avoid

COUNTRY	CASES TO AVOID	IMPLEMENTER	LOCATION	PHASE	LINK
GREECE (UPAT)	1. Lack of monitoring	Not specified	Thrace, onshore	Operation	https://www.contentarchive.wwf.gr/images/pdfs/Thrace.pdf
	2. Failure to comply with the Habitats Directive for Natura 2000 areas	Ministry of Environment	Onshore	Planning	https://www.endseurope.com/article/1813544/infringements-greece-cautioned-failure-assess-environmental-impact-wind-farms
POLAND (Wise Europa)	Non-compliance of municipal authorities in Poland regarding guidelines and regulations related to the development of wind farms (specifically, their locations)	Public (municipal) authorities	Onshore	Planning	https://www.nik.gov.pl/plik/id,7128,vp,9004.pdf
LATVIA (Green Liberty)	Prohibition of wind farms in intensive agricultural areas	Ministry of Agriculture	Zemgale region, onshore	Planning	https://likumi.lv/ta/id/257136-noteikumi-par-nacionalas-nozimes-lauksaimniecibas-teritorijam

3.4. Good Practice Assessment

After identifying good practices, the partners were asked to evaluate them based on the following criteria:

1. **Their effectiveness in mitigating biodiversity risks** (Positive impact)
2. **Their lack of impact on the economic activity of the wind farm** (Negative impact)
3. **Their transferability potential, namely their potential for being replicated or adapted to other contexts** (Positive impact)**.**

Each criterion is further broken down into sub-criteria and scored on a scale of 0 to 3. To account for the second criterion measuring negative impact, a reverse scoring is applied, i.e., the highest score is assigned to the lowest economic impact. This allows for the scores to be aggregated and presented as a single, uniform evaluation, assessing only positive impacts, namely 1) effectiveness, 2) lack of economic impact, and 3) transferability potential.
This subsection outlines the award criteria and displays the scores that the partners assigned to the identified good practices.

3.4.1 Award criteria

The questionnaire helped collect opinion-based evidence and personal views on good practices identified in the partners' respective countries using 4 questions:

1. **To what extent has the Good Practice mitigated specific biodiversity risks**. Biodiversity risks addressed include:

a) Bird and bat casualties – collision with turbines
b) Habitat disturbance (Reduction or loss of available habitat including short-term habitat disturbance and habitat fragmentation
c) Interference in birds' movements between feeding, wintering, breeding, and moulting
d) Barriers to movement in migration routes
e) Communication disturbance (e.g., of marine mammals)

2. **To what extent has the Good Practice impacted the wind farm's economic activity.** Potential impacts include the following:

a) Delays in wind farm deployment
b) Capital or operational costs of the wind farm increased
c) Decreased energy generation
d) Reduced land availability for wind farm deployment.

3. **Could you evaluate the Good Practice's transferability regarding aspects judged as pertinent during preliminary desk research.** Partners assessed the following parameters:

a) The ease of adoption

b) The efficacy in solving the biodiversity issue addressed
c) Applicability to other territories (if the issue it aims to tackle is widely encountered).

4. How widespread is the Good Practice?

Partners were asked to evaluate the collected good practices based on any quantitative data they could identify. Where this was not possible, they were asked to evaluate the good practices following their judgment. To measure effectiveness, all the individual scores assigned to the sub-questions (a-e) of question 1 were added. To measure the absence of the economic impact, all the individual points assigned to the sub-questions (a-d) of question 2 were added. Finally, to measure the transferability potential all scores assigned to the sub-questions (a-c) of question 3 and the score assigned to question 4 were added. The maximum score that can be achieved for the first criterion is 15, while the second and third criteria have a maximum score of 12 each. However, none of the identified good practices received a perfect score.

The following tables and graphs provide detailed information on the scores assigned to each good practice across the three award categories, organized by partner and country. Specifically, Tables 9, 11, and 13 display the cumulative scores for each good practice, while Charts 7, 8, 9, 11, 12, 13, 15, 16, and 17 compare the scores across different assessment criteria. Additionally, Tables 10, 12, and 14 show the reduced cumulative scores, which have been standardised to 100, and Charts 10, 14, and 18 compare the overall scores achieved by each good practice based on these reduced scores and the respective award criteria.

Table 9: Impact assessment of Good Practices from Greece – evaluated by UPAT

GOOD PRACTICE	Effectiveness in mitigating biodiversity risks	Lack of impact on the wind farm's economic activity	Transferability potential
1. Radar ornithology and thermal simulator	5	8	9
2. Autonomous video surveillance and birds' collision avoidance system	3	9	9
3. Automatic ultrasonic bat recording system	1	10	9
4. Naval radar adapted to the recordings of birds and Field ornithologists	3	10	8
5. Autonomous video surveillance and birds' collision avoidance system	5	10	9
6. Map of sensitive areas for the construction of wind farms	7	4	9

The above table highlights the fact the good practices provided by the UPAT showed relatively low effectiveness in mitigating biodiversity risks. This may be due to the wide variation in the individual biodiversity threats that were put up for evaluation in the questionnaire. A low or medium score does not necessarily reflect poor performance. A good practice may appear to lag in individual threats but be very good at addressing a single one, resulting in a low score. Alternatively, a practice may be moderately effective in all areas, leading to a higher score, but not exceptionally good at addressing particular threats. Therefore, this cumulative score should be evaluated in conjunction with the individual criteria.

Another observation is that as the effectiveness increases, the practice's impact on the wind farm's economic activity also grows. This suggests that there is a trade-off between effectively mitigating threats to biodiversity and avoiding any impact on wind farm's operations, which further complicates policy making.

The sixth good practice highlights this issue, as its effectiveness in mitigating biodiversity risks would lead to a significant reduction of the available wind farm sites. So, while it is reasonable for selected areas (e.g. Natura areas) it is not a practice that could be broadly transferred to other areas suitable for wind farm development.

The charts below compare the good practices collected in Greece across the three sets of criteria.

Chart 7: Biodiversity Risk mitigation assessment: Good practice comparison in Greece

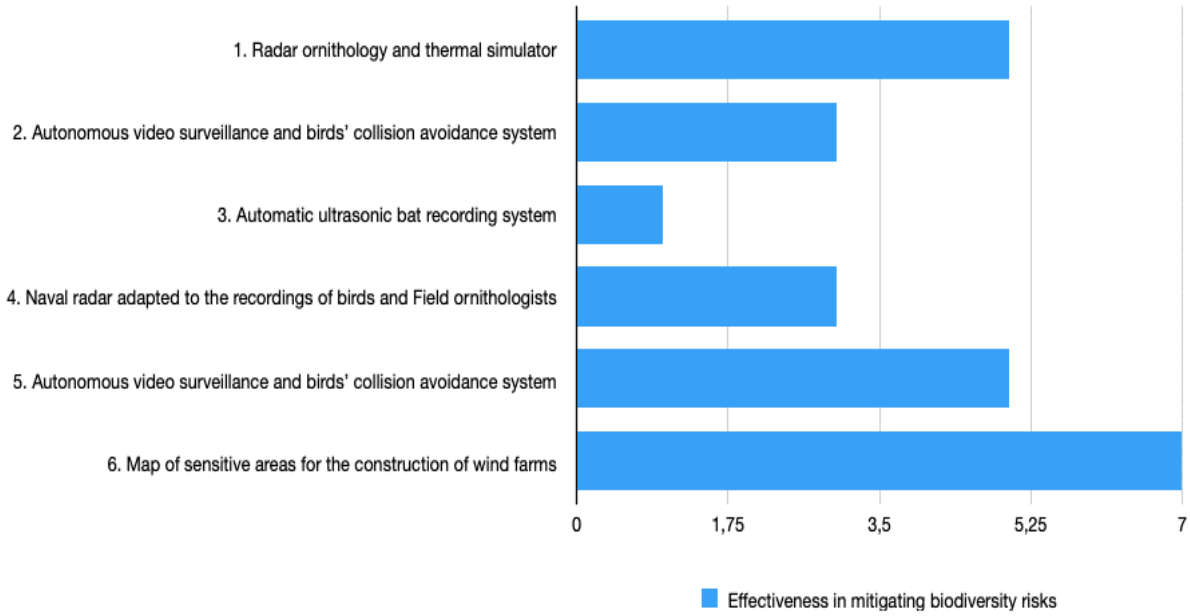


Chart 8: Economic impact assessment: Good practice comparison in Greece

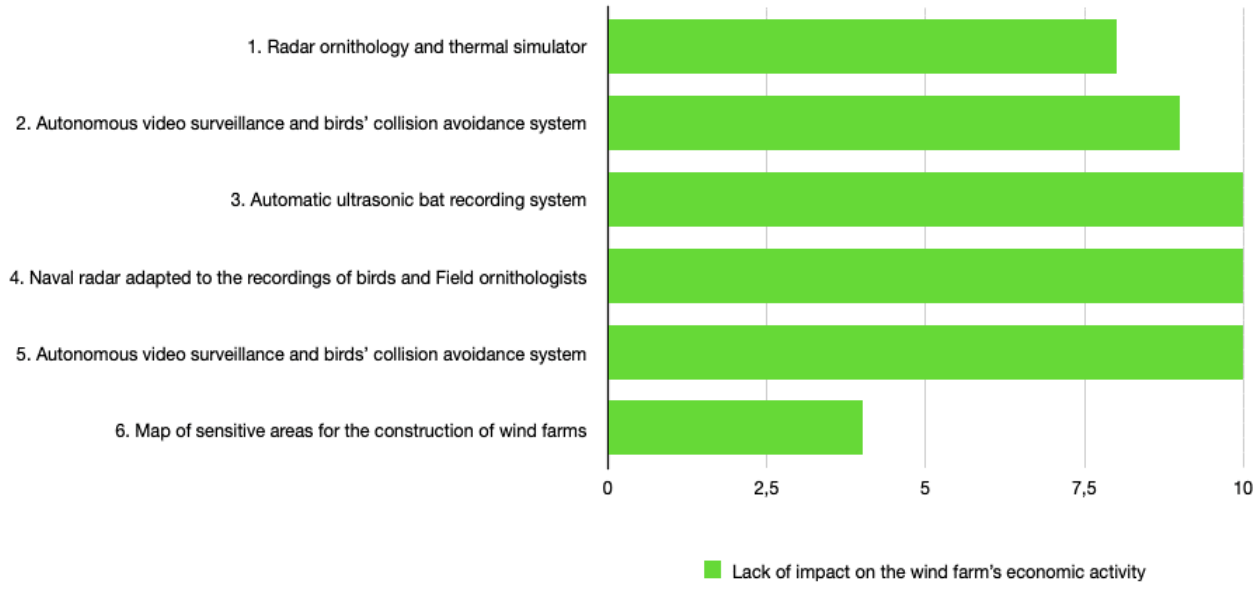
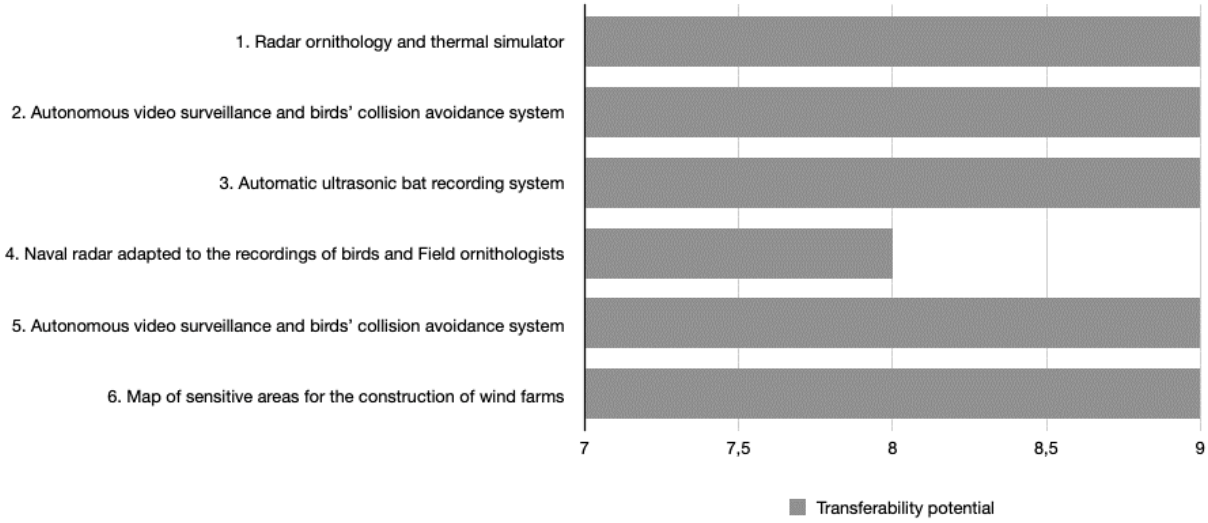


Chart 9: Transferability potential assessment: Good practice comparison in Greece

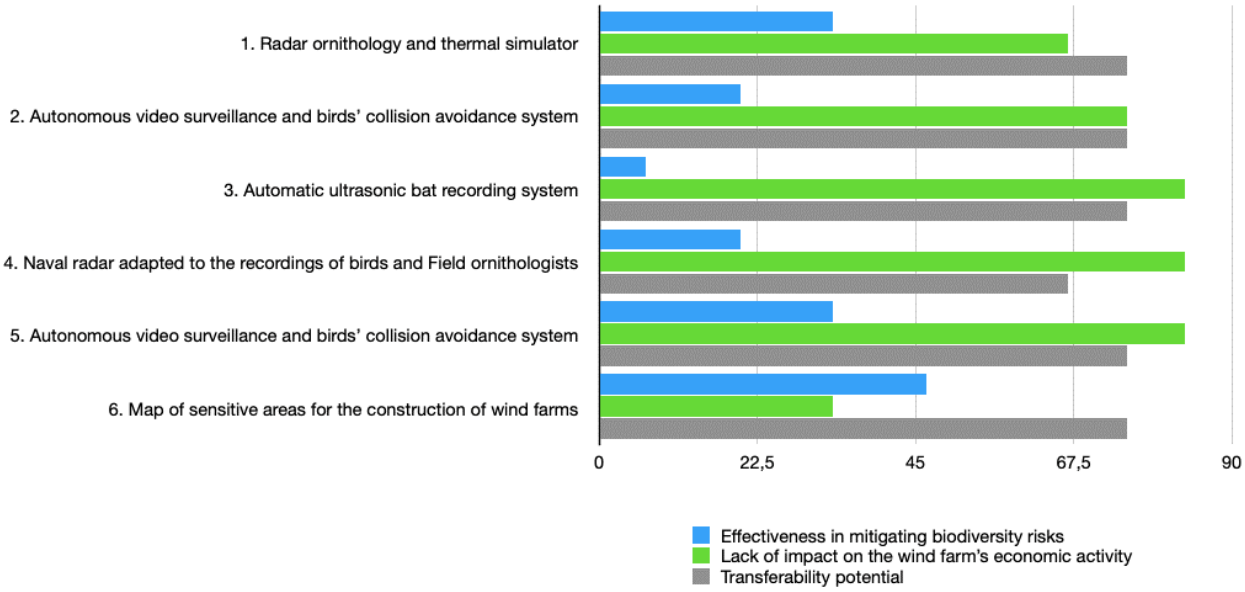


The following table depicts the reduced cumulative scores of the Good Practices from Greece after they have been normalised to 100, and the corresponding chart compares the overall scores achieved by each good practice based on these reduced scores across the award criteria.

Table 10: Impact assessment of Good Practices from Greece – evaluated by UPAT – normalised to 100

GOOD PRACTICE	Effectiveness in mitigating biodiversity risks	Lack of impact on the wind farm's economic activity	Transferability potential
1. Radar ornithology and thermal simulator	33,3	66,6	75
2. Autonomous video surveillance and birds' collision avoidance system	20	75	75
3. Automatic ultrasonic bat recording system	6,66	83,3	75
4. Naval radar adapted to the recordings of birds and Field ornithologists	20	83,3	66,6
5. Autonomous video surveillance and birds' collision avoidance system	33,3	83,3	75
6. Map of sensitive areas for the construction of wind farms	46,6	33,3	75

Chart 10: Overall impact assessment per criterion: Good practice comparison in Greece



The following table displays the cumulative scores for each good practice collected from Poland and evaluated by WiseEuropa.

Table 11: Impact assessment of Good Practices from Poland – evaluated by WiseEuropa

GOOD PRACTICE	Effectiveness in mitigating biodiversity risks	Lack of impact on the wind farm's economic activity	Transferability potential
7. Ornithological monitoring system (advanced tools)	9	1	9
8. Monitoring and protection	5	1	6
9. Environmental & Social Action Plans	6	2	7
10. Guidelines for assessing the impact of wind power plants on birds	4	0	7

This table illustrates even more graphically that identified good practices have moderate or low efficiency but at the same time high economic impact. The seventh practice which seems to have a significantly higher effectiveness may not be an attractive option as it seems to have a crucial negative impact on the economic activity of the wind farm.

The charts below compare the good practices collected in Poland across the three sets of criteria.

Chart 11: Biodiversity Risk mitigation assessment: Good practice comparison in Poland

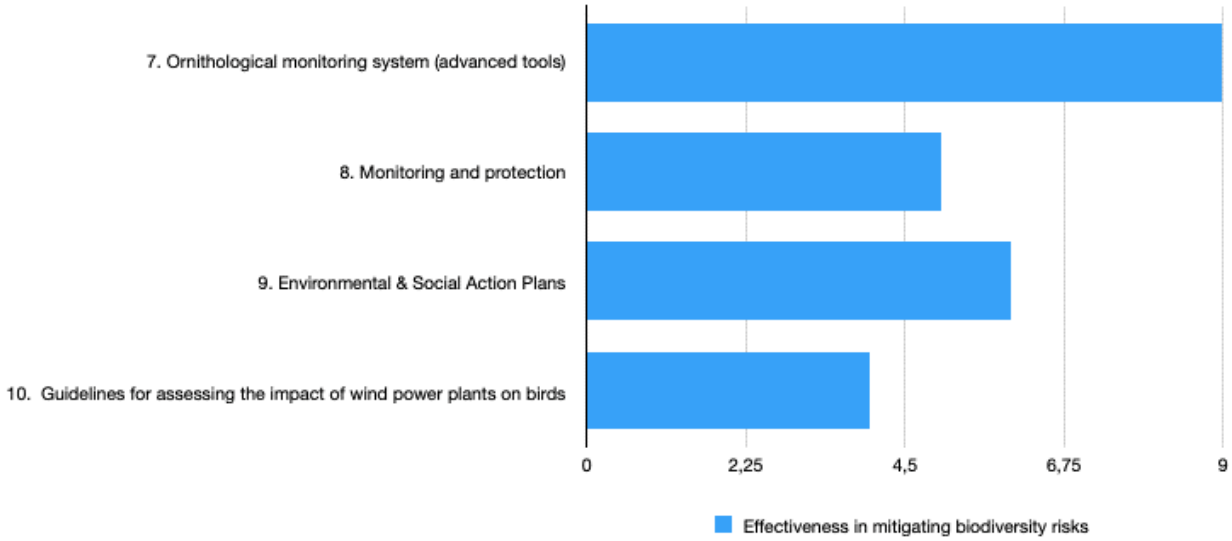


Chart 12: Economic impact assessment: Good practice comparison in Poland

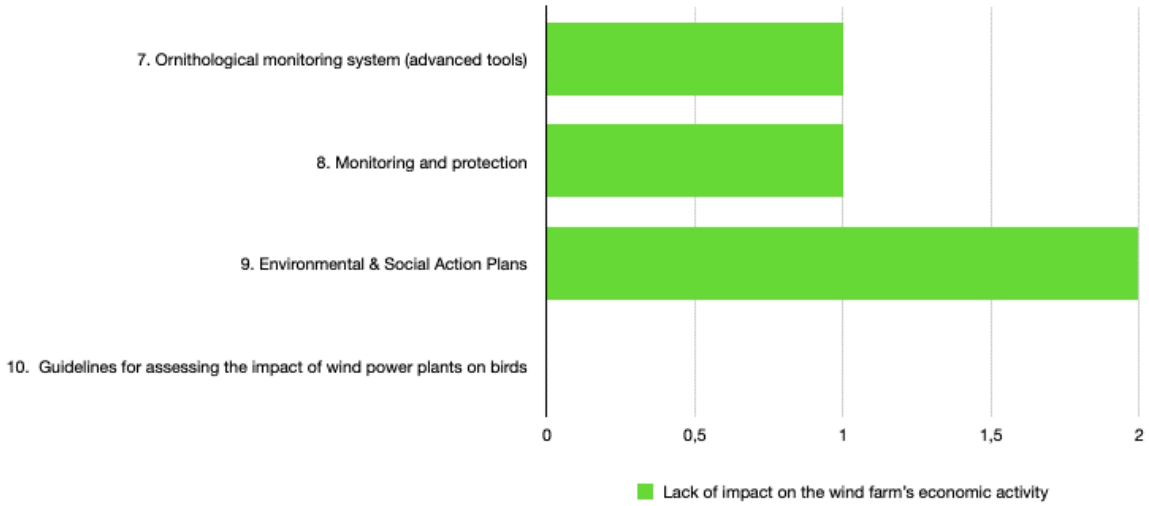
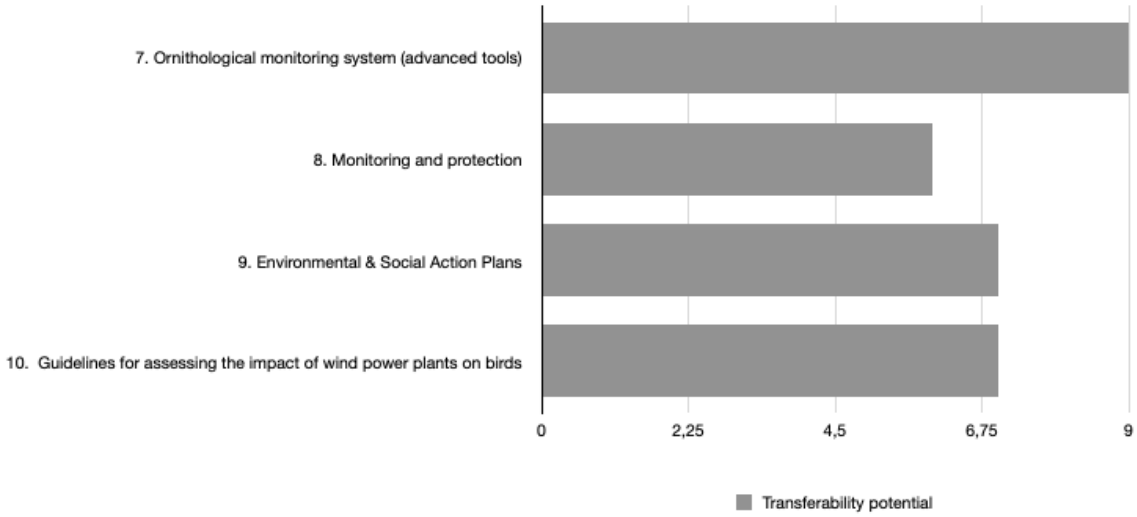


Chart 13: Transferability potential assessment: Good practice comparison in Poland

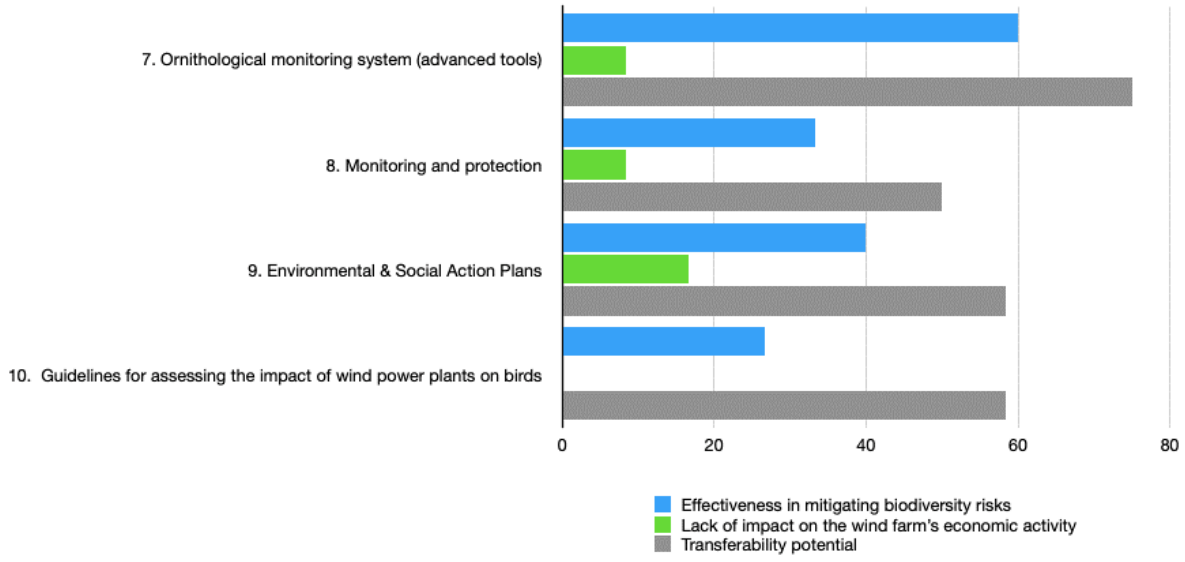


The following table depicts the reduced cumulative scores of the Good Practices from Poland after they have been normalised to 100 and the corresponding chart compares the overall scores achieved by each good practice based on these reduced scores across the award criteria.

Table 12: Impact assessment of Good Practices from Poland – evaluated by WiseEuropa – normalised to 100

GOOD PRACTICE	Effectiveness in mitigating biodiversity risks	Lack of impact on the wind farm's economic activity	Transferability potential
7. Ornithological monitoring system (advanced tools)	60	8,3	75
8. Monitoring and protection	33,3	8,3	50
9. Environmental & Social Action Plans	40	16,6	58,3
10. Guidelines for assessing the impact of wind power plants on birds	26,6	0	58,3

Chart 14: Overall impact assessment per criterion: Good practice comparison in Poland



The following table displays the cumulative scores for each good practice collected from Latvia and evaluated by Green Liberty.

Table 13: Impact assessment of Good Practices from Latvia – evaluated by Green Liberty

GOOD PRACTICE	Effectiveness in mitigating biodiversity risk	Lack of impact on the wind farm's economic activity	Transferability potential
11. Sensitivity mapping and standardized guidelines: impacts on birds	8	4	8
12. Net positive impacts on biodiversity communities	10	10	8
13. Data portal for nature observations	4	8	8
14. National Guidelines for assessing wind parks impacts on bats	9	9	10

In this table, the twelfth practice seems to score very highly. However, it is not a good practice by definition as it concerns future targeting and is not an established practice. It is however included here as it was recorded by the partner who collected it and is being considered to the extent that it could be a recommendation for the future. In all three tables overall, there is a slight preference for procedural over technological good practices. That is, although technologies are those that enable monitoring and help to predict and avoid the risk of bird and bat casualties, which is the most important and immediate of threats to biodiversity, procedures, rules, and generally the existence and adherence to a protocol or regulatory framework are considered to be the most important.

The charts below compare the good practices collected in Latvia across the three sets of criteria.

Chart 15: Biodiversity Risk mitigation assessment: Good practice comparison in Latvia

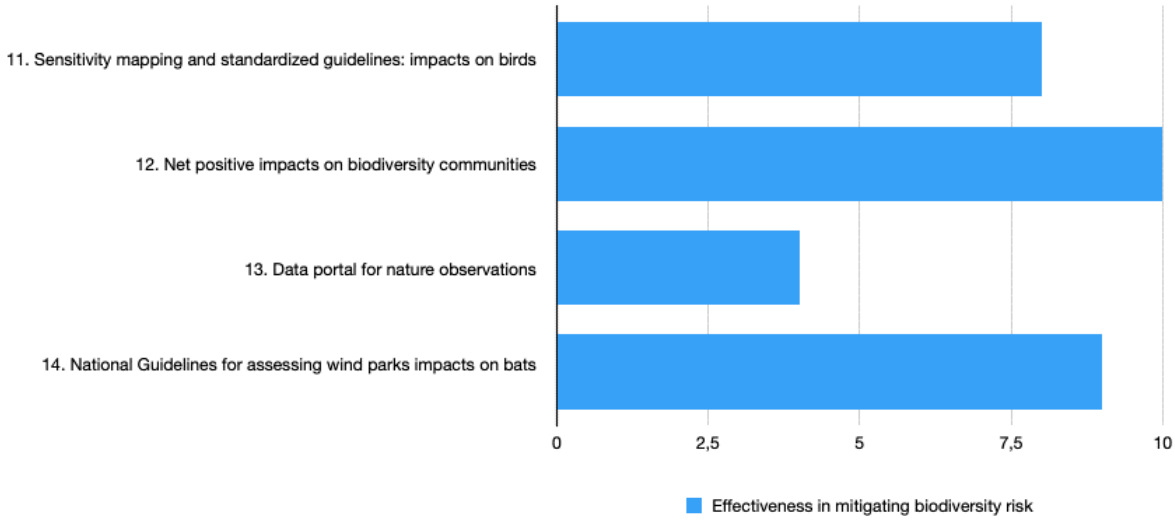


Chart 16: Economic impact assessment: Good practice comparison in Latvia

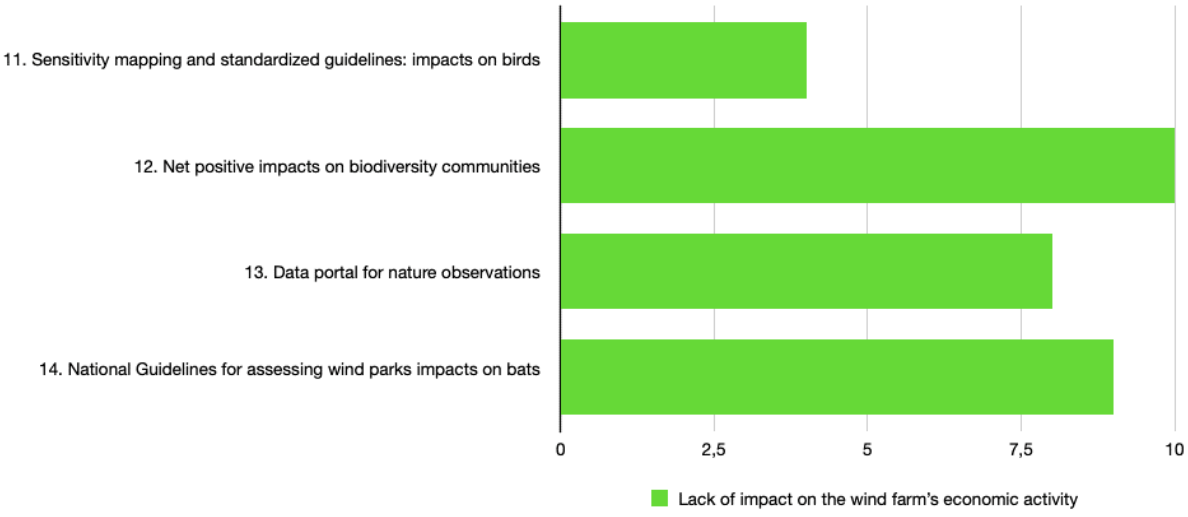
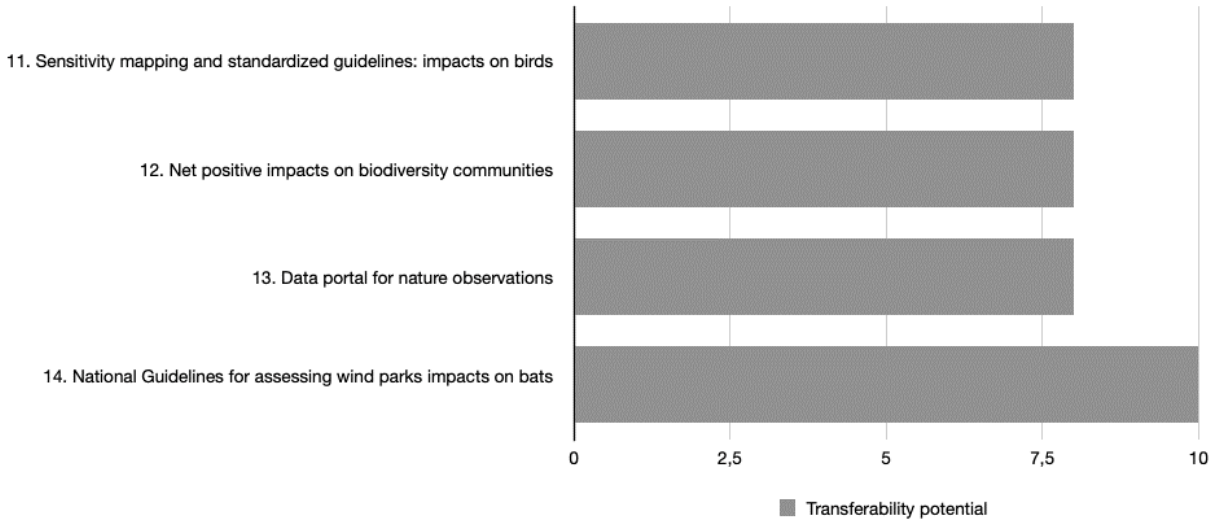


Chart 17: Transferability potential assessment: Good practice comparison in Latvia

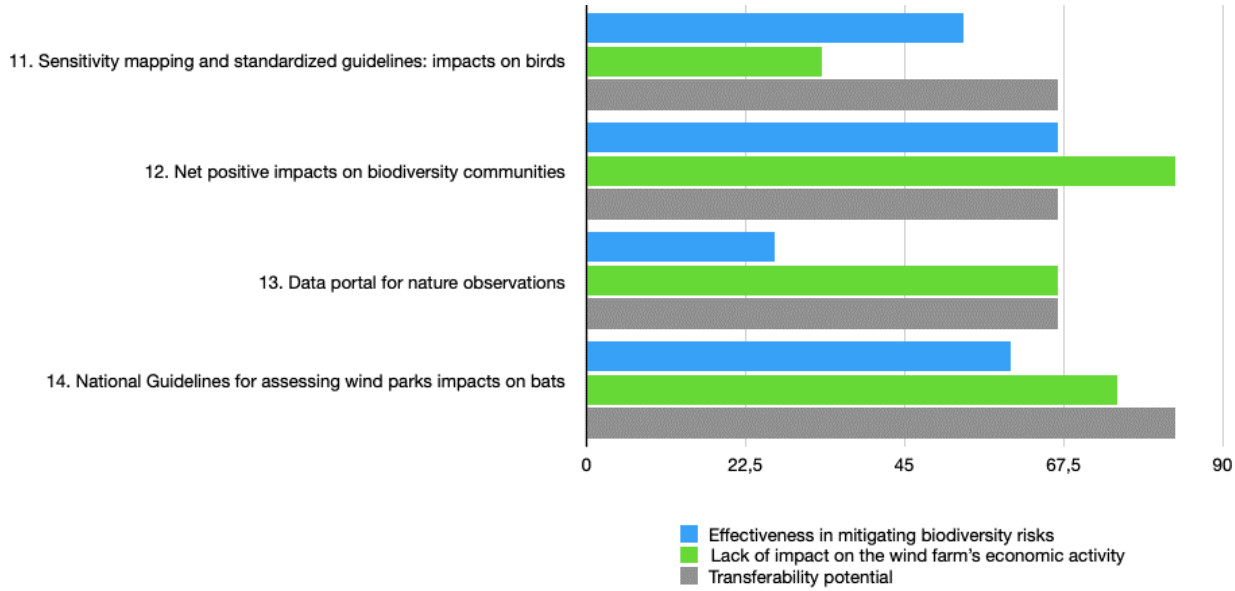


The following table depicts the reduced cumulative scores of the Good Practices from Latvia after they have been normalised to 100 and the corresponding chart compares the overall scores achieved by each good practice based on these reduced scores across the award criteria.

Table 14: Impact assessment of Good Practices from Latvia – evaluated by Green Liberty – normalised to 100

GOOD PRACTICE	Effectiveness in mitigating biodiversity risk	Lack of impact on the wind farm's economic activity	Transferability potential
11. Sensitivity mapping and standardized guidelines: impacts on birds	53,3	33,3	66,6
12. Net positive impacts on biodiversity communities	66,6	83,3	66,6
13. Data portal for nature observations	26,6	66,6	66,6
14. National Guidelines for assessing wind parks impacts on bats	60	75	83,3

Chart 18: Overall impact assessment per criterion: Good practice comparison in Latvia



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Wind4Bio

4. Discussion

This section covers the main findings of the survey and provides policy recommendations to improve biodiversity protection in Wind4Bio countries, based on the findings of the survey.

4.1 Key findings

The survey conducted in the three partner countries yielded several valuable results regarding the integration of biodiversity protection measures in wind farm projects. Key findings are presented below.

Status of biodiversity risk reduction efforts

Through the survey, the partners documented a range of successful practices related to biodiversity risk mitigation that are still being employed in their respective countries. These practices predominantly concern a) technologies such as monitoring systems and bird/bat collision avoidance systems, and b) procedures such as systematic impact monitoring, casualty assessment, and regulatory frameworks that mandate and encourage preemptive measures and precautionary principles for biodiversity risk mitigation. While there is variation in the implementation and effectiveness of these practices, preliminary desk research revealed that several new technologies are currently being tested or used in Europe but not yet employed in the partner countries. This indicates a need for further integration of advanced technological solutions to improve biodiversity risk mitigation efforts.

A dearth of quantitative data, pointing to insufficient monitoring

The survey revealed a significant dearth of quantitative data related to both biodiversity risk mitigation - such as measuring bird and bat mortality before and after the implementation of good practices - and the economic impact of such practices on costs and energy production at operational wind farms. It is moreover remarkable, that no good practices that exclusively concern offshore wind farms were identified, and no good practices that focus on the retirement phases were recorded. This general lack of data highlights the need for improved and more comprehensive monitoring and assessment throughout all stages of the wind farm's lifecycle, necessitating the involvement of public energy agencies, private companies operating the farms, and the scientific community.

The impact assessment process

According to the partners' assessments, the current set of good practices were deemed to have moderate to low effectiveness in preventing potential threats to biodiversity, whereas their lack of impact on the economic activity of wind farms was rated much higher. While these ratings were

largely based on personal judgments due to the lack of available quantitative data, the relatively low economic impact of good practices holds significant promise. If this can be demonstrated with evidenced-based knowledge (e.g. measurements and economic reports), it may help to alleviate opposition from private companies and facilitate the integration of biodiversity risk mitigation practices as a standard feature of future wind farms.

The challenge posed by the lack of a regulatory framework

The partners' responses consistently highlight the importance of rules and regulatory frameworks in mitigating biodiversity risks associated with wind farm projects. This is evident in both the identified good practices and the cases to avoid, where the presence or absence of regulations can make a significant difference in the effectiveness of biodiversity risk mitigation measures. While technologies such as monitoring systems and bird and bat collision avoidance systems are essential, partners judged that procedures, guidelines, and rules are more effective in achieving biodiversity risk mitigation goals. Thus, all partners with their scores concur in the following: biodiversity risk mitigation should start as early as the planning and permitting phase. The case of Latvia's legislative framework is particularly interesting, as it prohibits wind farms in intensive agricultural areas designated as "farmlands of national importance." While this regulation aims to protect these areas and the interests of farmers and rural economic activity, it also limits wind park planning to mixed-cover or forest landscapes where biodiversity risks are much higher. This demonstrates the need for a more nuanced approach to regulations that balances economic considerations with biodiversity conservation goals.

4.2 Policy recommendations

Based on the above-mentioned findings the following recommendations have been developed.

1. **Offer incentives for the adoption of innovative technologies**

One possible solution to enhance the status of biodiversity risk mitigation is to incentivise (e.g., providing grants and other financial incentives) for the adoption of new technologies that are currently available in Europe but have not yet been adopted in the consortium countries due to high costs or other constraints. This approach is also recommended in good practice number 12 from Latvia (‘Net positive impacts on biodiversity communities’), which emphasises the introduction of innovative practices and technologies to the national context.

2. Encourage continuous monitoring and impact assessment by promoting a culture of collaboration among public authorities, private stakeholders, and the scientific community

Establishing a culture of collaboration among public authorities, private entities, and the scientific community is essential for the implementation of permanent monitoring and continuous impact assessment practices. This entails defining clear procedures for measuring and analysing quantitative and qualitative data and fostering knowledge sharing with the ultimate goal of enhancing the effectiveness and sustainability of wind farms.

3. Identify and address regulatory gaps and weaknesses that may compromise the effectiveness of biodiversity risk mitigation measures

Particular attention should be paid to the regulatory framework governing the development of wind farms. With wind power expected to scale-up in the coming years it is important to strike a balance between the interests of energy producers, landowners, and the state, and in that way prevent unnecessary hindrance or unnecessary cost to wind farm operations. The consortium countries are already taking steps to review and tighten regulations, with some areas being designated as off-limits for wind farm development due to high biodiversity sensitivity. The next critical step is to ensure that all stakeholders involved adhere to the regulatory frameworks. This can be achieved by integrating the significance of biodiversity risk mitigation measures and providing capacity building and training for the implementation of new technologies and monitoring tools that are currently available.

4. Prioritise informed site selection in wind farm development

It is imperative to prioritise informed site selection from the outset to avoid the need for expensive, energy-intensive mitigation measures in the future. This should involve conducting a comprehensive biodiversity risk assessment to identify areas of high biodiversity value and avoid locating wind farms in such areas.