

**Environmental Due Diligence (EDD)
Of Renewable Energy Projects**

GUIDELINES

for

Wind Energy Systems

Release 1.0



UNEP

United Nations Environment Programme

BASE

Environmental Due Diligence (EDD) process for Wind Energy Systems

Definition and background

Environmental Due Diligence (EDD) is the collection and assessment of data relative to environmental conditions or impacts prior to a transaction to identify and quantify environment-related financial, legal, and reputational risks.

Banks have put in place a number of instruments to manage risk. One of these instruments is commonly termed a **Due Diligence** review. This term, as well as its practice, originates from the U.S. and refers to the background work (investigation, analysis, and verification) done by a prudent entrepreneur, owner, executive, or lender when making a decision. The general intention of a due diligence review is to ensure that a projected investment does not carry financial, legal, or environmental liabilities beyond those that are clearly defined in an investment proposal. The environmental component of the due diligence procedure is referred to as environmental due diligence (EDD). Originally, lenders or investors used EDD to manage environmental risks and liabilities stemming from an investment decision. Recently, it has become a way for financial institutions to incorporate environmental and social considerations in their investment review process.

EDD has become largely standardised for many sectors, but not for all. There is a growing realisation in energy and environmental policy and research circles that procedures for environmental due diligence of Renewable Energy Technologies (RETs) are poorly defined and financiers must often adopt *ad hoc* procedures for environmental review. Although most renewable energy technologies are environmentally sound in theory, all of them can have negative impacts on the environment if poorly planned.

The Environmental Due Diligence process

The process consists of three stages (Figure 1)

1. Establishing the regulatory framework
2. Environmental appraisal
3. Monitoring the project after approval

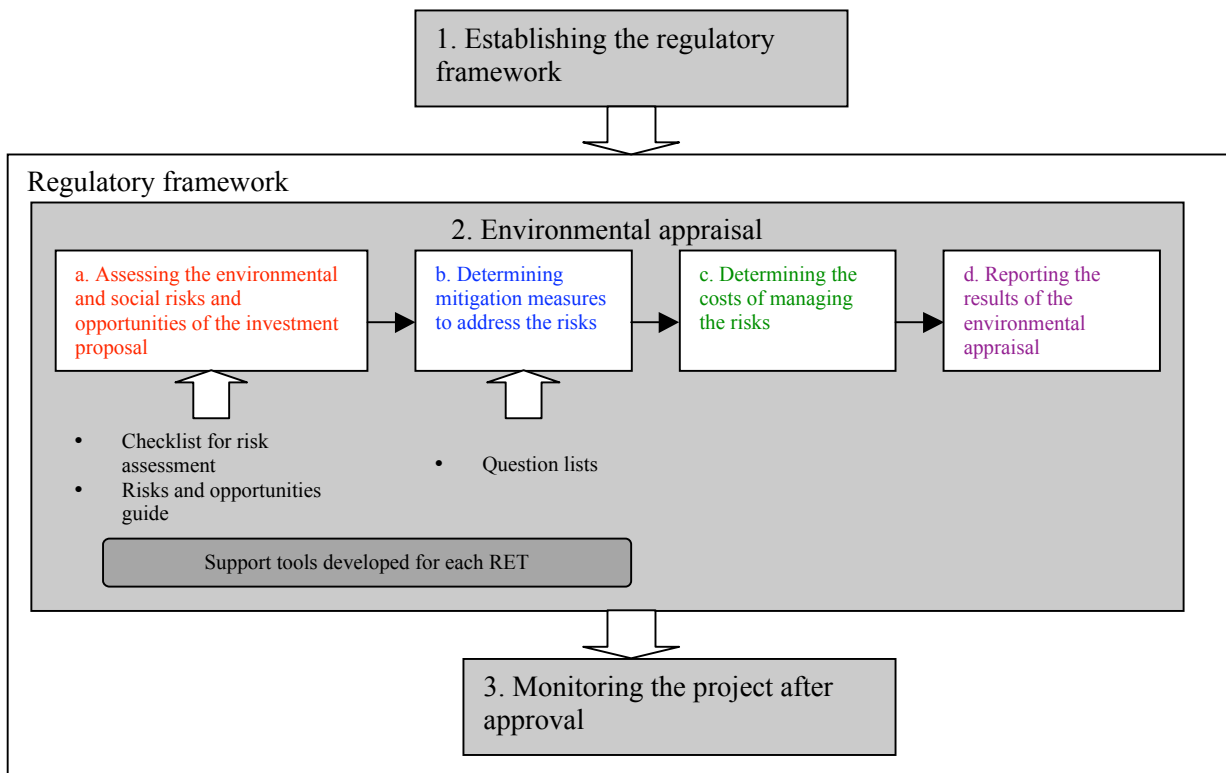


Figure 1: Procedure for environmental due diligence of RET projects

1. The first stage of the procedure is establishing the relevant regulatory framework for the project, including national regulations, international standards, and good practice guidelines.

The environmental laws provide the background for determining the main issues that should be considered during the environmental appraisal process. Environmental regulations, standards and guidelines provide practical information concerning emission limits, permitting requirements, pollution abatement and control techniques and equipment, best management and operational practices, etc., against which the investment proposal should be benchmarked. Two timeframes must be considered for this process: first, that of existing laws and regulations that currently affect the project, and second, that of anticipated laws and regulations (e.g. in process of development, discussion, or approval) that may change the conditions under which the project must operate.

2. The second stage is the core of the entire process. It comprises four main steps: a) assessing the environmental risk; b) determining mitigation measures; c) estimating the cost of risk management; and d) reporting the results.

To facilitate the first two steps of this stage a number of new EDD tools are proposed. These tools are intended to complement, not replace, any EDD tools currently used for environmental review procedures. In addition, it is important to note that since these tools are intended for general use, they may not reflect all the possible environmental and/or social

issues related to a particular investment. The analyst should incorporate additional issues as needed.

3. The third stage is the monitoring and environmental evaluation of the project. This procedure serves two main purposes: a) to ensure that the project sponsor complies with the applicable environmental standards and various environmental components of operations included in legal agreements; b) to keep track of ongoing environmental impacts associated with project operations and of the effectiveness of any mitigation measures.

EDD Guidelines for Wind Energy Projects

The guidelines for EDD of on-shore wind energy follow **the three stages** shown in Figure 1.

1. Regulatory framework for the project

The regulatory framework for the guidelines consists of the current and anticipated national and regional laws, international standards, and best practice guidelines¹.

2. Environmental appraisal of the project

This stage comprises **four main steps**: a) assessing the environmental risk, b) determining mitigation measures, c) estimating the cost of risk management, and d) reporting the results.

a) Assessing the environmental and social risks and opportunities of the project

The objective of this task is to provide an initial evaluation of the environmental risks and opportunities presented by a particular wind energy project. The expected outcome of this step is a matrix that provides the analyst with an estimate of the risk potential of a project with respect to a number of potential environmental issues.

Two tools have been developed to aid the investment analyst in this task.

Table 1 provides a list of potential environmental issues that may be associated with an onshore wind energy project. The issues have been divided into four categories: effluent emissions, on-site contamination and hazardous materials issues; biodiversity protection issues; worker health and safety issues; and environmental issues sensitive to public perception. The table provides a checklist of information that an analyst may use to determine the risk potential of each issue for the project in review. This information may be contained in the documentation provided by the project developer, for example, in an EIA or other type of environmental assessment report that may accompany the proposal; or it may be ascertained during on-site field visits, stakeholder meetings, etc. Other possible sources of information include media reports, telephone conversations, electronic or post mail, etc. In any case, the responsibility for providing relevant information to the satisfaction of the analyst rests ultimately with the project developer/sponsor.

In some cases, the table also provides best practices and/or mitigation measures that could be planned, proposed or carried out on-site to manage a particular issue. It is important to note, however, that these best practices/measures are generic and therefore only meant for illustrative purposes.

Other important information to be used to assess the risk potential of a wind energy system include:

- impending environmental legislation that may affect the project;
- the environmental liability regime of the host country; and
- project sponsor characteristics including previous compliance problems and history of accidents.

The risk potential of each issue is to be rated using the following key:

¹ (e.g. as provided by the International Finance Corporation (IFC): Environmental, health and safety guidelines, available under: www.ifc.org/enviro/enviro/pollution/guidelines.htm).

Risk Rating Key:

Key	Definition	Characteristics
L	Low/no risk potential.	Information availability: Excellent (the issue is well documented) Environmental impact: Little to no negative environmental impact in case of occurrence Probability of occurrence: Low to non-existent Mitigation/compensation measures: readily available and considered in proposal
L-M	Low to moderate risk potential.	Information availability: Excellent to good (the issue is adequately documented) Environmental impact: Temporary/reversible damage in case of occurrence Probability of occurrence: Low (estimated at less than 20%) Mitigation/compensation measures: readily available and considered in proposal
M	Moderate risk potential	Information availability: Good (documentation is adequate, but may require improvement (e.g. clarification, addition)) Environmental impact: Temporary/reversible damage in case of occurrence Probability of occurrence: Estimated between 20-40% Mitigation/compensation measures: Readily available, but not considered in proposal
M-H	Moderate to high risk potential	Information availability: Requires improvement (there is little or no documentation pertaining to the issue, or the information requires clarification or addition) Environmental impact: Potential for adverse impacts, although to a lesser degree than H issues (e.g. impacts may be site-specific, mostly reversible, or with readily available mitigation measures). Probability of occurrence: Estimated between 20-60% Mitigation/compensation measures: Available, not considered in proposal
H	High risk potential	Information availability: Requires improvement (there is little or no documentation pertaining to the issue, or the information requires clarification or addition). Environmental impact: Potential for adverse impacts (the issue may become critical if not managed, e.g. it could affect more than the project site, pose irreversible environmental damages, affect sensitive flora, fauna, human communities, etc.) Probability of occurrence: Higher than 40% Mitigation/compensation measures: Not available from technical/logistical/financial/legal perspective/ or available, but not considered in proposal

The second table, **Table 2**, is a matrix in which the user can enter the appropriate letter (i.e. L, L-M, M, M-H, H) according to his/her estimation of the risk each issue presents for the project in review. The purpose of the table is simply to provide a snapshot of the environmental and social risks of a particular project and their corresponding risk rating at a

particular point in time. This risk rating can help the investment analyst decide further actions in the EDD process.

Table 2 also presents a column of potential environmental opportunities of a project, to present a more balanced view of the environmental impact (both positive and negative) that may be attributed to a particular project.

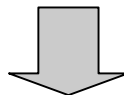
The assessment of a certain risk potential will depend on the results of the review of relevant information, as well as on the analyst’s experience and common sense.

How to use the tables:

Table 1 contains a list of potential risks as well as information to help estimate the risk potential. Once the analyst makes this estimation, the appropriate letter is filled in Table 2.

Template of Table 1: Checklist for environmental risk assessment

Risk	Information to look for
1. Risk 1	Information 1
2. Risk 2	Information 2
3.
...	



Risk rating
L, M, H
to be entered here

Template of Table 2 (Matrix):

Activity	Environmental and social risks					Environmental opportunities
	Issue 1	Issue 2	Issue 3	Issue 4	Issue 5	
1.	H	L				
2.	M	M-H				

Table 1: Checklist for environmental and social risk assessment of a wind energy system

Aspect	Information to look for
Effluent emissions, on-site contamination, hazardous materials issues	
–	–
Biodiversity protection issues	
1. Habitat damage from plant-construction activities	<ul style="list-style-type: none"> • Site location: e.g. proximity to sensitive ecosystems such as wetlands or peat bogs, or areas with archaeological or recreational value (e.g. Natura 2000 areas). • Compliance with best construction practices: rights-of-way alignment, noise mitigation, erosion control, replanting of disrupted vegetation, siting of construction materials, etc. • Mitigation measures planned or carried out: transmission line route planning to reflect preservation of existing parks and reserves, establishing protection perimeters around major animal habitats and/or sensitive or valuable ecosystems such as peat bogs, marshlands, and valuable forests, where no construction activities are allowed, marking of power lines or guard wires, installation of anti-roosting devices or nesting platforms to persuade birds to nest in safest possible locations, etc.
2. Bird strikes and disturbance	<ul style="list-style-type: none"> • Site location: existence of bird-protected areas (e.g. Important Bird Areas, Special Protected Areas, Ramsar areas), nesting or brooding areas, migration areas, or other areas of ornithological importance in or near proposed development sites; studies on both local and migrant bird populations and their uses (foraging, breeding, resting, passing through, staging, etc.) of proposed development sites. • Site planning: careful siting of turbines avoiding bird-protected areas, migratory paths, or other ornithologically valuable areas; defining the location and spatial arrangement of turbines taking into account factors such as risk mitigation for resident or migratory bird species: (e.g. deciding between dense cluster arrangements, linear arrangements (line of turbines parallel to the main migration direction), open clusters, sparse layout arrangements (placing turbine-free corridors between clusters of turbines), etc.) as well as wind resources, and proximity to the grid. • Mitigation measures planned or carried out: Monitoring programmes (scientific and experimental) /before-after-impact studies to judge effect of constructed wind farms on birds.
3. Habitat damage from generation activities	<ul style="list-style-type: none"> • Site location: e.g. increased access to sensitive ecosystems such as wetlands or peat bogs, or areas of archaeological or recreational value (e.g. Natura 2000 areas). • Site planning: avoidance of potentially fragile ecosystem areas, or areas of archaeological or recreational value (e.g. Natura 2000 areas)
Worker health and safety issues	
4. Accidents from plant-construction activities	<ul style="list-style-type: none"> • Compliance with international, local, and national health and safety regulations • Training of personnel • Emergency plans in place • Outstanding worker compensation claims
5. Accidents from generation activities	<ul style="list-style-type: none"> • Compliance with international, national, and local health and safety regulations • Training of personnel • Emergency plans in place

	<ul style="list-style-type: none"> Outstanding worker compensation claims
Environmental issues sensitive to public opinion	
6. Land use	<ul style="list-style-type: none"> Site location: proximity to populated areas, land-use replacement (e.g. agricultural, recreational, etc.), possibility of using the land between turbines for other purposes.
7. Noise emissions	<ul style="list-style-type: none"> Compliance with statutory (e.g. local or national regulations) or recommended (e.g. manufacturer, international guidelines) noise emission levels Site location: proximity to populated areas, topographical characteristics that could affect noise emission Compliance with best practices for wind farm design and development: keeping recommended distances to nearest noise-sensitive properties, using wind turbines manufactured and assembled to high-quality standards, etc. Neighbour complaints
8. Visual impacts	<ul style="list-style-type: none"> Site location: e.g. proximity to populated areas, or areas with high scenic or recreational value (e.g. Natura 2000 areas). Local community participation in siting decisions Incorporation of conditions to minimize visual impact of schemes in tender documents and status of compliance with these conditions (e.g. restoration of land surface, tree screening, etc.) Visual mitigation measures employed for wind farm development: vegetation screens, turbine colour, tower structure, layout of turbines, avoidance of areas with high scenic or recreational value etc. Protests about development
9. Electromagnetic interference (EMI)	<ul style="list-style-type: none"> Material employed for wind turbine blades (Note: this problem is more likely for turbines with metallic blades, which are highly reflective. Fibreglass blades are partially transparent to electromagnetic waves, and therefore do not generally cause EMI problems.) Compliance with guidelines and other requirements to avoid electromagnetic interference with aviation equipment. Complaints from neighbour about interference with TV or other electromagnetic signals.
10. Accidents involving the public	<ul style="list-style-type: none"> Operation and maintenance routines in place. Compliance with statutory, administrative or contractual obligations concerning safety issues Insurance policies, warranties, and technical know-how (particularly for new turbines)
11. Local community approval	<p>Potential/existing conflicts of interest between the wind farm development and other uses/users of the location must be determined on a case-by-case basis. Generally, conflicts of interest become known during the early planning stages. Given than severe conflicts of interest may even preclude a site from being developed, this issue should be carefully and thoroughly analysed. Although the information to look for depends on the specific conflicts identified for a project, points of interest include:</p> <ul style="list-style-type: none"> Lobbying organisations and their positions concerning wind farm development: e.g. grassroots community groups, ornithological associations, etc. Open planning process including stakeholder participation (public hearings, open discussion forums, etc.) Mitigation/compensation measures planned/carried out to address

	<p>conflicts of interest</p> <ul style="list-style-type: none"> • Protests about the development
12. Air traffic safety	<ul style="list-style-type: none"> • Collision risk analyses, and risk analyses of wind farm's interference with aviation equipment • Mitigation measures planned/carried out: safety features included in wind farm development (e.g. marking lights, ability to switch off all turbines during emergency conditions, emergency plans and protocols) • Compliance with statutory, administrative or contractual obligations concerning air traffic safety issues • Compliance with guidelines and other requirements to avoid electromagnetic interference with aviation equipment.
13. Shadow casting and shadow flickering	<ul style="list-style-type: none"> • Site location: proximity of development to sensitive locations such as roads or residences. • Site planning: Inclusion of site specific shadow casting studies to help determine turbine placement (The shadow casting and flickering effects depend on a number of factors including turbine height, rotor diameter, terrain, and prevailing wind patterns. Readily available software (e.g. Windfarmer, Windfarm from Resoft, or the Danish Wind Power site Shadow Calculator) may be used to predict where, when and for how long there may be a flicker effect, and thus help to protect nearby locations from potential impact).

Table 2: Environmental and social risks opportunities guide for a wind energy system

Activity	Environmental and social risks				Environmental opportunities
	Effluent emission, onsite contamination, hazardous materials issues	Biodiversity protection issues	Worker health and safety issues	Environmental issues sensitive to public opinion	
Plant construction	-	1. Habitat damage <input type="checkbox"/>		-	
Plant operation		2. Bird strikes and disturbance <input type="checkbox"/>	5. Accidents <input type="checkbox"/>	6. Land use <input type="checkbox"/>	Avoided CO ₂ and other air pollutant emissions from deployment
		3. Habitat damage <input type="checkbox"/>		7. Noise emissions <input type="checkbox"/>	
				8. Visual impact <input type="checkbox"/>	
				9. Electromagnetic interference <input type="checkbox"/>	
				10. Accidents involving the public <input type="checkbox"/>	
				11. Local community approval <input type="checkbox"/>	
		12. Air traffic safety <input type="checkbox"/>			
		13. Shadow casting and shadow flickering <input type="checkbox"/>			

b. Identifying risk management measures

Once the environmental and social risks of the project have been assessed, the next step is to identify what measures would be needed to eliminate, reduce, or manage those risks. In the case that the project sponsor has recommended measures for managing potential risks, the analyst must decide whether the measures are acceptable. If no or only inadequate risk-mitigation measures have been recommended, the project developer must modify the project to ensure satisfactory risk management.

Risk management measures may be identified through industrial or sectoral best practices, international or other widely used/accepted standards, etc. As mentioned in the previous section, Table 1 includes some mitigation/compensation measures, although the measures included in the table should not be considered as complete or exhaustive, but merely indicative.

The following question list may provide some assistance in determining the extent of compliance of the project with regulations, standards, and best-practice guidelines and protocols for risk management. The question list has been constructed in a modular form, with the first module containing general questions that should be answered for all projects, while subsequent modules should be applied only if considered necessary or relevant.

Table 3: Question list for a wind energy system

Level	Question
LEVEL I: All projects	1. Has the project complied with all legislated requirements for operation, receiving all necessary licences and permits? Possible requirements include (but are not limited to): <ul style="list-style-type: none"> - Leases or use permits for land involved in the project from local, regional, and/or national authorities - Permits for road construction and for electricity transmission and distribution. - Requirement to prepare and present an environmental assessment of the project - Requirement for public consultation - Construction permits - Operational permits for power production
	2. Has the project site been chosen giving due consideration to all potential environmental impacts of the development, including impacts on natural habitats and wild life disturbance (particularly to birds), and impacts on populated areas concerning noise or visual intrusion? Is there documentation about the site choosing process?
	3. What are the planned/existent operation and maintenance routines at the wind farm development?
	4. Does the project comply with requirements from aviation authorities to avoid electromagnetic interference?
	5. Does the project comply with the following noise impact mitigation measures: <ul style="list-style-type: none"> -Statutory or recommended noise emission levels? -Recommended minimum distance to nearest noise sensitive property? -Employment of turbines designed for noise minimisation?
	6. Has the project given due consideration to the following visual mitigation measures: <ul style="list-style-type: none"> -Employment of neutral, non-reflective colours, tower structure, turbine layout, vegetation screens?
	7. Have there been studies about the ornithological value of the wind farm site? E.g. avian corridors, nesting areas, local and migratory bird species, etc?
	8. Have all moderate and high risk issues identified in the previous stage, other than those that may have been covered in questions 1-7, been appraised and have mitigation measures been proposed?

LEVEL II: Optional	9. Has a site visit been planned? Is one required?
	10. How can the environmental liability regime of the host country affect the financial institution?
	11. Have there been any protests or complaints about the project? If so, what have they focused on?
	12. What are the potential environmental benefits of the project? Is the general public aware of these benefits?
	13. Has the local community been encouraged to participate with the wind farm development?

c. Determining the costs of managing the risks

When the mitigation measures have been determined, the next step is to estimate the cost of the risks and their management. This includes both the real cost of the mitigation measure itself, as well as the potential costs associated with non-compliance (e.g. increased charges, fines and other penalties, the closure of an operation by environmental authorities, project delays due to permitting requirements, etc). Estimating such costs is important even if the financial institution or investor may not be directly responsible for them: first, any unforeseen costs can compromise the financial viability of the proposal; and secondly, the financial institution could be held liable under certain liability regimes. How exact the cost calculation should be and the level of detail is up to the analyst.

The analyst must also take into consideration any future liabilities that could occur as a result of changed environmental legislation, regulations, and standards.

Costs should be determined on a case-by-case basis, depending on the results of the previous step.

d. Reporting the results

The third step of the environmental appraisal stage is to present the key findings of the EDD review in a report that can be used during the investment decision process. The final report should include at a minimum the following information:

- Brief description of the project
- General information about the project sponsor
- Status of compliance with host-country regulations, international standards, best-practice guidelines
- Main environmental impacts and proposed mitigation measures (including an assessment of the adequacy of these mitigation measures if necessary or appropriate)
- An analysis of how the costs of the necessary mitigation measure affects the project's financial viability
- Environmental opportunities (potential benefits of the project)
- Any missing information that may be significant for the assessment of the environmental risks and opportunities of the project
- In the case of moderate and high-risk projects, the key findings should highlight high-risk potential issues and their mitigation measures, as well as the results of environmental assessment reports and site visits that may have been carried out during the review process.
- Further actions required by the financial institution or the project sponsor with respect to environmental issues

3. Monitoring the project

If the project has been approved, the final stage of EDD is the monitoring stage. For this purpose, specific provisions should be included in the legal documentation, for example, the requirement of annual environmental reports, independent environmental audits at specific intervals, site visits, etc. This is especially important for high-risk projects, for which the agreements between project sponsor and financial institution or investor should always include an environmental reporting and evaluation clause. In this case the monitoring should be carried out at regular intervals (e.g. annually or semi-annually), preferably including independent site visits or audits in addition to the project sponsor's environmental evaluation reports.

For low and moderate risk projects, environmental reports from the project sponsor on an annual or semi-annual basis should be sufficient.

Significant changes in the project (e.g. projected expansions, changes in technology), changes in the type of finance (e.g. from loan to equity), and/or foreclosures should **always** be preceded by a re-assessment of environmental risk. This is in order to determine whether the changed project carries environmental and social risks and opportunities that were not considered in the initial review. The environmental monitoring of the project should continue until the loan has been repaid, the financial institution or investor has divested its equity share in a company, or the operation has been cancelled.

Disclaimer:

The UNEP Guidelines on Environmental Due Diligence of Renewable Energy Projects are intended to serve as a practical tool for identifying and managing environmental risks associated with renewable energy projects. They are not meant to supplant national or local environmental or permitting requirements. The EDD Guidelines are to be considered work in progress and UNEP and BASE will continue to improve and refine the Guidelines to make them as suitable and useful as possible for reviewing renewable energy projects.

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