GUIDELINES FOR SOLAR ENERGY PROJECTS

1.0 Introduction

Rapid economic and social advancement is placing an increasing demand for energy need. The growing awareness of environmental impacts of project development and the need for sustainable development particularly has made solar energy a more viable option in most Tropical environment.

This guideline is designed to ensure that all potential environmental issues pertaining to the construction, operation and closure of solar power facilities are adequately well assessed and addressed. Also, this guideline will assist in sustainable project planning, permitting, and implementation for both project developers and regulators. This guideline aims to provide directions to project proponents, developers and regulators for the appropriate identification, assessment and evaluation of all potential environmental issues pertaining to solar energy projects.

2.0 Project Justification

The project proponent shall provide necessary and adequate information on the justification of the project. This shall include a summary of the report of the Project's feasibility study; the need, value and sustainability (social, cultural and economic) of the Project. Such justification shall expressly define the benefits of the Project to its intended end-users and indicate the over-riding advantages or positive impact of the Project over its anticipated environmental impacts. The justification may also include the rationale for selecting the Project amongst various available options or alternatives and any socio-economic factor's justifying the Project.

3.0 Project Description

The proposed solar energy generation project should be described in details. Description should include a schematic process diagram and a layout of the facility which should be detailed. The EIA study should also report a description of the development in relation to the local environment as follows:

- Description of development type with physical characteristics, scale and design.

- An estimate of quantities and types of materials needed during construction and operation phase of the project.
- Description of the main characteristics of the operational process with diagrams, plans and maps.
- A description of indication of the physical presence and appearance of completed development within the receiving environment.
- The land area to be taken by the development with its location clearly defined on a map.
- The uses to which the land will be put should be described.
- The estimated duration of the construction phase, operational phase and where appropriate, decommission phase should be given.
- The numbers of workers and/or visitors entering the site during construction and operation should be estimated. The access to the site and likely means of transport should be given.
- The means of power evacuation.
- An estimate, by type and quantity, of expected residues and emissions (heat, noise, vibration, light, heat, radiation, air water, and soil contamination/pollution, etc.) resulting from construction and operation phases of the proposed project.

Emphasis should however be given to those components with the most potential for significant short and long term environmental impacts.

4.0 Description of Project Environment/Baseline Study

A detailed description of the existing environmental status, in terms of the biophysical and human environment, in which the proposed solar power plant is to be sited. The methods and investigations undertaken for this purpose should be disclosed and be appropriate to the size and magnitude of the project. The baseline data (primary and/ or secondary) shall be collected and interpreted to describe the proposed project area. The description shall include, but not limited to, geographic location, topography and elevation, climatic conditions and the ecological characteristics of the project area. Table 1 below gives a detailed description of some relevant environmental components to be examined while describing the Environment.

Table 1: Environmental Components and Indicators of Existing Environment

Environmental Components	**Indicators**
Climatic variables	Climatic zone
	Climate variability and Extreme events
	Climate change projections
	Solar Radiation
	Temperature (air and land surface temperature) - pattern, seasonality and trend
	Rainfall – Pattern, amount, trend
	Prevailing wind – direction, speed
Topography	Drainage pattern, elevation and slopes {this can be presented with a digital elevation model}, Specific landform types, etc.
Soil	Type, properties and characteristics
Water	Availability and abundance
	Water quality
	Wastewater discharges
	Waste discharges, etc.
Air	Ambient air quality (for gaseous and particulate pollutants)
Biological	Flora – type, density, exploitation, etc.
	Fauna – distribution, abundance, rarity, migratory, species diversity, habitat requirements, habitat resilience, economic significance, commercial value, etc.
	Fisheries – migratory species, species with commercial/ recreational value, etc.
Land Use	Land use pattern, actual and projected, specially designated areas, manmade features, incompatible land use attributes (e.g. public water supply, tourism site, etc.),

	ESAs – sensitivity (distance, area and significance).
Socio-Economic Factors	Demography details of all project affected communities, economy (employment rate, income distribution), services (types, capacity, adequacy), housing, etc. cultural

5.0 Associated and Potential Environmental Impacts

The identification, prediction and evaluation of potential impacts of the project on the environment should be investigated and described. The impacts should be broadly defined to cover all potential effects on the environment.

a) A description of direct impact and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative impact of the project should be addressed.

b) The types of impact in (a) above should be described with regards to human beings, flora and fauna, soil, water, air, climate, land, cultural and interactions amongst them.

c) Impacts during construction and operation phases should be considered including impacts that might arise from non-standard operating conditions, accidents e.t.c.

d) Predicted impacts should be derived from baseline conditions as to prevail as a consequence of the project.

e) Identification of impacts should be by a systematic methodology such as project specific checklists, matrices, overlays, Ad-hoc, networks, geographic information system (GIS), expert opinion, Delphi technique e.t.c.

f) A brief description of the impact identification method should be described and the rational for using it.

g) The significance of impacts should be assessed, taking into account appropriate national and international standards where available. Consideration should also be made for magnitude, location and duration of the impacts. The choice of significance assessment should be justified and any contrary opinion elaborated upon.

h) The EIA study for solar energy projects should also consider the cumulative impacts that could arise from a combination of the impacts due to other projects, especially impacts that has to do with the human component (socio-economics) of the environment, with those of other existing or planned projects in the surrounding area and including residual impacts.

6.0 Mitigation Measures / Alternatives

At this stage, the possible preventive, remedial and compensatory measures for each adverse impact shall be determined and recommended. A table showing the potential impacts of project with corresponding mitigation measures should be provided. The project proponent shall state the mitigation measures that shall be taken against identified adverse environmental impacts of the proposed renewable energy generation projects. All the possible preventive, remedial and compensatory measures for each adverse impact shall be determined and recommended. A table showing the potential impacts of project with corresponding mitigation measures should be provided.

6.1 Mitigation Measures for Potential Impacts of Solar Energy Projects:

Potential mitigation measures for solar energy projects include, but not limited to:

i. Conduct pre-disturbance surveys as appropriate to assess the presence of sensitive areas, fauna, flora and sensitive habitats;
ii. Plan visual impact reduction measures such as natural (vegetation and topography) and engineered (berms, fences, and shades, etc.) screens and buffers;
iii. Utilise existing roads and servitudes as much as possible to minimize project footprint;
iv. Site projects to avoid construction too near pristine natural areas and communities;
v. Locate developments away from important habitat for faunal species, particularly species which are threatened or have restricted ranges, and are collision-prone or vulnerable to disturbance, displacement and/or habitat loss;
vi. Fence sites as appropriate to ensure safe restricted access;
vii. Ensure dust abatement measures are in place during and post construction;
viii. Develop and implement a storm water management plan;
ix. Develop and implement waste management plan; and

x. Re-vegetation with appropriate indigenous species to prevent dust and erosion, as well as establishment of alien species.

7.0 Environmental Management Plan (EMP)

The Environmental Management Plan (EMP) outlines the mitigation, monitoring and institutional measures to be taken during project implementation and operation to avoid or control adverse environmental impacts, and the actions needed to implement the measures.

a) The EMP for the for projects in the renewable energy industry should be site-specific, focused and logical with a clear framework for management of key environmental impacts that could arise from the project.

b) The EMP should be prepared with involvement of key stakeholders (proponent, regulators and local community).

c) The EMP should cover all areas of the environment (human beings, flora and fauna, air, soil, water, land, cultural heritage, waste management, traffic and transport, noise and vibration) e.t.c.

d) The EMP should also outline the following;

i. summary of potential impacts of the project;

ii. description of recommended mitigation measures;

iii. description of monitoring programme to ensure compliance with relevant standards and residual impacts;

iv. allocation of resources and responsibilities for plan implementation;

v. implementation schedule and reporting procedures and contingency plans and disaster management plan.

8.0 Remediation Plans After Decommissioning

Project proponent shall provide the best remediation plans that will be taken if the renewable energy generation project is to be decommissioned or closed (temporarily or permanently). Both beneficial and adverse environmental effects of the decommissioning or closure shall be scrupulously stated. Mitigation measures shall be proffered for the adverse effects due to decommissioning or closure.

Project proponent shall also design means of restoring the project location back to its original status before the project execution.

GUIDELINES FOR WIND ENERGY PROJECTS

1.0 Introduction

Wind power is an inexhaustible resource and one of the key alternatives to fossil fuels. Nigeria has good wind resources in certain states from the middle belt to the Northern plains. Generating energy from wind is capital-intensive, but clean, freely available, sustainable and pollution-free. The aim of this document is primarily to provide guidance on how to conduct an environmental impact assessment of wind power projects. The guidelines will assist proponents to identify the key environmental issues that need to be assessed in siting a wind power project as well as mitigation measures and alternatives that need to be considered in the actual environmental assessment.

2.0 Project Justification

The project proponent shall provide necessary and adequate information on the justification of the project. This shall include a summary of the report of the Project's feasibility study; the need, value and sustainability (social, cultural and economic) of the Project. Such justification shall expressly define the benefits of the Project to its intended end-users and indicate the over-riding advantages or positive impact of the Project over its anticipated environmental impacts. The justification may also include the rationale for selecting the Project amongst various available options or alternatives and any socio-economic factor's justifying the Project.

3.0 Project Description

The EIA Report should provide a detailed description of the of the proposed developmental wind power project including associated and potential positive and negative impacts. Project description, shall include:

i. Nature of the proposed project; project type, size, location, purpose, intended user, land use requirements during the construction and operational phases.
ii. Sector overview of the wind power industry and processes.

a) Wind Farms
b) Turbines and Power Generation.

iii. Materials to be used in the project;
iv. Overriding advantages of project. and
v. Project outputs including waste and its management technique.

4.0 Environmental Baseline Data

A detailed description of the existing environmental status, in terms of the biophysical and human environment, in which the proposed wind energy project is to be sited. The methods and investigations undertaken for this purpose should be disclosed and be appropriate to the size and magnitude of the project. The baseline data (primary and/ or secondary) shall be collected and interpreted to describe the proposed project area. The description shall include, but not limited to, geographic location, topography and elevation, geology and geo-technical survey, climatic conditions and the ecological characteristics of the project area. Table 1 below gives a detailed description of some relevant environmental components to be examined while describing the Environment.

Table 1: Environmental Components and Indicators of Existing Environment

Environmental Components	**Indicators**
Climatic variables	Prevailing wind {direction, speed, wind energy potential}- pattern, seasonality, anomalies and trend Temperature - pattern, seasonality and trend Rainfall – Pattern, amount, trend Climatic zone Climate variability and Extreme events Climate change projections
Topography	Elevation and slopes form, Landform and terrain analysis, specific landform types, etc.
Soil	Type, properties and characteristics, vertical profile, etc
Geology	Geological structures (faults, etc), underlying rock type and texture.
Water	Availability and abundance Water quality

Air	Ambient air quality (for gaseous and particulate pollutants)
Noise	Spatial and temporal variation in Noise level Sources of noise
Biological	Specie composition of flora and fauna Flora – type, density, exploitation, etc. Fauna – distribution, abundance, rarity, migratory, species diversity, habitat requirements, habitat resilience, economic significance, commercial value, etc.
Land Use	Land use pattern, actual and projected, specially designated areas, manmade features, incompatible land use attributes, ESAs – sensitivity (distance, area and significance).
Socio-Economic Factors	Demography details of all project affected communities, economy (employment rate, income distribution), services (types, capacity, adequacy), housing, etc. cultural

5.0 Associated and Potential Environmental Impacts

The EIA Report shall contain a list of envisaged impacts of the proposed development on all components of the environment. The scientific and technical credibility of an EIA relies on the ability of EIA report to envisage and estimate the nature, extent, and magnitude of change in environmental components that may result from the project activity. Information about predicted changes is needed for assigning impact significance, prescribing mitigation measures, designing and developing EMPs, and monitoring programs. Such information shall include, but not limited to;

5.1 Impacts on Land

The proponent shall give an exhaustive detail on the permanent disturbances caused due to construction of wind turbine pads, access roads, substations, service buildings and other infrastructure on land in the EIA report. It shall include;

a) Land disturbance due to direct and impact
b) Visual intrusion.
c) Noise, vibrations and dust
d) Deforestation and vegetation loss
e) Effect on future development,
f) among others

5.2 Impacts on biodiversity

The proponent shall give an exhaustive detail of this impact in the EIA report. The details shall include potential impacts of the project development on biodiversity due to:

a) Wind turbine construction, installation and associated activities (like erection of transmission lines) i.e. habitat fragmentation,
b) injuries to and mortality of birds and bats, habitat loss, wildlife mortality due to electrocution,
c) Disruption of migratory pattern of birds, bat, etc
d) disruption of canopy continuity for arboreal animals in closed-canopy forests,
e) cutting of vegetation resulting in weed proliferation and
f) suppression of native vegetation regeneration ,
g) among others

5.3 Noise pollution

The proponent shall enlist the information on the level of noise that will be generated from the proposed wind power project. Details shall include but not limited to levels of sound generated from the rotation of the turbine blades, mechanical sounds from gearboxes, cooling fans and generators.

5.4 Social impacts

The proponent shall highlight all the relative potential social impact from the project development. A well detailed information, which should include, but not limited to the potential impact on;

i. indigenous communities around the proposed project area
ii. Impact on settlement pattern
iii. Local economy

iv. Community structure and institutional arrangement
v. Crime and perception of crime rate
vi. Human migration,
vii. Among others

5.5 Air

The EIA report should highlight the potential impact of the project development on the ambient atmosphere, in terms of impact on;

i. change weather pattern
ii. Air quality
iii. Change in air moisture
iv. Human physiological climate (combined effect of weather parameters)
v. Alteration to air flow

5.6 Health and Safety

The proponent shall enlist the information about potential health and safety of the local inhabitants in terms of impacts on air pollution, land contamination, change in emergency situation, operational accidents, among others.

6.0 Mitigation Measures / Alternatives

The possible preventive, remedial and compensatory measures for each adverse impact shall be determined and recommended. The EIA report should provide in detail the corresponding mitigation measures to the potential environmental impacts of project which were highlighted in the previous section. All the measures for each adverse impact shall be determined and recommended. Example of some common impacts of renewable energy development project and their likely mitigation measures are shown in Table 1.

Table 2: Common impacts of Renewable Energy project and their mitigation measures

Impact	**Mitigation Measure**
Land use	Project should not be sited in environmental sensitive areas such as erosion prone lands, tip or base of a mountain etc.
Habitat	Location of solar energy projects shall not infringe on

loss/fragmentation	any sensitive habitat for faunal species, particularly species which are threatened or have restricted ranges, and are collision-prone or vulnerable to disturbance, displacement and/or habitat loss.
Visual Impact	Visual impact reduction measures such as natural (vegetation and topography) and engineered (berms, fences, and shades, etc.) screens and buffers
Noise Impact	Noise impact reduction measures such as noiseless wind turbines, noise absorbing structures, and engineered (berms, fences, and shades, etc.) screens and buffers
Social Tension	Appropriate relocation and resentment of all affected persons and businesses shall be ensured prior to project execution
Electrocution	Sites shall be fenced as appropriate to ensure safe restricted access
Dust Impacts	Proponent shall ensure dust abatement measures are in place during and post construction
Light pollution and Shadow flicker	Minimise development lighting in order to minimise light pollution, disturbance to visible communities, and attraction of invertebrates, birds, bats and other animals that could constitute nuisance at night
Impacts on biodiversity	Pre-disturbance surveys shall be conducted as appropriate to assess the presence of sensitive areas, fauna, flora and habitats
Risks and accidents	Use of appropriate personal protective equipment, warning signs, adequate security etc. shall be ensured.
Waste Disposal	Development and implementation of a site specific solid and liquid waste management plan shall be ensured during pre-construction, construction, operation, and decommissioning stages.

7.0 Environmental Management Plan (EMP)

The EMP shall translate recommended mitigation and monitoring measures into specific actions and steps that have to be carried out by the proponent. Depending on specific requirements, the plan may be included in the EIA report or may be prepared as a separate document.

The proponent shall provide a qualitative and quantitative plan on the environmental monitoring scheme. This scheme shall discuss the scope of monitoring process, how the monitoring program shall be carried out, how often test shall be carried out to monitor the effects of pollutants (either solid, liquid or gaseous) and other factors on the environment, and the parameters to be monitored.

A properly designed monitoring programme shall discuss the following elements:

(a) Scope of monitoring (e.g. well-articulated waste management plan)
(b) How the monitoring programme will be implemented
(c) Selection of parameters to be monitored in the environment (land, air, water)
(d) Selection of sampling locations
(e) Sampling procedures and frequency of sampling
(f) Monitoring schedule/frequency
(g) Post-commissioning environmental audit

8.0 Remediation Plans After Decommissioning

Project proponent shall provide the best remediation plans that will be taken if the renewable energy generation project is to be decommissioned or closed (temporarily or permanently). Both beneficial and adverse environmental effects of the decommissioning or closure shall be scrupulously stated. Mitigation measures shall be proffered for the adverse effects due to decommissioning or closure. Project proponent shall also design means of restoring the project location back to its original status before the project execution.

GUIDELINES FOR HYDROPOWER PROJECTS

1.0 Introduction

Hydropower projects are large scale construction projects which involve land clearing, tunnelling, diverting of river course, diversion of forest, altering the hydrological regime etc. These activities change the entire environmental regime of the project area. The range of adverse environmental and social impacts that can result from hydropower projects is remarkably diverse and complex. The nature and magnitude of these impacts vary from one project to another depending on the site sensitivity and project scale.

Therefore, Environmental Impact Assessment (EIA) guidelines for hydropower development are required to provide clear, consistent and comprehensive guidance on:

i. the legal requirements for impact assessment;

ii. key issues to be considered in project design, construction, commissioning, operation and decommissioning; and

iii. management plans to be prepared, to seek project approval and to effectively design, construct, commission, operate and decommission projects in a sustainable manner

2.0 Project Justification

The project proponent shall provide necessary and adequate information on the justification of the project. This shall include a summary of the report of the Project's feasibility study; the need, value and sustainability (social, cultural and economic) of the Project. Such justification shall expressly define the benefits of the Project to its intended end-users and indicate the over-riding advantages or positive impact of the Project over its anticipated environmental impacts. The justification may also include the rationale for selecting the Project amongst various available options or alternatives and any socio-economic factor's justifying the Project.

3.0 Project Description

This section covers specifically identified physical elements, aspects, and facilities to be achieved within the scope of the project; and activities that are likely to generate impacts and environmental and social risks. The project description should

highlight construction, operation and maintenance plan for the intended hydropower development project, and shall also provide exhaustive details of the existing environment of the area covered by the project which shall include: nature and type of the proposed project; project activities; materials to be used in the project; and project outputs including waste. The proposed hydropower generation project shall be described in details. Description should include project type, size, location, magnitude, purpose, intended user, project technology, resettlement plan, and overriding advantages of project.

Project description shall be a straightforward and concise document that should contain the following information:

- Characteristics of the Project.
- Brief description of the proposed project including type of project, the form of energy source, size of the project in terms of capacity installed, transmitted or distributed length of transmission, distribution lines, and number of people to benefit from the project, raw materials needed as well as product by product.
- Background of the project: How was the project conceived? Findings from previous studies such as energy supply and demand analysis that contributed to the conception of the project; relationship with other existing/planned projects.
- Project site: Maps and photographs of the project location relative to surrounding physical, natural and man-made features; existing land uses on/ around the site and any future planned land uses; protected and sensitive areas e.g. national parks, forests, wetlands, sites of cultural interest; alternative project sites; reasons for choosing the particular site.
- Physical form of the development: layout, buildings, other structures, construction materials, etc., including details of: energy source, energy generated, transmitted or distributed.
- Construction practices: Specific construction techniques to be used with emphasis on any potential impacts of construction such as noise and dust. Needed housing, transportation and other facilities for workers.
- Preliminary analysis of alternatives: The brief should indicate reasonable alternatives to meet project objectives. This may lead to alternatives that are

sounder from an environmental, social, cultural and economic point of view from the original proposed project. Alternatives can be other energy sources, construction of smaller energy facilities, alternative sites and different technologies.

- Other large development projects ongoing or planned for within the area of influence of the energy project

The essential project related information is:

- Location of project:

a Village(s)

b Geographical coordinates for location of dam

c Geographical coordinates for location of powerhouse

d Accessibility

- Catchment area characteristics

a Name of river and major tributaries.

b Overall description of the catchment area.

c Total catchment area in km^2 including the catchment area at the dam.

d Rivers mean annual flow at project site in Mm^3 (MCM).

e Maximum mean monthly flow at project site in Mm^3 (MCM).

f Minimum mean monthly flow at project site in Mm^3 (MCM).

g Probable maximum flood in Mm^3 (MCM).

h Headworks/spillway design flood in Mm^3 (MCM).

i Minimum flow of river in m^3/sec.

j Minimum dry season flow from side streams/rivers in the de-watered stretch.

- Type of project

a Simple run-off-river.

b Reservoir run-off-river.

c Seasonal storage.

d Pumped storage.

e With or without an inter-basin diversion.

f Location of power house in relation to dam.

g Installed capacity in megawatts.

h Energy generation.

- Engineering characteristics
- Reservoir characteristics

- Permanent infrastructure for power generation:
- *Construction phase*

a The location, area and accommodation details of the camp and office areas

b Temporary access roads

c Size, number, location and the capacity of the burrow pits and quarry sites to be used for construction purpose

d Spoil areas (in hectares)

- *Operational phase*

a Reservoir filling

b Reservoir operation

c Downstream hydrology and water quality below intake point

d Downstream hydrology and water quality below tailrace

e Downstream hydrology and water quality below re-regulation weir

4.0 Description of Project Environment/ Baseline Study

A detailed description of the existing status of the various environmental and social components of the project area shall be carried out by project proponent. Baseline data (primary and secondary) shall be collected and interpreted to describe the proposed project. The comprehensive description shall include, but not limited to the following:

4.1 Physical Environment

i. Climate: Precipitation patterns (amount, frequency, type), air quality, wind patterns (direction, speed, frequency), climatic zone.

ii. Hydrography: Depths, tides, as applicable.

iii. Geology and Topography: Regional geology and germorpholgy, drainage pattern, seismic history.

iv. Hydrogeology, Regional hydrogeology, site hydrogeology.

v. Surface Water: Volumes, flow rates, frequency and duration of seasonal variations, ecological characteristics, uses.

4.2 Biological Environment

Since activities in the project life cycle may have impact on the ecological resources, description of the existing biological environment should include:

i. Species checklist e.g. species composition, unusual rare or endangered species, pest/nuisance species, key species;
ii. Plant communities e.g. terrestrial and aquatic
iii. Biological diversity e.g. species diversity include, spatial diversity inventory and relative important values;
iv. Productivity e.g. productivity levels and carrying capacities of different communities
v. Biogeochemical/nutrient cycling e.g. nutrient levels and nutrient budgets
vi. Environmentally sensitive areas e.g. prime agricultural land, mangrove swamps, wetlands/coastal zones/shorelines and landfills (hazardous waste disposal sites)

4.3 Socio-Economic, Cultural and Health factors (Human Environment)

The following issues should be considered and discussed in the project for the communities likely to be affected by the project activities:

i. Location, access, population (number, demographic and social characteristics);
ii. Archaeological, historic and cultural characteristics e.g. architecture, life styles, cultural events, native fishing camps/hunting reserves; sites of archaeological, historical and religious significance;
iii. Economy, life patterns (employment opportunities, wages, housing, medical services, social and cultural interactions)
iv. Effect of influx of large work force on existing community services including education, social-cultural and health conflicts between work force and local population;
v. Human health impacts from noise and vibrations from construction equipment, truck traffic and piling at jetty;
vi. Areas of ecological interest including unique ecosystem and reserves for endangered species;
vii. Water use pattern e.g domestic (drinking, bathing etc), industrial (intake and discharge), recreational, transportation, agricultural (e.g. irrigation and fish farm); fishing.

viii. Human health impact on indigenous population, disease vectors, health needs, traditional medicine, waste management etc.

5.0 Associated and Potential Environmental Impacts

The characteristics of potential impacts shall be identified, evaluated and predicted using the baseline information on one hand and the features of the project on the other hand (cause-effect relationship). The impacts should be broadly defined to cover all potential effects on the environment.

(a) A description of direct impact and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative impact of the project should be addressed.

(b) The types of impact in (1) above should be described with regards to human beings, flora and fauna, soil, water, air, climate, land, cultural and interactions amongst them.

(c) Impacts during construction and operation phases should be considered including impacts that might arise from non-standard operating conditions, accidents e.t.c.

(d) Predicted impacts should be derived from baseline conditions as to prevail as a consequence of the project.

(e) Identification of impacts should be by a systematic methodology such as project specific checklists, matrices, overlays, Ad-hoc, networks, geographic information system (GIS), expert opinion, Delphi technique e.t.c.

(f) A brief description of the impact identification method should be described and the rational for using it.

(g) The significance of impacts should be assessed, taking into account appropriate national and international standards where available. Consideration should also be made for magnitude, location and duration of the impacts. The choice of significance assessment should be justified and any contrary opinion elaborated upon.

(h) The EIA study for hydropower renewable energy projects should also consider the cumulative impacts that could arise from a combination of the impacts due to other projects with those of other existing or planned projects in the surrounding area and including residual impacts.

6.0 Mitigation Measures / Alternatives

(a) For ensuring a thorough site selection process, alternative sites should have been considered where practicable with primary advantages and disadvantages and reasons for the final choice detailed. Including alternative processes, designs, and operating conditions.

(b) Mitigations of all significant adverse impacts for the project type should be considered. Any residual or unmitigated impacts should be justified.

(c) The extent of effectiveness of mitigations measures when implemented should be described.

(d) Mitigation methods considered should include modification of project, compensation and the provision of alternative facilities as well as pollution control.

(e) Details of how the mitigation measures will be implemented and function over the time span for which they are necessary should be highlighted.

(f) Mitigation measure should be described with respect to the impact of significances to which it relates and the conditions under which it is required (for example, continuously or in the event of contingencies). These should also be cross-referenced to the project design and operating procedures which elaborate on the technical aspects of implementing the various measures.

6.1 Mitigation Alternatives

Prior to selecting mitigation plans it is appropriate to study the alternatives for cost-effectiveness, technical and social feasibility. Such mitigation measures include:

(a) avoiding environmental sensitive areas (ESAs)

(b) adjusting work schedules to minimize disturbance

(c) engineered structures such as berms and noise attenuation barriers

(d) pollution control devices such as scrubbers and electrostatic precipitators

(e) changes in fuel feed, manufacturing, process, technology use, or waste management practices, such as substituting a hazardous chemical with a non-hazardous one, or the re-cycling or re-use of waste materials, etc

Figure 1 below gives an indication of the mitigation procedure.

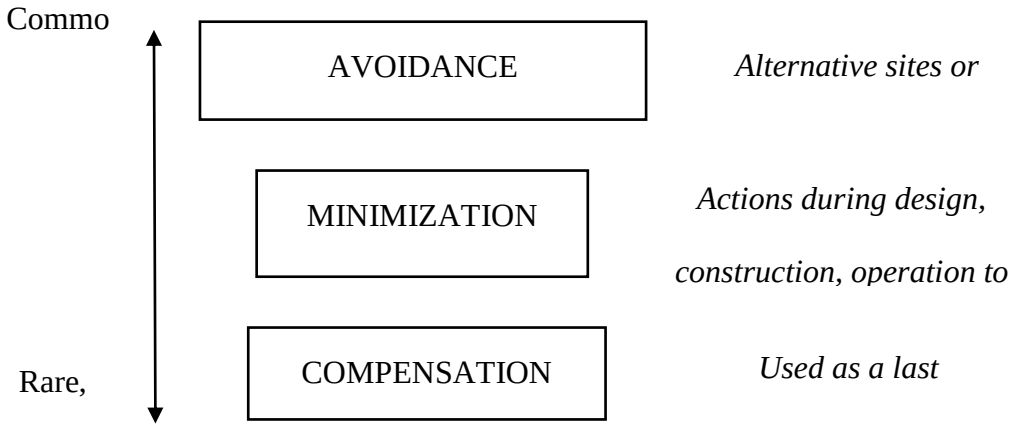

Figure 1: Hierarchy of elements of mitigation plan

7.0 Environmental Management Plan (EMP)

The Environmental Management Plan (EMP) outlines the mitigation, monitoring and institutional measures to be taken during project implementation and operation to avoid or control adverse environmental impacts, and the actions needed to implement the measures.

(a) The EMP for the projects in the hydropower industry should be site-specific, focused and logical with a clear framework for management of key environmental impacts that could arise from the project.

(b) The EMP should be prepared with involvement of key stakeholders (proponent, regulators and local community).

(c) The EMP should cover all areas of the environment (human beings, flora and fauna, air, soil, water, land, cultural heritage, waste management, traffic and transport, noise and vibration) etc.

(d) The EMP should also outline the following; be composed of the following; summary of potential impacts of the project; description of recommended mitigation measures; description of monitoring programme to ensure compliance with relevant standards and residual impacts; allocation of resources and responsibilities for plan implementation; implementation schedule and reporting procedures and contingency plans and disaster management plan.

8.0 Remediation Plans after Decommissioning or Closure

Project proponent shall provide the best remediation plans that will be taken if the renewable energy generation project is to be decommissioned or closed (temporarily or permanently). Both beneficial and adverse environmental effects of the decommissioning or closure shall be scrupulously stated. Mitigation measures shall be proffered for the adverse effects due to decommissioning or closure. Project proponent shall also design means of restoring the project location back to its original status before the project execution.

GUIDELINES FOR

BIOFUELS PROJECTS

1.0 Introduction

Bio-fuels in liquid form are produced from the conversion of biomass and when correctly utilised, can be substituted for fossil-fuel derived fuel oils. Typical applications include transportation use and the generation of power via internal combustion engines. The two most commonly encountered bio-fuels are bio-ethanol and bio-diesel. Bio-ethanol is produced through a fermentation process, whereas bio-diesel is manufactured using the chemical reactions trans-esterification and esterification. The bio-diesel manufacturing process involves vegetable or animal fats and oils being reacted with short-chain alcohols (typically methanol or ethanol). Bioenergy is energy that one derives from biomass.

In Nigeria, solid biofuels in particular charcoal are important fuels. However, charcoal is produced using inefficient technologies where more than half of the energy in the wood is lost during the process of converting wood into charcoal.

Advanced technologies available today facilitate production of liquid biofuels and generation of electricity using solid by-products through cogeneration. Using current technologies, economically feasible production is through the use of agriculture crops which in some cases are also food crops.

The purpose of this document is primarily to provide guidance on the environmental impact assessment legal framework applicable to biofuel generation and all the role players in the sector. The guideline is principally intended for use by all stakeholders involved in EIA process of Biofuels Projects.

2.0 Project Justification

The project proponent shall provide necessary and adequate information on the justification of the project. This shall include a summary of the report of the Project's feasibility study; the need, value and sustainability (social, cultural and economic) of the Project. Such justification shall expressly define the benefits of the Project to its intended end-users and indicate the over-riding advantages or positive impact of the Project over its anticipated environmental impacts. The justification may also include the rationale for selecting the Project amongst various available options or alternatives and any socio-economic factor's justifying the Project.

3.0 Project Description

The project description should detail the features of the biofuel development project with respect to plant configuration, raw material requirement and sources, utilities and services, infrastructural facilities and sources of waste generation, their quantity, treatment and safe disposal of the waste. A flow diagram of the production process and a layout of the facility should be detailed.

The EIA study should report a description of the development in relation to the local environment as follows:

- Description of development type with physical characteristics, scale and design.
- An estimate of quantities and types of materials needed during construction and operation phase of the project.
- Description of the main characteristics of the production process with diagrams, plans and maps.
- A description of indication of the physical presence and appearance of completed development within the receiving environment.
- The nature of the operational processes intended to be employed and expected generation rate.
- The land area taken by the development with its location clearly defined on a map.
- The uses to which the land will be put should be described.
- The estimated duration of the construction phase, operational phase and where appropriate, decommission phase should be given.
- The numbers of workers and/or visitors entering the site during construction and operation should be estimated. The access to the site and likely means of transport should be given.
- The means of transporting raw materials and products to the site and the approximate quantities involved should be described.
- An estimate, by type and quantity, of expected residues and emissions (water, air and soil pollution, odour, noise, vibration, light, heat, radiation, etc.) resulting from operation of the proposed project.

Emphasis should however be given to those components with the most potential for significant short and long term environmental impacts.

4.0 Description of Project Environment/Baseline Study

A detailed description of the existing status of the various environmental and social components of the project area shall be carried out by project proponent. Baseline data (primary and secondary) shall be collected and interpreted to describe the proposed project. The comprehensive description shall include, but not limited to the following:

4.1 Physical Environment

i. Atmosphere: climatic zone, Temperatures, Humidity, Precipitation, air quality, wind patterns, noise, odour.

ii. Topography: Regional geology, drainage pattern, elevation and slopes.

iii. Hydrogeology, Regional hydrogeology, site hydrogeology.

iv. Surface and ground water: volumes, quality, abundance, duration of seasonal variations, ecological characteristics, uses.

4.2 Biological Environment

Since activities in the project life cycle may have impact on the ecological resources, description of the existing biological environment should include:

i. Species checklist e.g. species composition, unusual rare or endangered species, pest/nuisance species, key species;

ii. Plant communities e.g. terrestrial and aquatic

iii. Biological diversity e.g. species diversity includes, spatial diversity inventory and relative important values;

iv. Biogeochemical/nutrient cycling e.g. nutrient levels and nutrient budgets

v. Environmentally sensitive areas e.g. prime agricultural land, mangrove swamps, wetlands/coastal zones/shorelines and landfills (hazardous waste disposal sites)

4.3 Socio-Economic, Cultural and Health factors (Human Environment)

The following issues should be considered and discussed in the project for the communities likely to be affected by the project activities:

i. Location, access, population (number, demographic and social characteristics);

ii. Economy, life patterns (employment opportunities, wages, housing, medical services, social and cultural interactions)

iii. Effect of influx of large work force on existing community services including education, social-cultural and health conflicts between work force and local population;

iv. Human health impacts from odour, noise and vibrations from construction equipment, truck traffic and piling at jetty;

v. Areas of ecological interest including unique ecosystem and reserves for endangered species;

vi. Water use pattern e.g domestic (drinking, bathing etc), industrial (intake and discharge), recreational, transportation, agricultural (e.g. irrigation and fish farm); fishing.

vii. Human health impact on indigenous population, disease vectors, health needs, traditional medicine, waste management etc.

5.0 Associated and Potential Environmental Impacts

The identification, prediction and evaluation of potential impacts of the project on the environment should be investigated and described. The impacts should be broadly defined to cover all potential effects on the environment.

(a) A description of direct impact and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative impact of the project should be addressed.

(b) The types of impact in (1) above should be described with regards to human beings, flora and fauna, soil, water, air, climate, land, cultural and interactions amongst them.

(c) Impacts during construction and operation phases should be considered including impacts that might arise from non-standard operating conditions, accidents etc.

(d) Predicted impacts should be derived from baseline conditions as to prevail as a consequence of the project.

(e) Identification of impacts should be by a systematic methodology such as project specific checklists, matrices, overlays, Ad-hoc, networks, geographic information system (GIS), expert opinion, Delphi technique etc.

(f) A brief description of the impact identification method should be described and the rational for using it.

(g) The significance of impacts should be assessed, taking into account appropriate national and international standards where available. Consideration should also be made for magnitude, location and duration of the impacts. The choice of significance assessment should be justified and any contrary opinion elaborated upon.

(h) The EIA study for biofuel projects should also consider the cumulative impacts that could arise from a combination of the impacts due to other projects with those of other existing or planned projects in the surrounding area and including residual impacts.

(g) For ensuring a thorough site selection process, alternative sites should have been considered where practicable with primary advantages and disadvantages and reasons for the final choice detailed. Including alternative processes, designs, and operating conditions.

(h) Mitigations of all significant adverse impacts for the project type should be considered. Any residual or unmitigated impacts should be justified.

(i) The extent of effectiveness of mitigations measures when implemented should be described.

(j) Mitigation methods considered should include modification of project, compensation and the provision of alternative facilities as well as pollution control.

(k) Details of how the mitigation measures will be implemented and function over the time span for which they are necessary should be highlighted.

(l) Mitigation measure should be described with respect to the impact of significances to which it relates and the conditions under which it is required (for example, continuously or in the event of contingencies). These should also be cross-referenced to the project design and operating procedures which elaborate on the technical aspects of implementing the various measures.

6.1 Mitigation Alternatives

Prior to selecting mitigation plans it is appropriate to study the alternatives for cost-effectiveness, technical and social feasibility. Such mitigation measures include:

(a) avoiding environmental sensitive areas (ESAs)

(b) adjusting work schedules to minimize disturbance

(c) pollution control devices such as scrubbers and electrostatic precipitators

(d) changes in fuel feed, manufacturing, process, technology use, or waste management practices, such as substituting a hazardous chemical with a non-hazardous one, or the re-cycling or re-use of waste materials, etc.

7.0 Environmental Management Plan (EMP)

The Proponent shall design an Environmental Management Plant (EMP) which shall provide a framework for managing or mitigating environmental impacts throughout the life of the project. The EMP shall also make provision for monitoring/auditing the effectiveness of the proposed environmental protection measures and procedures. A well prepared EMP shall have the following:

(a) Summary of the project activities and the associated impacts

(b) Outline of legal requirements and best practices that apply to the project

(c) Plan for mitigation management

(d) Identified monitoring and auditing requirements

(e) Roles and responsibilities of the project proponent and its contractors

(f) A plan for environmental monitoring, auditing and reporting

(g) Prescribed mechanism through which public consultation will continue during the project

(h) Programme for training of project crew on the implementation of the EMP.

8.0 Remediation Plans after Decommissioning or Closure

Project proponent shall provide the best remediation plans that will be taken if the renewable energy generation project is to be decommissioned or closed (temporarily or permanently). Both beneficial and adverse environmental effects of the decommissioning or closure shall be scrupulously stated. Mitigation measures shall be proffered for the adverse effects due to decommissioning or closure. Project proponent shall also design means of restoring the project location back to its original status before the project execution.

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