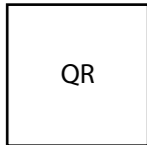




Ministry of Industry and Trade



on the basis of a decision by the German Bundestag



**Environmental and Social Impact Assessment Guidelines for a Biomass Power Project in Viet Nam**

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**Environmental and Social Impact Assessment Guidelines for a Biomass Power Project in Viet Nam**

November 2022







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GIZ/Climate Protection through Sustainable Bioenergy  
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**On behalf of the**

German Federal Ministry for Economic Affairs and Climate  
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## Foreword by the Electricity and Renewable Energy Authority (EREA) - Ministry of Industry and Trade (MOIT)

The development of energy, both in general and specifically in electricity generation, has been facing numerous challenges in fully meeting the needs of efficient use of natural resources to limit environmental impacts and maintain national energy security. Therefore, synchronous development and diversification of energy resources, prioritizing full and efficient use of potential renewable energy sources is one of the most important approach. In particular, biomass energy source is considered as one of the effective solutions to optimize the value of agro-forestry production, rural development, and environmental protection.

As a developing agricultural economy, Vietnam has a great and diverse potential of biomass resources. Main types of biomass include: post-harvest residues/byproducts generated from various types of plants, sawdust, woodchips. Biomass resources can be converted into energy, including electricity through different energy conversion technologies.

In attempt to resolve the challenges of energy demand, ensure energy security and mitigate the impacts of climate change, the Communist Party of Vietnam and the Government of Vietnam have issued directive instructions, and development targets for

strengthening the development of renewable energy, reduction of greenhouse gas emissions and fossil fuel consumption through the Politburo's Resolution No. 55-NQ/TW dated February 11, 2020 on Orientation for National Energy Development Strategy of Vietnam and Decision No. 2068/QĐ-TTg dated November 25, 2015 on Vietnam's Renewable Energy Development Strategy by 2030, with a vision to 2050. The targets for biomass developmentsupplying for both electricity and heat production are:

- Total biomass energy supply for electricity generation to reach about 9.0 million tonnes of oil equivalent (TOE) by 2030 and about 20 million TOR by 2050. The power generated from biomass to reach about 37 billion kWh by 2030 and 85 billion kWh by 2050;
- Total biomass energy for heat generation to reach about 16.8 million TOR by 2030 and about 23 million TOR by 2050;

To support the implementation of biomass power development targets, the Prime Minister and the Ministry of Industry and Trade promulgated a series of incentive mechanism and guidelines for the development of biomass power projects in Vietnam

through the Prime Minister's Decision No. 24/2014/QĐ-TTg dated March 24, 2014, the Circular No. 44/2015/TT-BCT dated December 9, 2015 of the Ministry of Industry and Trade and amended in the Decision No. 8/2020/QĐ-TTg dated March 5, 2020 of the Prime Minister; Circular No. 16/2020/TT-BCT dated July 7, 2020 of the Ministry of Industry and Trade. Following the amendment and supplementation of prevailing mechanisms and policies, the current feed-in-tariff for biomass has been increased for attracting investment in the biomass power projects, which proved the major efforts of the Vietnamese Government and ministries.

For the purpose of supporting the Investor of the biomass power project to conveniently look up information during the project development, access financial resources and develop a social risk management plan during the project implementation process. To develop biomass power projects, **the Electricity and Renewable Energy Authority - Ministry of Industry and Trade** is pleased to release the reference document **"Environmental and Social Impact Assessment Guidelines for a biomass power project in Viet Nam"**. This guideline is supported by the GIZ Energy Support Program in Vietnam to assist investors in the process of implementing agreements, approvals, etc., and

providing information, as a reference basis for financial institutions and authorities to support the project due diligence, environmental and social impact assessment through the development of grid-connected biomass power projects in Vietnam.

Sincerely,



**Mr. Pham Nguyen Hung**  
Deputy Director General  
Electricity and Renewable Energy Authority  
Ministry of Industry and Trade



## Foreword by GIZ Energy Support Programme

In recent years, the Government of Viet Nam has introduced a number of policies and mechanisms designed to promote the utilisation of biomass energy for heat and power generation. In which the price paid to biomass power projects (feed-in tariff) was increased by 14 – 21% depending on the technology used, as specified by the Decision No. 8/2020/QD-TTg dated March 5th 2020.

As a pioneer in maximisation of renewable energy sources, the German Government has set ambitious goals for energy production from all potential renewable sources in Germany, and also strengthened its development cooperation with partner countries in combating global climate change through renewable energy development. In Viet Nam, on behalf of the German Government, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH has been cooperating with the Electricity and Renewable Energy Authority (EREA) of the Ministry of Industry and Trade (MOIT) since 2008 via the GIZ Energy Support Programme to develop a sustainable market for renewable energy and energy efficiency.

This **Environmental and Social Impacts Assessment Guidelines for a biomass power project in Viet Nam** were developed by the “Climate Protection through Sustainable Bioenergy Markets in Viet Nam” (BEM) project under the GIZ Energy Support Programme in partnership

with EREA/MOIT. This guidelines is to support biomass power project development, providing the information for accessing green finance for grid-connected biomass power projects, and develop environmental and social risks management during project development. The preparation of the Guidelines adopted various methods for collecting, consolidating and verifying information and data, expert interviews, consultation workshops with relevant stakeholders.

GIZ believes that this Guidelines will support investors, project developers, financial institutions to obtain reliable information during project development, due diligence, risk evaluation and management, for the efficient development of biomass power projects.

Sincerely,



**Mr. Philipp Munzinger,**

Programme Director

GIZ Energy Support Programme



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## Abbreviations

<b>ADB</b>	Asian Development Bank
<b>BEM</b>	Climate Protection through Sustainable Bioenergy Markets in Viet Nam
<b>CHP</b>	Combined heat and power
<b>EIA</b>	Environmental Impact Assessment
<b>EPC</b>	Engineering Construction and Procurement
<b>EPFI</b>	Equator Principles Financial Institutions
<b>ERM</b>	Environment Resource Management
<b>ESIA</b>	Environmental and Social Impact Assessment
<b>ESMP</b>	Environmental and Social Management Program
<b>ESS</b>	Environmental and Social Standards
<b>EVN</b>	Electricity of Viet Nam
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>GCF</b>	Green Climate Fund
<b>GHG</b>	Green House Gas
<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
<b>GSO</b>	General Statistic Office
<b>GT</b>	Gas turbine
<b>ICE</b>	Internal combustion engine
<b>IE</b>	Institute of Energy
<b>IFC</b>	International Finance Corporation
<b>IGCC</b>	Integrated Gasification Combined Cycle
<b>IUCN</b>	International Union for Conservation of Nature
<b>PS</b>	Performance Standards
<b>SES</b>	Social and Environmental Standards
<b>UNDP</b>	United Nations Development Programme
<b>WB</b>	World Bank
<b>WBCSD</b>	World Business Council for Sustainable Development





### 1.1 Biomass power potentials in Viet Nam

Viet Nam is a tropical country, it is favorable for the development of agriculture as well as forestry, and in this context Viet Nam has a wide range of biomass resources including forestry residues, and agriculture residues

that can be effectively used to meet part of the country’s overall fuel and electricity needs. The potential biomass sources for power generation in Viet Nam are presented in the **Figure 1-1** below.

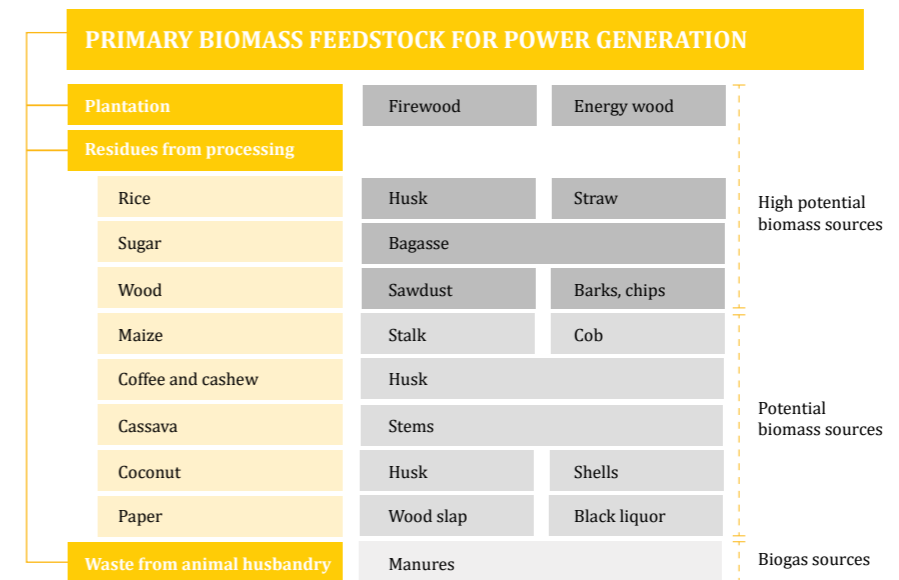


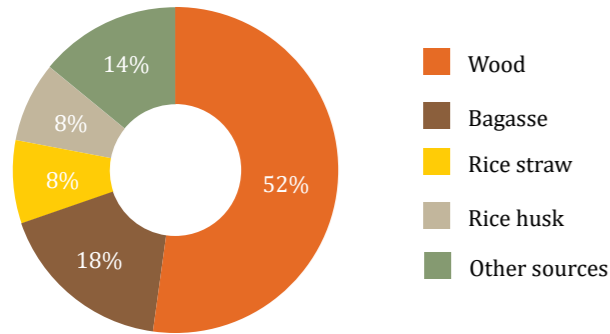
Figure 1-1. Primary biomass sources in Viet Nam

Biomass can be used for different purposes in Viet Nam, and according to the latest study of Institute of Energy under the draft Power Development Plan VIII, April 2022 version,<sup>1</sup> the technical potential of biomass power to grid in Viet Nam is 6,981 MW, equivalent to annual production of 30,673 GWh with high potential

biomass sources of rice husk, wood, bagasse, rice straw and other sources such as corn cobs, coconut shells ...etc. Of these resources 50% come from wood source. The distribution of potential biomass power by source is presented in the **Figure 1-2** below.

<sup>1</sup> Institute of Energy





To date (January 2022), only sugar baggasse is utilised for power generation in Viet Nam. A number of biomass power projects from other sources are currently under preparation.

Figure 1-2. Distribution of potential biomass power by sources in Viet Nam

According to the revised Power Development Plan VII, 16 biomass power projects have been approved with a total capacity of 605MW. Amongst these, twelve projects are either fully or partly in operation with a total capacity of 392MW, three projects are still under the investment phase, and one project has been by the end of 2020.

The biomass power project sizes withdrawn in Viet Nam are commonly less than 50MW. With the exception of

the An Khe (110MW), Vietsugar (60MW) and Lee & Man (125MW, now cancelled) plants, the remaining approved projects are all in the range of 1 MW to 37MW.

The overview on the status of biomass power projects in Viet Nam by the end of 2021 is presented in **Annex 6.1**.

### 1.2 Lenders' Environmental and Social Safeguards (ESS) Policy

There are numerous types of organisations providing international financing that supports energy sector investment, and these include International Finance Institutions (IFIs), bilateral (semi-government) export banks, and private sector funds run by international finance companies. Almost all of these organisations

(‘lenders’) have within their governance policies on Environmental and Social Safeguards (ESS). In practice, this means that any project/investment made by the lender must meet the lender’s ESS, and this typically requires an assessment of the project/investment against the ESS.

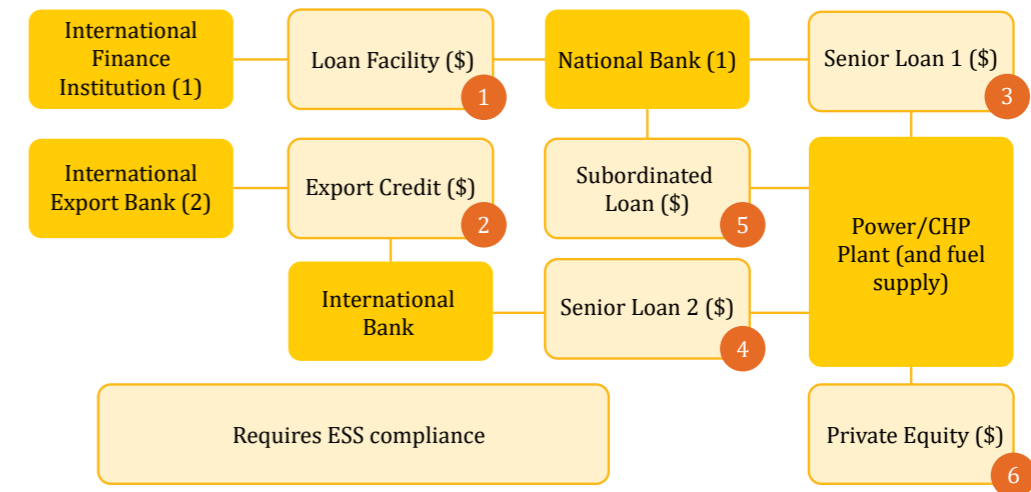


Figure 1-3. Lender approach with power plants

**Figure 1-3** illustrates how project finance for a typical power plant may be set up. The illustrated power plant is financed by blended finance (e.g. finance from different sources with different financial instruments), where two international organisations provide different financial instruments for loans, IFI provides a loan facility [1] and an export bank provides a credit guarantee to purchase equipment [2]. The loan facility is administered by a national bank who provides a senior loan [3] and subordinate loan [4]. An international bank then uses the credit guarantee to provide a second senior loan [5],

and the power plant owner provides private equity [6]. In this illustration, the bulk of the capital/credit for financing the power plant comes from organization that requires ESS compliance (shown in yellow) and thus an assessment needs to be made. In this case, there are two organisations that may have different ESS policies, but in general, they all include most of the ten ESS areas indicated in **Table 1-1** below. Noting that **Table 1-1** only shows four IFIs, and a general list of organisations providing international financial in Viet Nam in the past can be found in **Annex 6.5**.

Table 1-1. ESS areas addressed by different IFIs

No.	ESS Area	Asian Development Bank (ADB)	International Finance Corporation (IFC)	World Bank (WB)	Green Climate Fund (GCF)
1	Assessment and management of risk	X	X	X	X
2	Biodiversity and natural habitats	X	X	X	X
3	Community health	X	X	X	X
4	Cultural heritage*	X	X	X	X
5	Disaster risk management				
6	Gender*	X		X	X
7	Indigenous people*	X	X	X	X
8	Labor and working conditions	X	X	X	X
9	Pollution	X	X	X	X
10	Resettlement*	X	X	X	X

\* For many IFIs Culture, Gender, Indigenous People, and Resettlement are linked in within ESS standards

There are a few important issues to note with regard to the ESS areas addressed by different lenders, including the IFIs shown in the table above. Gender inclusion is not a part of the ESS of all lenders, most notably it is absent in the specific ESS elements in the International Finance Corporations (IFC) Performance Standards. Though many lenders still require aspects of gender inclusion, and in some cases, a specific gender assessment is required such as with the Green Climate Fund (GCF).

Disaster risk management and resilience are also not specifically included in the ESS areas of most lenders.

This is because ESS has traditionally only focused on the risks the project places on ESS areas and not the risk of the impact that the climate (and climate change) has on the project. There is a current trend by practitioners to include disaster risk management and resilience when addressing ESS areas within projects, especially where information is available to determine the potential risks and impacts on the individual project/investment and the lenders' overall portfolio of investments in many projects.





### 1.3 Legal basis for Environmental and Social Impact Assessment (ESIA)

A biomass power project that seeks international finance may need to comply with the ESS policy of the organisations providing the international finance, other lenders, and co-investors, on top of compliance with national regulations in Viet Nam. These adhoc compliance with ESS policy requirements will mostly depend on the selection of lenders and co-investors. Whereas EES is the policy of organisations providing the international finance, an Environmental and Social Impact Assessment (ESIA) is the tool commonly used to implement the ESS policy, along with other internal governance processes of the organisation.

Currently, the most commonly applied ESIA framework is the Performance Standards (PS) for Environmental and Social Sustainability of International Finance Corporation (IFC), which are commonly referred to as the IFC Performance Standards. The IFC Performance Standards consist of eight areas (i.e. eight performance standards) which should be addressed throughout the life-cycle of an investment/project.



Figure 1-4. Overview of IFC's Performance Standards on Environmental and Social Sustainability

- **Risk management** (or assessment and management of environmental and social risk impact): Risk management applies to business activities with environmental and/or social risk and/or impacts, which are identified under the remaining 7 standards. Risk management is documented and maintained via an Environmental and Social Management Program (ESMP). The ESMP includes 7 elements: (1) policy, (2) identification of risk and impacts, (3) management program, (4) organizational capacity and competency, (5) emergency preparedness and response, (6) stakeholder engagement, and (7) monitoring and review. Where there is a high risk, the assessment may extend to an impact assessment by third parties and the supply chain. All improvement needs are included in the ESMP. **Viet Nam has not yet issued regulations on the development of social risk management plans for an investment project, but has already issued regulations on environmental risk management.** In the field of environmental protection, Circular 02/2022/TT-BTNMT has provided guidance on identifying risks and impacts, stakeholder engagement, supervision, and evaluation as well as the development of environmental management and monitoring program guiding the implementation of the environmental impact assessment (EIA). Notably, the guidelines will focus on environmental impact assessment of the project area (biomass power

plant or biomass fuel processing investment), without provisions for the supply chain.

- **Labour** (Labour and Working Conditions): Depending on the workforce and type of employment, the risks and impacts are addressed in compliance with the applicable labour law including working conditions, working environment, workplace health and safety, workforce, as well as an employment policy. **Viet Nam has adequate regulations related to labor and working conditions as a basis for assessment.**
- **Resource efficiency** (resource efficiency and pollution prevention): Risks and impacts are addressed in connection with compliance under the Environmental Protection Law as well as utilisation, safety, and management of inputs and outputs during construction and operation (incl. water consumption, hazardous materials, pesticide, GHG and other emissions, biofuels...etc.). **Viet Nam has promulgated a legal framework on using chemicals safety, water supply, and energy economical and efficient consumption as well as standards and national regulations on environmental protection.** However, in addition to national standards and regulations on water, air, and soil quality, there is currently no any regulation on how to effectively use resources.

- **Community** (Community Health, Safety, and Security): Risks and impacts are addressed in connection with compliance with national standards and regulations and the plan on ecosystem services, security personnel, and emergency preparedness and response. **Viet Nam has issued policy frameworks on electricity, occupational safety and health, fire prevention, and disaster prevention.** However, there are no standards and national regulations related to the preparation and response to emergencies caused by the project to support EIA for both the biomass power plant area and the raw material chain, if any.
- **Land Resettlement** (Land Acquisition and Involuntary Resettlement): Risks and impacts are addressed in connection to the transaction of land rights or land use rights that cause involuntary resettlement with landlessness, joblessness, homelessness, marginalization, food insecurity, increased morbidity, and mortality, loss of access to common property and services, as well as social disarticulation. **Viet Nam has promulgated a legal framework on compensation, support, and resettlement when the state recovers land.** However, these provisions are identified according to the direct loss of rights of land owners, excluding the loss of access to indirect benefits of the resettled people. This is one of the reasons why it is difficult to reach an agreement on involuntary resettlement. Biomass power projects consume wood, and energy

trees from planted forests and the investor has completed resettlement and afforestation before investing in biomass power projects. Therefore, biomass power projects usually do not have the problem of resettlement land.

- **Biodiversity** (biodiversity conservation and sustainable management of living natural resources): Risks and impacts are addressed in connection to the biodiversity of habitat, species, protected areas, and internationally recognized areas. **Viet Nam has an adequate regulation related to biodiversity conservation and sustainable management of living nature.** The biodiversity impact assessments are required as a part of the environmental impact assessment report.
- **Indigenous People:** Risks and impacts are addressed in connection to collective impacts on indigenous people with a focus on human rights, dignity, aspirations, culture, and natural resource-based livelihood. **Viet Nam has not yet issued a legal framework for supporting impacts and risks assessment on the indigenous people.**
  - **Cultural heritage:** Risks and impacts are addressed in connection to any form of cultural heritage regardless of its legal status of protection (legally or previously disturbed) and form (objects, property, sites, structures with historical, cultural, artistic, religious values, natural features, cultural

knowledge, innovation, practices of communities...). Risks and impacts connected to the cultural heritage of indigenous people are addressed under the performance standard for Indigenous People. **Viet Nam has promulgated adequate regulations related to cultural heritage conservation.** The impact and risk assessment on the cultural heritage of the project is also required to be summarized in the environmental impact assessment report.

The IFC offers a large number of guidance tools to help to apply each Performance Standard, these tools can be found at the IFC Performance Standards website<sup>1</sup>.

**Figure 1-5** below depicts Viet Nam's existing legal framework compared with IFC's environmental and social risk management performance standards, in which the contents (\*) are not fully regulated in the Vietnam legal system.

There are two approaches to ESIA in Viet Nam. The international financing organizations follow international standards as described above in **Figure 1-3**. The national commercial banks required compliance to an ESIA checklist, which includes legal documents from investors, ie. licenses, permissions, and contracts, under the Law at the stage of application. IFC has developed and this is about to change.

At the legal basis level, Viet Nam has developed a comprehensive legal framework to cover most of the performance standards in environmental and social protection, in which an Environmental Impact Assessment is required under the Law on Environmental protection.

However, there is no legal framework at any level for indigenous people.

<sup>1</sup> International Finance Corporation, Environmental and Social Performance Standards



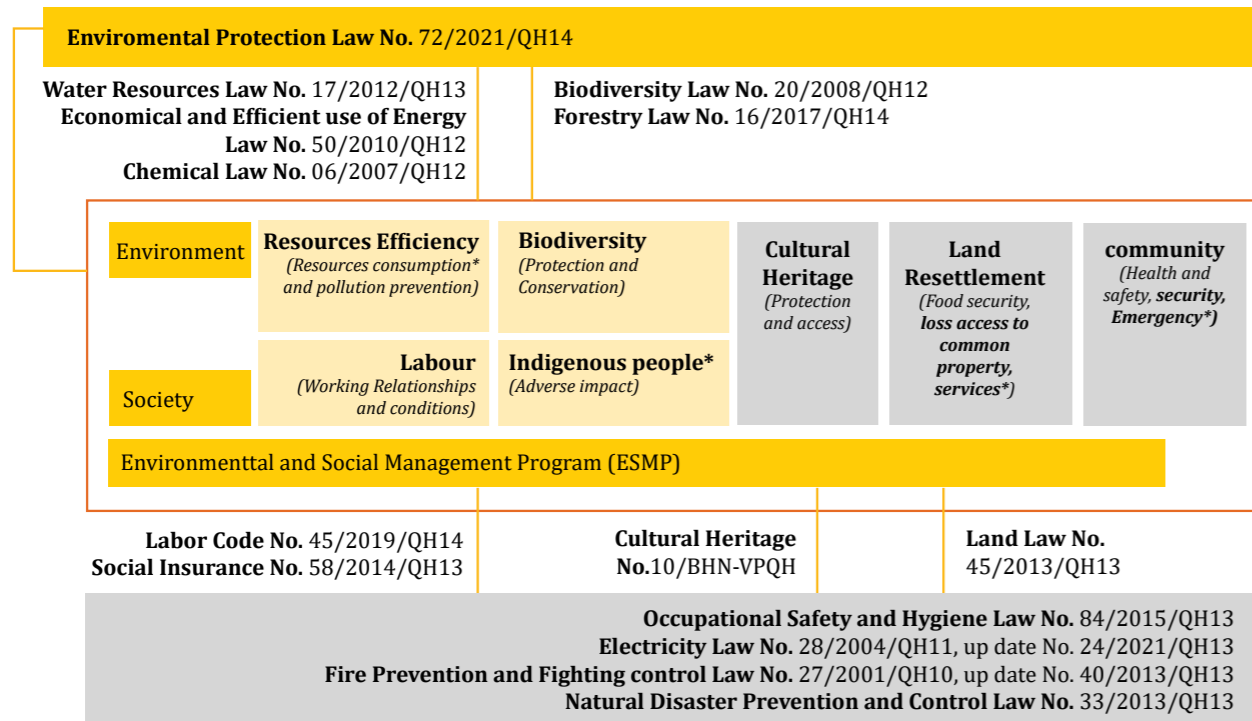


Figure 1-5. Viet Nameese legal framework on environmental and social performance standards

Several important compliance requirements related to ESIA of a biomass power project are summarized in **Annex 6.6**

## 1.4 Overview of this these guidelines

### 1.4.1 Objectives

The guidance detailed in this report has the primary aim to provide developers with a basic understanding of the processes and areas of focus in conducting a bankable ESIA for a biomass power project in Viet Nam. The secondary aim is to provide the same level of understanding to other stakeholders such as bank officers and regulatory authorities so that they can effectively and efficiently understand and assess the results of an ESIA during the approval process for lending and eventual operation.

### 1.4.2 Structure

The guidance detailed in this report is divided into the three main chapters as follows:

- Specifics of a biomass power plant: Basic information on type and characteristics of raw materials, technology, equipment and operation of a biomass power plant
- Procedure of Environmental and Social Impact Assessment (ESIA): The general principles and steps to conduct ESIA; and
- Templates and forms: How to document information during the ESIA process and list of documents.

### 1.4.3 Targeted users

The targeted users of this ESIA guidance are:

- The developers of biomass power plant projects.
- Financial institutions including units providing preferential credits from the state budget (Viet Nam Development Bank – VDB), sponsorship/support programs from governments, NGOs, international financial institutions, domestic commercial banks, international commercial banks, financial funds, financial companies...
- State management agencies (The Ministry of Natural Resources and Environment, Department of Industry and Trade, Department of Natural Resources and Environment, Department of Agriculture and Rural Development, Department of Culture-Sports and Tourism, etc)
- Association of environmental protection, natural resources conservation.
- Universities, colleges, etc.



# 2.

## SPECIFICS OF A BIOMASS POWER PLANT

A biomass power plant may use biomass sources such as bagasse, wood, rice husk...etc. or heat residues from sugar production to generate electricity. When using biomass resources, a power plant will convert stored biomass energy into power through combustion systems, the biomass is burned to produce high-pressure steam that rotates a turbine to produce electricity.

A typical biomass power plant includes storage systems, conveyors, and vehicles to handle biomass materials on site. Biomass is burnt in boiler to produce high-pressure steam which flows through a turbine and generator producing electricity. Beyond the boiler, the process

uses equipment such as condensers, cooling towers, exhaust gas treatment systems, pumps, fans, pipes...etc. in which the operation of the boiler and steam turbine is the heart of the plant.

Alternative to a biomass boiler and turbine system is the use of a gasifier to convert biomass into syngas that is then combusted in a boiler or used directly in a generator.

The overview of inputs, outputs and effluents from a biomass power plant is generalized in the **Figure 2-1** below.

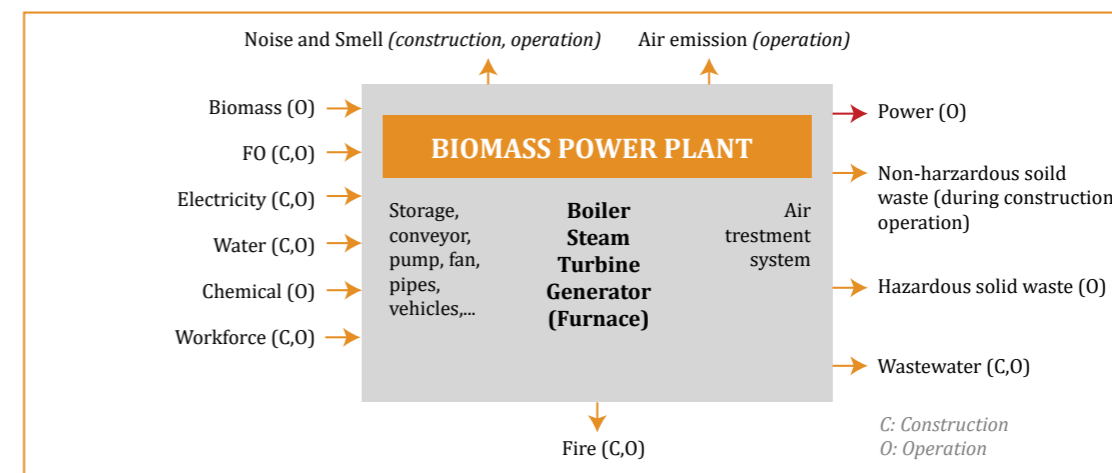


Figure 2-1. General input-output of a biomass power plant



The electricity output parameters of an average biomass power plant in Viet Nam (of 10MW) is presented in the table below.

Table 2-1. Power generation from biomass sources of 10MW in Viet Nam

No.	Category	Unit	Value by source			
			Baggage	Wood	Rice husk	Rice straw
1	Electricity generation	kg/kWh	2,11	0,94	1,15	1,54
2	Operation time	hour/year	3.600	6.500	6.500	6.500

Source: (GIZ, 2017)

Investment into a biomass power plant is considered a green investment, i.e. mitigating net greenhouse gas emissions (GHG), when the alternative is the operation of fossil fuel power plants and the biomass fuel originates from sustainable sources. Despite this positive impact on the environment, depending on location, the material

consumption of biomass resources and mobilization of the workforce may cause some environmental and social impacts at different stages of the project (investment), including both at the biomass power plant and with the biomass supply chain

## 2.1 Biomass resources in Viet Nam

### Primary biomass

Biomass resources vary in both types and characteristics. Typical biomass resources used for power generation in Viet Nam are sugar bagasse, rice husk, rice straw, wood chips and others such as sorghum, corn cob, etc. (see Figure 2-2).



Figure 2-2. Biomass sources with high potential for power generation in Viet Nam



### Sugar bagasse

Viet Nam currently (March 2022) has 39 sugar plants with a total installed processing capacity of 157,000 tons of sugar cane per day. The average size of these plant is 3,000 tons per day, ranging from 1,000 to 18,000 tons per day. This average size of sugar plant is rather modest, as is the availability of bagasse per plant, when comparing with average size of Brazil (5,900 tons per day), Thailand (15,400 tons per day), and Australia (10,400 tons per day).

By the end of 2021, there were twelve sugar plants in Viet Nam provided electricity to grid, i.e. production more electricity than the plants consume themselves (see **Table 1-1**).

It is estimated that utilization of bagasse contributes 18% to biomass power generation in Viet Nam (see **Figure 1-2**).

### Rice husk and rice straw

Viet Nam's two main regions for rice cultivation are the Red River and the Mekong River Delta, and rice production ranges from 43-45 million tons per year. In 2020, Viet Nam had 7.3 million ha of rice fields with a total production of 42.7 million tons (GSO, 2021), leading to an estimated amount of 8.5 million tons of rice husk and 42.7 million tons rice straw.

Both rice husk and rice straw have high calorific values, and in Viet Nam rice husk is mainly used as fuel, in

which 80% industrial processed in the form of pellets, briquettes, or ground powders. Rice straw is not used in industry as a fuel, but is instead used industrially as animal feed, animal bed, and paddy for mushroom plantations. However, most rice straw is burnt openly which causes environmental pollution, or is left in the field for soil improvement.

There are currently no biomass power plants using rice straw or rice husk as a primary fuel in Viet Nam in operation or with finalised investment. It is expected that rice husk and rice straw can each contribute to 8% of the potential for biomass power generation in Viet Nam. It is expected that the Hau Giang rice mill may be the first of its kind in Viet Nam (see Figure 1 2).

### Fire wood (wood residues and energy wood)

By the end of 2020, Viet Nam had 14.7 million ha of forest, of this 4.4 million ha is plantation forests (GSO, 2021). Wood bark, off cut, are sawdust are processing residues of logging, sawmills, pallet plants, production of furniture and flooring, and tree trimming/forest management. Wood residues are commonly pre-processed into wood chips to obtain equal size and lower moisture content to ensure higher combustion efficiency.

There is currently no biomass power plant operation in Viet Nam that used wood biomass resources as primary fuel materials but there are a number of investments into wood biomass power plants are under preparation.

It is expected that the biomass power fuelled by wood biomass resources will account of up to 52% of biomass power in Viet Nam in the future.

### Other biomass source

There are a number of other potential biomass sources for power generation in Viet Nam. They are corn cob and stalk, coffee and cashew husk, cassava stems, coconut husk and shells... as well as black liquor from pulping process of pulp and paper mill. For power generation, they might be used together with one of the main biomass sources listed above.

### Characteristics of biomass materials

Biomass fuel is characterized based on its physical and chemical composition. Characteristic of biomass used as a fuel including:

- Moisture content
- Ash content and Ash composition
- Element composition
- Heating value
- Bulk density and morphology
- Volatile mater content
- Fixed carbon content
- Bulk density and morphology

Amongst these, the primary characteristics of a biomass materials are heat values, moisture and ash content.

**Moisture content:** Moisture content of biomass is defined as the quantity of water in the material expressed as a percentage of the materials mass. Wet biomass is not preferred since it reduces the heating value of biomass, can reduce ignition ability, and can reduce biomass boiler efficiency. High moisture content in biomass can also lead to the bad color of flue gas when the combustion process is not optimum. Suitable drying before combustion or gasification is optimal for using biomass as a fuel. Due to its physical nature, biomass can easily absorb moisture given certain weather conditions.

**Ash content and ash composition:** Ash is the inorganic or mineral content of the biomass, which remains after complete (or incomplete) combustion. Ash content affects the design of furnaces as well as gasification reactors since the combustion process requires different ways for ash removal. The chemical composition of ash is also important because it affects the melting behavior of the ash. Ash melting can cause slagging and channel formation in boilers, economizers, flue gas systems, and in gasification reactors. Slag may ultimately block the ash removal system and block fuel flow into a boiler or gasification reactor.





**Heating value:** This is defined as the total amount of heat energy in terms of kJ (or other types of energy unit such as kCal, Btu, etc.) produced when burning one kg (or other types of mass unit such as pound) of fuel. The heating value is determined by the elemental composition, the ash content of biomass, and particularly the fuel moisture content. On a dry and ash-free basis, most biomass species have a heating value of 19 MJ/kg. The heating value of fuel could be measured in a Bomb calorimeter where fuel is combusted with oxygen. Heating value is identified and presented by the two methods of Higher Heating Value (HHV) or Lower Heating Value (LHV).

- Higher Heating Value (HHV) or gross calorific value is the maximum amount of energy that can be obtained from combusting fuel including the heat energy from the condensation of steam in flue gas in the combustion process.
- Lower Heating Value (LHV) or net calorific value of the energy obtained from combusting fuel excluding the heat energy from the condensation of steam in flue gas in the combustion process.

Depending on the methodology of calculating efficiency of the combustion equipment as well as efficiency of gasification reactor. In general, Europe calculates using LHV and the USA prefers to calculate using HHV. Thus, with the same equipment and fuel, efficiency calculated based on LHV will be higher compared to efficiency calculated based on HHV.

The fuel properties of potential biomass resources are shown in Table below. For an investment decision, the fuel analysis should be carried out for a proper system design.

Table 2-2. Fuel properties of potential biomass resources

Type	LHV (GJ/ton)	Moisture (%)	Ash (%)
Wood chips, sawdust	8.4 - 17	10 - 60	0.25 - 1.7
Rice husk	13	9 - 10	19
Rice Straw	12	10	4.4
Bagasse	7 - 8	40 - 60	2 - 4
Corn cob, stalks	13 - 15	10 - 20	2 - 7
Coffee husks	16 - 17	10 - 11	0.6
Cassava stems	8	40	N/A
Coconut husk and shells	13 - 18	7 - 10	4 - 14

Source: (Clean Energy Handbook for Financial Service Institution, 2014; WB, Biomass Atlas for Viet Nam, 2018)

Bioenergy from biomass is mostly gained through the combustion process, when using biomass for power generation the following points should be considered under ESIA.

In order to reduce the high moisture content, biomass materials are commonly pre-dried (naturally or artificially) before the combustion process. It may also be pre-processed to save on costs of transportation and storage.



#### TIP: Selection of biomass resources

- Biomass materials are characterized with low energy density, and this requires large volumes of feedstock, which can lead to sourcing difficulty and costly transportation and storage. Thus, The economical collection radius should be less than 50 km for profitability (Cost analysis of straw-based power generation in Jiangsu Province, China, 2013).
- Biomass fuel with (1) a big size limited in the grate firing technology, (2) with an uneven size the combustion process may be more difficult to control due to excess air which leads to inefficient combustion, and (3) a high water content can lead to a low heating value and difficulty in combustion process. In addition, biomass fuel, in some cases such as forest residue or wood residue may be mixed with soil, stone, sand, etc. leading to higher ash content. In these cases, pre-processing of biomass materials may be carried out
- Biomass fuel may easily decompose. Biomass storage in dry conditions, and fire protection, should be considered to limit decomposition.
- Biomass materials can be used for many different purposes in cultivation, plantations, as well as heat generation and for industrial products. The evaluation of the sustainability of biomass supply should be considered. International financial institutions commonly request an in-depth assessment on sustainability of biomass supply independently from ESIA.

#### Processed biomass

Biomass can be wet or dry, dense or fluffy, with high or low ash containing, small in shape or large, homogeneous or inhomogeneous, etc. This makes the use of biomass resources in combustion equipment or gasifier reactors quite difficult and therefore in most cases, some pretreatment is needed.

Biomass sources can be pre-dried or reformed into energy carriers (pellets, briquettes, chips, milled powders, charcoal or syngas...) or directly convert into energy through feeding into the combustion process without pre-processing (example: *sugar bagasse, sludge*)



Pellets



Briquette



Wood chips



Milled husk

Figure 2-3. Pre-processing biomass materials



## Pellets

The biomass pellets have stable heating values and are uniform in size, allowing them to be transported easily and they are suitable for higher-quality applications. In Viet Nam, biomass pellets are produced from rice husk and wood, and mainly for export because the demand for biomass pellets remains very low in the domestic market.

- **Wood pellets** with higher caloric value, low Sulfur content (<0.03%), low ash content (<1.5%) are mainly produced for export to developed countries including Korea, Japan and Europe to be used as a fuel for power generation. In 2020, 80 enterprises in Viet Nam produced 4.5 million tons of pellets, of them 74 enterprises exported pellets<sup>1</sup>.
- **Rice husk** pellets have a high ash content (8 -10%) and are mostly used domestically. The rice husk pellets could be used for fixed-bed boilers as well as chain-grate boilers. Rice-husk pellets sold domestically to supply needs for boilers and heating purposes.

Normally, biomass pellet boilers have a small capacity (< 1 ton/hr) and fuel pricing has a low impact into the total product cost.

## Briquettes

Biomass briquettes are mostly produced from rice husk and sawdust in Viet Nam. There were a number of trials

locally on briquetting rice straw into fuel which were technically successful.

Biomass briquettes are used to replace wood as fuel in fixed-bed or chain grate boilers, which tend to be small in size. Biomass briquettes can compete with traditional fuels in the market due to its affordability and suitability for household application. In an industrial context, briquettes can be used in small-sized industries.

## Woodchips

Woodchips are produced by cutting or chipping larger pieces of wood as trees, branches, residues... into equal size. Wood chips are relatively uniform fuel, allowing easy feeding into a boiler automatically. Woodchips are common forms of wood energy in general and power generation in particularly at industrial scale.

## Milled-biomass powder

Milled-biomass powder is sourced mostly from rice husk that could be used for both animal feed and combustion in boilers. In Southeastern Viet Nam, some fluidized-bed boilers use milled-biomass powder as fuel as its transportation costs are reduced. Even though fluidized bed boilers use rice husk powder as a fuel, the technology used is blowing the powder so that most of fuel is burned in the space of combustion chamber, but not in the fluidized bed method.



<sup>1</sup> <https://goviet.org.vn/bai-viet/san-xuat-va-xuat-khau-vien-nen-tai-viet-nam-9339>

## 2.2 Workforce

Workforce is mobilized during construction and operation of the biomass power plant. Workforce may also be required for biomass collection and transportation.

There is no common information on the workforce during construction, biomass collection and transportation, and it very much depends on the type of biomass used and location.

For operation, the size of workforce depends on the size of the biomass power plant, the biomass resources used, the energy technology used, the degree of automation, and the operation and maintenance strategy being used.

On average, a biomass power plant from 1-5 MW requires 3-5 peoples while larger plants of 20 - 40 MW may need as many as 20 - 40 peoples. The higher number is mainly needed mobilize sorting and feeding activities. A combined heat and power (CHP) biomass plant is expected to require a greater workforce than that of a power generation plant.

## 2.3 Process, technology, and main equipment

The biomass to electricity includes four main stages as shown in the **Figure 2-4** below.

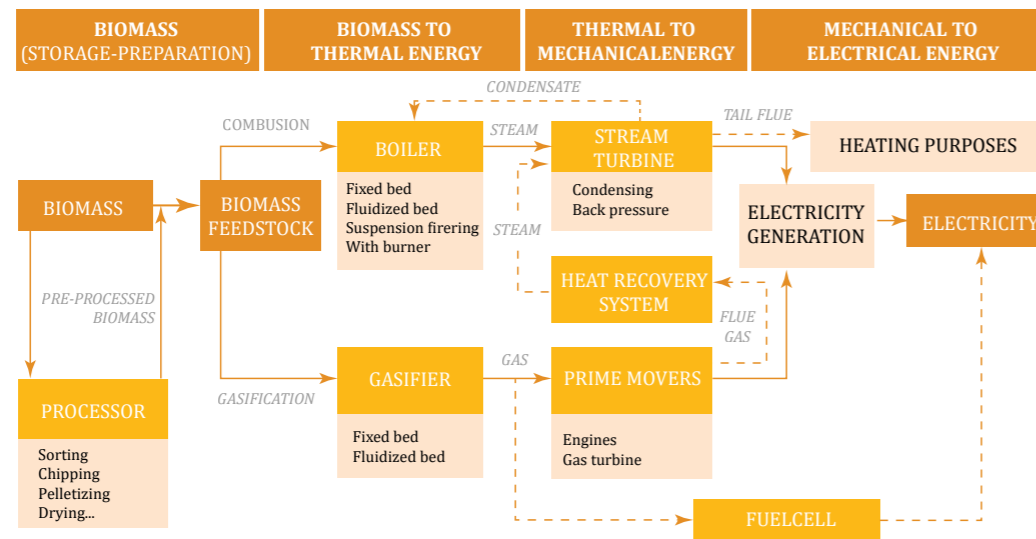


Figure 2-4. Overview of biomass to power process

## Biomass storage and preparation

The storage area for biomass should be big enough to store the fuel for at least one week of operation but is often larger. Biomass is a fuel that is easily affected by climatic conditions such as humidity and rain, so the storage needs to have a suitable roof and wall structure to ensure lower moisture content. Biomass is a flammable fuel, so it is necessary to have appropriate fire prevention methods ready in the case of fire.

In order to increase efficiency of the combustion/gasification process, biomass may be processed to obtain equal size and humidity, where conveyor systems, stackers, and shredders are commonly seen at this stage.

## Combustion vs Gasification

Depending on the capacity need and biomass resources, biomass is converted to thermal energy by either combustion or gasification process.

In the **combustion** process, biomass is burned in a boiler to generate superheated steam that is then introduced into a steam turbine. The steam turbine drives the generator to generate electricity. Steam with lower pressure could be extracted from the steam turbine extraction gate or from the exhaust steam at the end of the turbine to use in industrial applications. This is the **combined heat and power (CHP)** process. CHP is popular in biomass power generation plants where this is a demand for heat resources to dry raw biomass and / or heat demand for sugar production.

**Gasification** is a less commonly used process. In the gasification process, solid biomass is converted into syngas under very low oxygen levels, where syngas composition includes CO, CO<sub>2</sub>, N<sub>2</sub>, C<sub>x</sub>H<sub>y</sub>, H<sub>2</sub>, H<sub>2</sub>O. After the gasifier, the combustible gas will generate electricity via gas-based prime movers such as internal combustion engines, gas turbines, sterling engines, and thermoelectricity generator. Alternatively, gas can be converted directly to electricity via solid oxide fuel cells.

For large scales, i.e. more than 50MW, an **Integrated Gasification Combined Cycle (IGCC)** should be applied. This is a combination of a gas turbine and steam turbine where the flue gas temperature coming out of the gas turbine, which is used at a high temperature and at a large volume, is used to produce superheated steam in a heat recovery steam generator. This superheated steam than can be used for a steam turbine to drive a generator to generate electricity.

In both technologies, combustion and gasification, fixed bed stocker and fluidized bed technologies are observed. A fixed bed means the fuel stays fixed on the grate at the time of combustion and gasification. A fluidized bed means the fuel is blown up with higher airflow velocity from the bottom to create a fluid state of fuel and inert materials acts as fluidization material aid. The fixed bed technology is generally more suitable for smaller capacities of less than 10 MW and the fluidized bed is more suitable for intermediate and large capacities of 10-50 MW and over 50 MW, respectively.



### Boiler and steam turbines

Combustion in boiler is most popular for power generation in all sizes of capacity and fuel materials.

**Boiler** is the main equipment of the combustion process. The boiler is a device that organizes the burning of biomass to generate heat and uses it to produce saturated steam at high pressure and boiling temperature.

In a power generation system, superheated steam, i.e. steam at high temperature, is required and the boiler will

be equipped with a super heater to convert saturated steam into superheated steam. The production of superheated steam with high pressure and temperature also requires a higher quality of feed water to the boiler, and a boiler feed water treatment system is therefore commonly required.

There are three types of combustion technologies: fixed bed, fluidized bed, and suspension. The differences between these are presented in the **Table 2-3** below.

Table 2-3. Combustion technologies

No.	Category	Fixed bed stocker boiler	Fluidized bed boiler	Suspension boiler
1	Technology	Fixed grate Moving grate	Bubbling Circulating	Suspension firing with burner
2	Technology feature	Traditional	Popular	New
3	Biomass materials	Selective	Low caloric values Equal size	Varies
4	Capacity	Low (less than 10MW)	Medium (10-50 MW) or High (>50MW)	
5	Combustion efficiency	Lower	Medium	High

A fluidized bed boiler has more advantages than a fixed bed at a large scale. Compared to grate combustors, fluidized-bed systems generally produce more complete carbon conversion, resulting in reduced emissions and improved system efficiency. In addition, fluidized-bed boilers can use a wider range of feed stocks. Furthermore, fluidized-bed systems have a higher parasitic electric load than fixed-bed systems due to increased fan power requirements.

**Steam turbine** converts heat energy from steam to mechanical energy to drive the generator that makes generated electricity. Steam coming out of a turbine, tail flue, has a low temperature and pressure, and is commonly collected via a condenser and returned to the boiler. The electricity generation efficiency of a steam turbine is between 20-40%.

There are two types of steam turbines, condensing turbines with extraction gates and back pressure turbines. Condensing turbines allow steam extraction. The tail flue of a condensate turbine is cooled down by the water while that of a back pressure turbine can be released without cooling water. However, the heat content in the cooling water is normally wasted by releasing it into the air in a cooling tower.

### Gasifiers and gas prime movers

**Gasifiers** are found in small and medium systems, i.e. less than 10 MW or from 10-50 MW, respectively.

In the gasification process, the lighter elements were volatilized, and raw syngas is generated through biomass degradation in the first stage of gasification. Biomass gasification creates tar, a viscous blend of heavy metals and higher aromatic hydrocarbons. It could lead to degradation of the produced gas quality. The application of partial oxidation, thermal cracking, and steam reforming may be applied additionally to reduce the tar. A gasification process with biomass materials creates less tars than that with other materials. Syngas conditioning can also be used to improve gas components such as H<sub>2</sub> and CO. In this case, advanced design, catalytic gasification, candle-based filtration, H<sub>2</sub>/CO<sub>2</sub> membrane, syngas cooler, CO<sub>2</sub> remover, etc. might be used.

Similar to boilers, there are two categories of gasifiers, fixed bed and fluidized bed. The characteristics of these are presented in the **Table 2-4** below.



Table 2-4. Gasification technologies

No.	Category	Fixed bed gasifier	Fluidized bed gasifier
1	Technology	Updraft Downdraft	Bubbling fluidized bed Circulating fluidized bed Entrained flow bed
2	Technology feature	High flexibility for gas usage Slow heating up	Low flexibility for gas usage Fast heating up, easy start and shut down
3	Biomass materials	High ash content feedstock Large uniform pellets	Wide variation in materials Wide variation in size
4	Capacity	Low (less than 10MW)	Medium (10-50MW)
5	Gasification efficiency	Lower	Medium
6	Gas quality	Rather clean, 200-700°C	High content of dust, 800-1200°C

**Gas prime movers** (for power generation) technologies are continuing to be advanced with an electrical efficiency of 10% to more than 60%. Internal combustion engines (ICE) and gas turbines (GTs) are common gas prime movers for both small and larger scales respectively.

ICEs have an electrical efficiency of 20-35% with a low noise level (about 44dB), a proven performance record in rapid start up and shut down, and are more tolerant to syngas contaminants such as tar, particulate, alkali, metal than other technologies. While ICEs are suitable for small and medium capacity (less than 25 MW), gas turbines are chosen when the capacity demand is at least 22 MW. An advanced gas turbine can reach an

efficiency of up to 65% but can only tolerate a low level of contaminants.

#### Other equipment

Besides the above main equipment, a biomass power system may use the following auxiliary devices:

- Pumps, fans, conveyors
- Pipes and valves
- Pressure and temperature control
- Economizers
- Flue air treatment system
- Water treatment system



# 3.

## ESIA PROCESS



### 3.1 National compliance in Viet Nam vs. ESIA

The development, implementation, and operation of a power plant in general, and a biomass power plant in particular, must comply with the national regulations in Viet Nam. The **Table 3-1** below lists these various applicable national laws and codes and shows how these relate to each IFC Performance Standard, with the exception of Performance Standard 7 (PS7).

Table 3-1. ESIA (IFC) performance standard and National Law

IFC Performance Standard		Related National Laws and Codes
PS1	Assessment and Management of Environmental and Social Risks and Impacts	<ul style="list-style-type: none"> <li>All below</li> </ul>
PS2	Labor and Working Conditions	<ul style="list-style-type: none"> <li>Labor Code No 45/2014/QH14 2019</li> <li>Law on Social insurance No 35/2018/QH14</li> </ul>
PS3	Resource Efficiency and Pollution Prevention	<ul style="list-style-type: none"> <li>Law on Environmental Protection No. 72/2020/QH14</li> <li>Law on Energy conservation and Efficiency No 50/2010/QH12</li> <li>Law on Water Resource No 17/2012/QH13</li> <li>Law on Electricity No 28/2004/QH11</li> <li>Law on update Electricity Law No 24/2021/QH13</li> <li>Law on Chemical No 06/2007/QH12</li> <li>Law on Forestry No 16/2017/QH14</li> </ul>
PS4	Community Health, Safety, and Security	<ul style="list-style-type: none"> <li>Law on occupational safety and hygiene No. 84/2015/QH13</li> </ul>
PS5	Land Acquisition and Involuntary Resettlement	<ul style="list-style-type: none"> <li>Law on Land No. 45/2013/QH13</li> <li>Law on Environmental Protection No. 72/2020/QH14</li> </ul>
PS6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	<ul style="list-style-type: none"> <li>Law on Biodiversity No 20/2008/QH12</li> <li>Law on Environmental Protection No. 72/2020/QH14</li> <li>Law on forestry No 16/2017/QH14</li> </ul>
PS7	Indigenous Peoples	<ul style="list-style-type: none"> <li>Strategy, programs</li> </ul>
PS8	Cultural Heritage	<ul style="list-style-type: none"> <li>Law on Cultural Heritage No 10/BHN-VPQH</li> </ul>

Under these laws and codes in **Table 3-1**, biomass power plant developers need to prepare documents to obtain a number of agreements, certificates, approvals, permits, and licenses for both the construction and operation of a biomass power plant. The detailed requirements are summarized and presented in **Annex 6.6**.

Depending on the stage of the project cycle and investment, there are different legal and supporting documents that must be completed outside of the ESIA process, but these can be used as primary inputs for ESIA as well.

Notably, not all biomass power projects required an environmental impact assessment report, but all biomass power projects do require an environmental permit. A biomass power project with a scale of 50MW or more needs to install an automatic flue gas monitoring system. The types of projects requiring environmental assessment reports are investment projects that meet the following criteria:

#### The common projects required an EIA report.

- Projects under the authority to decide and approve investment policies of the National Assembly and the Prime Minister
- Projects with an investment capital of 2,300 billion VND or more (group A)

#### The rare projects required an EIA report:

- Using land, land with surface water (except for forest development projects) at least 50 ha or more

- Using land, land with surface water of natural reserve area of at least 1ha, requiring conversion of land use;
- Using land, land with surface water of biosphere reserves area of at least 1ha, requiring conversion of land use;
- Using (converting) land, land with water surface of the buffer zone of world natural heritage, important wetland of at least 20 ha (5 ha) or more
- Using (converting) land, wetland of natural forest of at least 20ha (3ha) or more
- Using (converting) land, wetland of protected forest of at least 50ha (20ha) or more;
- Changing land use purposes of rice cultivation.
- Using land, land with surface water of historical, cultural relics or scenic spots that have been ranked national or special national from 2ha, ranked as world heritage sites or scenic areas ranked national, special national from 10ha or more;
- Investment project discharges 500m<sup>3</sup> of wastewater/day or more;
- Investment projects that require migration or resettlement from 1,000 people in mountainous areas or from 2,000 people in other areas or more;

The other documents, information to serve ESIA according to existing regulation are summarized and presented in **Figure 3-1** below.

### COMMON TIMELINE FOR ESIA

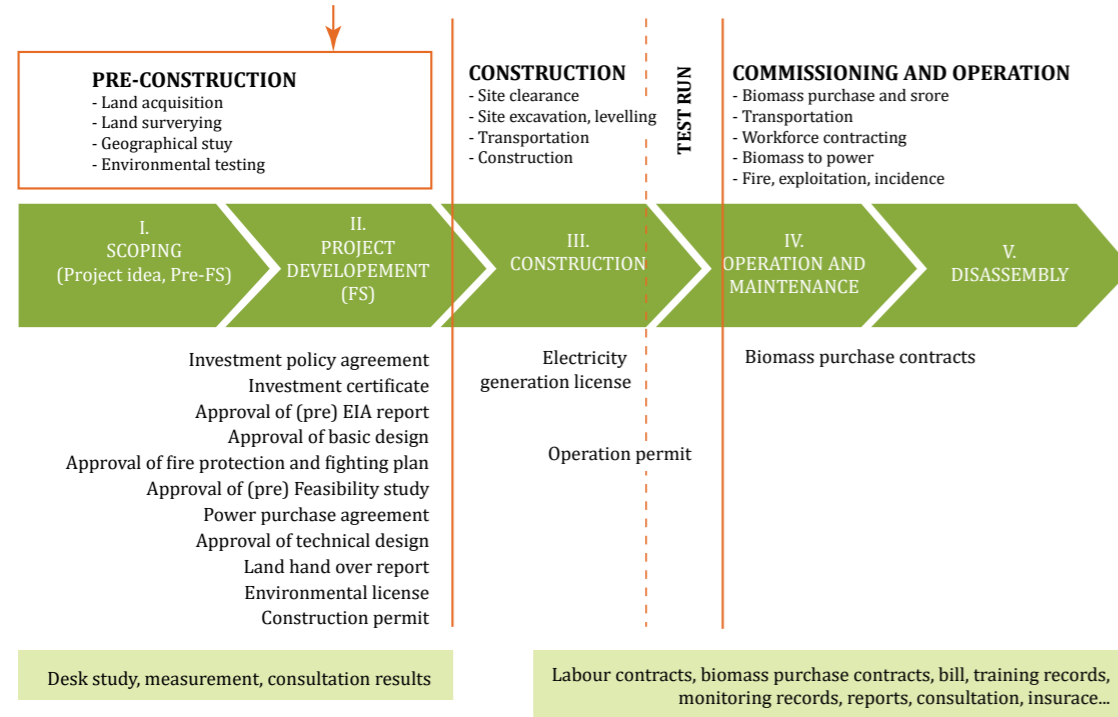


Figure 3-1. Readiness to ESIA in accordance with IFC Performance Standards

#### TIP: Readiness preparation

There will be a number of types of evidence required during construction and operation. It is advised that a developer should assign a person in charge of environmental and social issues and collect evidence in early stage to prove compliance and risk management of the project.

### 3.2 Principles for ESIA

The objective of an ESIA report is to identify risks and impacts caused by the implementation and operation of a project, and to develop a suitable management plan to either prevent or limit such risks and impacts.

An ESIA report takes both time and resources to complete, and it is therefore important that an ESIA for a biomass power plant is conducted in an effective way taking into account the following principles:

- Under the Law on Environmental Protection, an Environmental Impact Assessment (EIA) will need to be carried out for some categories that are described in Section 3.1. In case of EIA report is performed, ESIA should be included in the results of the EIA report.
- To follow the national frameworks that Viet Nam has developed for performance standards in environmental protection and social issues, which can be supplemented with international good practice where required, especially where national frameworks do not exist.
- To assess the risks and impacts of not only the construction and operation of the biomass power plant, but also the risks and of a sustainable biomass supply chain and logistics.

- To prioritize an effective consultation process with material stakeholders, in order to create mutual understanding and efficient use of resources for all parties involved. This includes a process to ensure that material stakeholders are consistently well informed with sufficient information about investors, the project, potential risks and impacts, and progress. (see **Form 01 - Project information**).

#### ESIA Process

Even though financing organisations have different ESS (as described in **Chapter 1**), the purposes and procedures for completing ESIA can be generalised into the two stages of Preliminary ESIA activities and Full ESIA activities. The total ESIA process is presented in the figure below, and the steps are presented in the following sections.

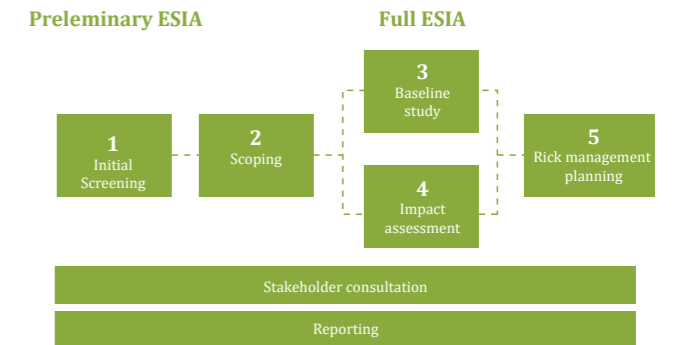


Figure 3-2. Overview of ESIA process



### 3.3 Initial screening

The purpose of the screening activity is to differentiate the level of potential risk and impacts that a project may have as per the screening criteria of financing organisations, as to whether or not an ESIA is required.

A preliminary assessment (i.e. initial screening) shall be conducted taking into account the categorization criteria as set by the financing organisations and their ESS and related guidance. This initial screening should be prepared in consultation with regulatory authorities (see **Form 02 - Screening**).

Normally, finance institutions classify the social and environmental management risks of an investment project into 3 categories to ascertain their ESIA requirements as described in **Table 3-2** below.

Table 3-2. Classification of impacts/risks of environment and society of an investment project

	CATEGORY A	CATEGORY B	CATEGORY C
Risks/impacts	Business activities with potentially significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented.	Business activities with potentially limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.	Business activities with minimal or no adverse environmental or social risks and/or impacts.
ESIA	Compulsory	Possible (if moderate or high environmental or social risks and impacts)	Noncompulsory

It is important to note that during this initial screening the different levels of requirements for review (e.g. mitigation opportunities, compensation measures, and disclosure needs) shall be applied for both environmental and social risks and impacts. In addition, in terms of regulatory compliance it is likely that a biomass power plant will require an EIA, thus potentially an ESIA is needed where the magnitude of environmental or social impacts are of sufficient magnitude, especially in the case of large biomass demand (e.g. supply chain).

An environmental and social impact assessment will be triggered for all projects in Category A and for some

projects in Category B where a project may potentially cause moderate or high environmental or social risks and impacts. It is also noted that some financing organisations may consider that any biomass power plant falling under Category A and B should undergo an ESIA when considering the biomass supply chain. The **Figure 3-3** below offers a picture of the general decision-making process, though it is noted that different international financial lenders may individually have different considerations that align with their ESS.



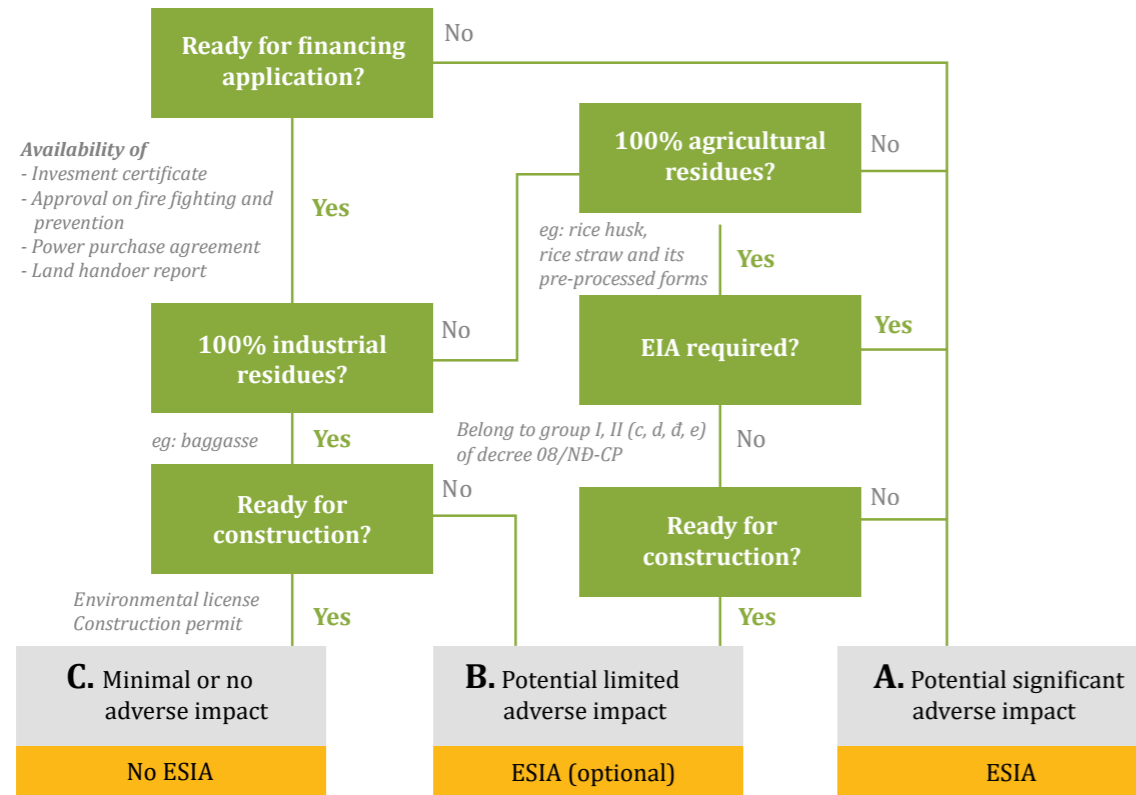


Figure 3-3. Overview of initial screening decision-making process

### 3.4 Scoping

The purpose of the scoping activity is to categorize risks and impacts based on their potential magnitude (negative) influence on the different receptors within the environmental and social boundary of a project, and thus identify the boundary of the ESIA.

Scoping is an important step in the ESIA, it not only helps to determine the study area but also saves time and human resources to focus on the key issues of the project. The project investment developer or implementing entity should scope the ESIA through a desk review in conjunction with the site visit and consultations with key stakeholders.

Under an ESIA, “receptors” are both the natural or socio-economic components that may be influenced by a project in terms of both increased risk and/or creating negative impacts. A simple definition for natural

receptors is flora (plants), fauna (humans, animals, insects), and ecosystems (bodies of water, forests...), and other receptors are community, manmade structures, and social & economic systems. An ESIA reviews different elements (sometimes referred to as ‘sources’) of project activities that have the potential to cause increased risk to and/or creating negative impacts on receptors. Note that the water, air, and soil are both receptors and pathways for different elements increasing risk and/or creating negative impacts on receptors.

#### Example: Relationship between elements, pathways, and receptors

The use of dangerous chemicals is an element of a project, and during chemical spill water, air, and/or soil acts as a pathway to transfer the chemical from the spill location to an area where receptors (e.g. humans and plants) may be exposed, causing illness and possibly death.



To operationally conduct an ESIA, receptors are commonly divided into three resource categories: Natural, Biological, and Socio-economic. The table below indicates examples of receptors in these different categories.

Table 3-3. EISA categories for receptors in a biomass power project

Categories	Receptors
Natural Resources	Climate, topography, geology, water (incl. hydrology), air, and soil
Ecological Resources	Habitats in terrestrial, subterranean, and aquatic & marine environments, including Flora (plants), fauna (animals, insects)
Socio-economic Resources	Population (households & communities), social status & conditions, cultural heritage & customs, utility services, transport systems, health systems, businesses & employment

Three categories of potential impacts and risks are used to define the scope of the ESIA boundary:

- Important impacts and risks (e.g. major and severe impacts and risks): Impacts and risks (including consequences thereof) of a high and very high magnitude, including a large spatial extent, cumulative effects, may still be reversible in the long-term, and which are considered to be sensitive to receptors.

- Negligible impacts and risks: Impacts and risks are either negligible or not adverse to receptors.
- Uncertain impacts and risks: Minor, medium or unknown impacts and risks (e.g. unknown due to lack of information).

The scoping activity is an important step in the ESIA process, and it not only defines the boundary of the ESIA but also directly defines the time and resources needed for completing a quality ESIA. It is recommended to complete the scoping activity through a combination of desk review, site visit, and consultations with key stakeholders.

COMMON TIMELINE FOR ESIA

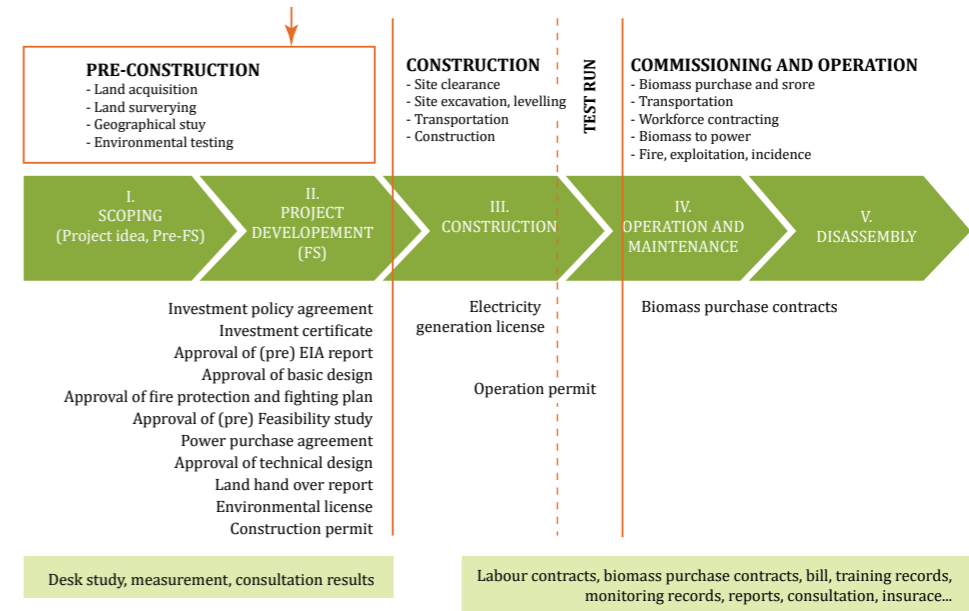


Figure 3-4. Documents support the ESIA process

During the desk review, all information available<sup>1</sup> for the project (Figure 3-4) should be reviewed together with provincial level topographic, geographic, hydro meteorological reports for first insight of project characteristics and potential impacts and risks. Interactions of these potential impacts and risks from elements and the associated receptors will lead to the

magnitude of each impact and risks (e.g. important, negligible or uncertain). A detailed, but not all inclusive, list of biomass power plant project elements to review can be found in Annex 6.5, divided between construction, commission & operation, and biomass supply chain.

<sup>1</sup> Minimum requirements are at least a prefeasibility study, concept design, identified location, concept of sourcing biomass resources, and preferably also a site-level topographic survey, site geological study, financing plan, financial analysis, initial permits, initial agreements with owners and community, community and regional social & economic statistics ...etc.

Site visits should be conducted with/at key receptors to confirm desk review results. It is recommended that site visits be carried out with the presence of the ESIA consultant, representative of the project developer, and representative of the technical engineering consultant.

The key natural receptors such as any biological areas (including the main site), adjacent water supply sources, water discharge areas/ecosystems, major sources of biomass the anthropological receptors including residential areas, pagodas, cemeteries, tourist sites, health clinics and schools... should be visited.

During the site visit, the scoping team should conduct some initial meetings and consultations with key stakeholders such as the communal people's committee, the district or provincial departments for environmental protection, and some local households on and/

or adjacent to the site (and biomass supply areas). Meetings with these stakeholders may provide the team with valuable information of the existing environmental and social settings to inform the later baseline study design and impact assessment.

The results of the scoping activity should be a completed scoping matrix which is divided into potential receptors (see **Form 03 - Scoping**), and the background information and explanation of each receptor reviewed, and justification for the scoping potential impacts & risks category chosen (e.g. important, negligible or uncertain). Photos and mapping/drawings of impacted or those at-risk receptors should be applied. The results of the scoping activity should also include where more information is needed on identified and evaluate elements, pathways, and receptors.

#### TIP: Free and partial free tools for scoping

Vital database for biodiversity related impact as potential conservation, world heritage sites, list of potential species that may present in the vicinity of the project area.... can be obtained from iBAT, or Open Development Mekong. Other tools for scoping are Google Earth, QGIS, and ESIA Performance Standard tools provided by IFC.

### 3.5 Baseline study

The baseline study aims to identify the existing conditions of the natural and socio-economic receptors as well as the condition/emissions of pre-project pathways.

Baseline study focuses on the quantification (and in some cases qualification) of the existing condition of receptors and pathways, which are defined by the boundary of the ESIA.

Where the boundary of the ESIA should include the receptors and pathways which face both important and uncertain impacts and risks. As indicated in the scoping activity it is expected that the information from the minimum requirements for scoping will be required amongst others, and if available an EIA will also be able to provide additional information.

Preferably the necessary primary information, and possibly secondary information (the current status of environment, economy, society, and health reports), for the baseline should be gained during the scoping site visit, and if not one or more new site visits will be required to collect all baseline data. The baseline study can be divided up into reviewing the EISA categories for receptors in a biomass power project (see **Table 3-3**), and (**Form 04 - Baseline**) can be used as guidance for recording baseline information.

#### 3.5.1 Natural baseline study

When collecting information and conducting measurements for the natural baseline parameters, the study should follow the sampling, analysis methodology and parameters as defined under Viet Nam's technical regulations and international guidance as follows (incl. in-situ or laboratory testing), which may require both site visits and desk review:





Table 3-4. Scope of a natural baseline study

Receptors	To be impacted by	Sampling and analysis method	Report
Air	<ul style="list-style-type: none"> <li>Operation of equipment (boiler, gasifier, vehicles)</li> </ul>	<ul style="list-style-type: none"> <li>QCVN 05:2013/BTNMT - National Technical Regulation on Ambient Air Quality;</li> <li>QCVN 06:2009/BTNMT - National Technical Regulation on Hazardous Substances in Ambient Air;</li> <li>Article 16, 17 of IFC EHS guidelines for thermal power plant, section 1.1 of the IFC's general EHS guidelines</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring location</li> <li>Existing potential source of emissions</li> <li>Air quality</li> <li>Potential air emission of the project</li> </ul>
Noise	<ul style="list-style-type: none"> <li>Operation of equipment (biomass pre-processor, boilers)</li> </ul>	<ul style="list-style-type: none"> <li>QCVN 26:2010/BTNMT - National Technical Regulation on Noise</li> <li>QCVN 27:2010/BTNMT - National Technical Regulation on Vibration</li> <li>Section 1.7 of the IFC general EHS guidelines</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring location</li> <li>Noise level (day time, night time and history)</li> <li>Potential noise level of the project</li> </ul>
Surface water	<ul style="list-style-type: none"> <li>Water exploitation</li> <li>Water supply treatment</li> <li>Hazardous waste handling and management (chemical from water treatment system, ash, bulbs...)</li> </ul>	<ul style="list-style-type: none"> <li>QCVN 08-MT:2015/BTNMT - National Technical Regulation on Surface Water Quality</li> <li>QCVN 14:2008/BTNMT - National Technical Regulation on Domestic Wastewater</li> <li>QCVN 40:2011/BTNMT - National Technical Regulation on Industrial Wastewater</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring location</li> <li>Surface water users and co-dependent habitats</li> <li>Surface water availability and quality</li> <li>Flood risk appraisal (flooding location only)</li> <li>Potential exploitation and discharge of the project</li> </ul>

Receptors	To be impacted by	Sampling and analysis method	Report
Groundwater	<ul style="list-style-type: none"> <li>Operation of water well</li> <li>Hazardous waste handling and management</li> </ul>	<ul style="list-style-type: none"> <li>QCVN 09-MT:2015/BTNMT - National Technical Regulation on Ground water Quality</li> <li>QCVN 43:2012/BTNMT National Technical Regulation on Sedimentation</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring location</li> <li>Ground water users and co-dependent habitats</li> <li>Groundwater availability and quality</li> <li>Flood risk appraisal (flooding location only)</li> <li>Potential exploitation and discharge of the project</li> </ul>
Soil and land use	Hazardous waste handling and management	<ul style="list-style-type: none"> <li>QCVN 07:2009/BTNMT - National Technical Regulation on Hazardous Waste Thresholds</li> <li>QCVN 03-MT: 2015/BTNMT - National technical regulation on the allowable limits of heavy metals in the soils</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring location</li> <li>Soil quality</li> <li>Soil and land use mapping</li> <li>Potential land use of the project, including material areas</li> </ul>

An EIA report in Viet Nam includes the above natural baseline data with regards to the receptors. The information on the selected technology, equipment, and the choice of biomass can be used to define the natural baseline parameters and may not be available from an EIA report, but can be gained from suppliers.

It is noted that QCVN 22:2009/BTNMT - National Technical Regulation on air emission of the thermal power industry will not be applied for a biomass power project as it is only applied for the thermal power projects with fossil fuel.

Note that there are other potential natural receptors that may not be included in the EIA regulations in Viet Nam for a baseline, which can be included in an ESIA, such as climate, topography, and geological resources

when these are deemed to constitute an important or uncertain risk. Especially for climate, some lenders will require a review of the risk of climate change on the project and not the risk of the project on climate change. Baseline data for this is often found in national climate change reports or regional climate change planning<sup>1</sup>.

Guidance for recording natural baseline study information can be found in **(Form 04 – Baseline)**, and a non-inclusive list of different elements which can impact or cause risk to the natural receptors can be found in **Annex 6.5**.

<sup>1</sup> Sources for climate change impacts are for example in Viet Nam's National Communications and National Adaptation Plan



### 3.5.2 Ecological baseline study

Viet Nam has no technical regulation with requirements or guidance on an ecological baseline study. An ecological baseline study should address the receptors in the terrestrial, subterranean, and aquatic and marine environments / ecosystems. The existing terrestrial and subterranean habitats will specifically address the project areas (site and biomass resources areas) and needs (potential offset areas). The existing aquatic and marine environments close to the above areas are important to a baseline, but there may be other special locations that are potentially impacted or caused at risk that are not in the above areas.

The ecological baseline study should be conducted by desk review and confirmed by site visits. It is noted that the IFC Performance Standard 6 provides five broad categories on biodiversity of species and fauna as follows which can be used in setting up and undertaking the ecological baseline study:

- Modified habitat
- Critical habitat
- Natural habitat
- Legally protected and internationally recognized areas
- Invasive alien species

Guidance for recording ecological baseline study information can be found in **Form 04 – Baseline**, and

a non-inclusive list of different elements which can impact or cause risk to the ecological receptors can be found in **Annex 6.5**.

### 3.5.3 Socio-economic baseline study

The socio-economic baseline study aims to cover the remaining receptors under the ESIA boundary that relate to livelihood, land use, cultural heritage, infrastructure and public services, community health and safety, economy and employment, traffic and transport, etc. Which are not included under the physical and biodiversity baseline studies.

Besides, addressing on existing conditions of receptors in the project area and needs and their needs, the study also aims to provide key characteristics and variables of the location as demographic information, legal and institutional context, population, ethnicity, religion, the social economic development indicators as well as other tendencies that may impact to social-economic conditions such as:

- Demographic change in size and composition of the resident populations or the influx of a temporal workforce;
- Economic change over the long term, including persons of an employable age and retired (and older) persons;





- Natural and ecological change that alter land use (for example subsistence agriculture), economically/culturally relied upon natural habitat, hydrological system resulting in a loss of subsistence's or livelihoods in resource dependent communities, etc.

Since biomass power plant projects often involve the participation of households in providing biomass resources in the supply chain, the socio-economic baseline study should address receptors in the community and household levels near the site and in the supply chain.

*Note that some international financing lenders may require a gender assessment as a part of the ESIA, or the ESIA work can address this if a separate gender assessment report is required. The baseline needs of a gender assessment may be included in the socio-economic baseline study.*

Guidance for recording socio-economic baseline study information can be found in **Form 04 – Baseline**, and a non-inclusive list of different elements which can impact or cause risk to the socio-economic receptors can be found in **Annex 6.5**.

### 3.6 Impacts & risks assessment

This step aims to evaluate the impacts and risks cause by project implementation in order to prepare a suitable risk management plan.

The impacts and risks assessment is carried out by addressing the three stage of project development. They are:

- Construction and commissioning: that address the potential changes that occur onsite, offsite, and supply chain, and
- Operation and maintenance: potential changes that occur onsite, offsite, and within the biomass supply chain
- Decommissioning: potential permanent changes that occur onsite and offsite.

Depending on the level of predicted impact & risk, project impact & risk can be analysed by a wide range of methods that include both simple qualitative evaluation to detailed quantitative evaluation, surveys, and/or modelling.

In the case where a final design and/or supply chain is not known when the ESIA is conducted, or where there is a material change to the final design and/or supply chain upon commissioning, then the impact &

risk assessment shall be performed again as a part of the environmental and social management plan (ESMP).

#### 3.6.1 Alternative option analysis

It is not uncommon that an ESIA is performed before the final design of the biomass power plants and the full supply chain is known. In this case, the impact & risk assessment (including baseline) should address create and analyse the possible design alternatives which may re-allocation (different locations) and/or adoption of different biomass sources and power plant technologies. In this case, a clear narrative of the options (including do nothing) for the analyses shall be presented in the ESIA, and one of these shall be the chosen final option for construction and operation. Guidance for performing an alternative optional analysis can be found in Annex B of the IFC EHS Guideline for Thermal Power Plant (2008) in the form of a qualitative evaluation<sup>1</sup>.

<sup>1</sup> International Finance Corporation, Environmental, Health, and Safety Guidelines Thermal Power Plants

### 3.6.2 Preforming the impact & risk assessment

#### Impact & risk prediction

A general (potential) impact & risk prediction was preliminarily conducted under screening and scoping phases of this guidance. For a biomass power plant, it is expected that water and air quality, community health and safety (from operation of boilers, gasifiers, and fire risk), land use, biodiversity, traffic and transport (from exploitation of biomass in supply chain), community economic and cultural will be commonly seen as receptors that require high attention in the impact & risk assessment. A non-inclusive list of different elements which can impact or cause risk to the receptors can be found in **Annex 6.5**.

To help with impact and risk evaluation for some elements, the following tools can be used:

- Construction & commissioning stage: UK guidance from the Institute of Air Quality Management<sup>1</sup> (IAQM) and Environmental Protection UK (EPUK)
- Operation and decommissioning stage:
  - Air quality can be predicted with plume modelling (i.e. AERMOD)<sup>2</sup> or puff modelling (i.e. CALPUFF)<sup>3</sup> software. Requirements for

<sup>1</sup> Institute of Air Quality Management, A guide to the assessment of air quality impacts on designated nature conservation sites, (2020)

<sup>2</sup> United States Environmental Protection Agency, Air Quality Dispersion Modeling-Preferred and Recommended Models <https://www.epa.gov/air-quality-dispersion-modeling-preferred-and-recommended-models> (2017)

<sup>3</sup> Exponent Engineering and Scientific Consulting, CALPUFF modeling System

baseline conditions are defined in the IFC General EHS Guidelines and the IFC EHS Guidelines for Thermal Power Plant.

- Noise impact & risk can be predicted with SoundPLAN<sup>4</sup> or CadnaA<sup>5</sup>. As well as groundwater and surface water modelling<sup>6</sup>.

Along with the baseline study, additional data on meteorology and topography might be needed for detailed impact & risk prediction.

Impact and risk prediction should be conducted with updated and more detailed information that was gathered during baseline study. This means, a list of receptors with important impacts or risk events under scoping step (**Form 03**) might be added to and updated from those with uncertain or negligible impacts and unplanted events.

*It is important to note that impact & risk prediction and evaluation take into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the project design and supply chain operation regardless of the results of the ESIA Process). This helps avoid a situation where an impact or risk is assigned a magnitude based on a hypothetical version of the project that considers none of the actual embedded controls.*

<sup>4</sup> SoundPLAN GmbH Company, SoundPLANnoise Software,

<sup>5</sup> DataKustik GmbH Company, CadnaA State of the Art Noise Prediction Software

<sup>6</sup> U.S. Department of the Interior, Water Resources Groundwater Software,

#### Impact & risk evaluation

Similar to the scoping phase, the impact & risk evaluation shall be performed but with more in-depth information and related qualitative and quantitative assessment. This assessment shall be carried out per each and every receptor and the results for each qualified under one of the following four impact & risk magnitudes:

- **Negligible:** An impact or risk of negligible significance is one where a receptor (including people) will essentially not be affected in any way by a particular activity or element, or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations that may occur within the boundary of the ESIA.
- **Minor:** An impact or risk of minor significance is one where a receptor will experience a noticeable effect, but the impact or risk magnitude is sufficiently small and/or the receptor is of low sensitivity/vulnerability/importance. In either case, the magnitude should be well within applicable standards as set by national, regional, or local regulations (and foreseen future regulations).
- **Moderate:** An impact or risk of moderate significance has an impact or risk magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit of national, regional, or local regulations (and foreseen future regulations). It is noted that to design activity so that its' effects only just avoid breaking a law and/or cause a major

impact or risk is not best practice and should be avoided. The emphasis for moderate impacts or risks is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts or risks of moderate significance have to be reduced to minor or negligible impacts or risks, but that moderate impacts or risks are being managed effectively and efficiently during the project phases.

- **Major:** An impact or risk of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts or risks occur to highly valued/sensitive receptors. An aim of an ESIA is to get to a position where the project does not have any major residual impacts or risks, and certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects, there may be major residual impacts or risks after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual or noise impact of a facility, or land use for biomass resources (which can have both positive and negative impacts and risks). It is then the function of the national and regional regulators and stakeholders to weigh such negative factors against the potential positive ones, such as employment and increase economic resources, in coming to a final decision on the project. Note that international lenders may also weigh in as they will require adherence to their ESS.



Table 3-5. Rating significance of impact &amp; risk

		Sensitivity/Vulnerability/Importance of receptor		
		Low	Medium	High
Impact & risk magnitude	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

Source: Adapted from ERM

#### Sensitivity/Vulnerability/Importance of receptor:

There is a range of factors to be taken into account when defining the sensitivity/vulnerability/importance of an impact or risk on a receptor. These sensitivities/vulnerabilities/importance should address the likelihood/probability of occurrence, as well as other factors, such as legal protection, government policy, stakeholder views, and economic value.

Three levels of sensitivity/vulnerability/importance of receptors (low, medium, high) can be used as common practice, and in principle is a qualitative assessment when

statistics or common practice cannot be provided. In some cases, two additional levels, e.g. very low and very high are added. A depiction of this can be found in **Table 3-5**.

#### Impact & risk magnitude

Impact & risk magnitude essentially describes the intensity of the change that is predicted to occur in the receptor as a result of the potential impact or risk. The magnitude designations are universally consistent, but the definitions vary depending on the resource/receptor.

Five levels of impact magnitude (Positive; Negligible; Small; Medium and Large) are defined based on the impact characteristics described below (see **Table 3-6**). In the case of a potential positive impact, no magnitude designation (aside from “positive”) is assigned. It is considered sufficient for the purpose of the ESIA to indicate that the Project is expected to result in potential positive impacts, without characterizing the exact degree of positive change likely to occur (e.g. the magnitude and Sensitivity/Vulnerability/Importance). Noting that it is also common to exclude positive impacts in an ESIA. Therefore, using five levels of impact & risk magnitude is a common practice for ESIA.

Table 3-6. Characteristics for impact &amp; risk magnitude designation

Characteristic	Definition	Designation
<b>Type</b>	A descriptor indicating the relationship of the potential impact or risk to the Project (in terms of cause and effect).	<ul style="list-style-type: none"> <li>• Direct: Potential impacts or risks that result from a direct interaction between the Project and a resource/receptor (e.g. between the occupation of a plot of land and the habitats which are affected)</li> <li>• Indirect: Potential impacts or risks that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g. viability of a species population resulting from loss of part of habitat as a result of the Project occupying a plot of land)</li> <li>• Induced: Potential impacts or risks that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g. influx of camp followers resulting from the importation of a large project workforce)</li> <li>• Cumulative: Potential impacts or risks that result during the project life</li> </ul>
<b>Extent</b>	The “reach” of the potential impact or risk (e.g., confined to a small area around the Project footprint, projected for several kilometers, etc.).	<ul style="list-style-type: none"> <li>• Local</li> <li>• Regional</li> <li>• National</li> <li>• International</li> </ul>
<b>Duration</b>	The time period over which a resource/receptor is potentially affected.	<ul style="list-style-type: none"> <li>• Temporary</li> <li>• Short-term: 0-5 years</li> <li>• Medium term: 5-15 years</li> <li>• Long-term, permanent: More than 15 years</li> </ul>
<b>Scale</b>	The size of the potential impact or risk (e.g. the size of the area with the potential to be damaged or impacted, the fraction of a resource that could potentially be lost or affected, etc.)	[no fixed designations; intended to be a numerical value or a qualitative description of “intensity”] <ul style="list-style-type: none"> <li>• Large</li> <li>• Medium</li> <li>• Small</li> </ul>

<p><b>Frequency</b></p>	<p><b>A measure of the constancy or periodicity of the potential impact or risk.</b></p>	<ul style="list-style-type: none"> <li>• High: &gt; 60%</li> <li>• Medium: 40-60%</li> <li>• Low: 5-40%</li> <li>• Impossible, no chance: &lt;5%</li> </ul>
<p><b>Likelihood / Probability</b></p>	<p><b>Same as Frequency, to be applied to unplanned events</b></p>	<ul style="list-style-type: none"> <li>• Unlikely: The event is unlikely but may occur at some time during normal operating conditions</li> <li>• Possible: The event is likely to occur at some time during normal operating conditions</li> <li>• Likely: The event will occur during normal operating conditions (i.e., it is essentially inevitable)</li> </ul>

A tool for recoding impact & risk magnitude is provided in **Form 05 - Impact assessment**.

Noting, the mitigation and compensation measures will be developed for receptors with major and moderate impacts and can be extended to those with minor impact levels (if so chosen), and this is described in the next section.

**Example: Vulnerability and magnitude of surface water pollution from fly ash**

Biomass power plants create fly ash, which has the potential to contaminate surface water resources and impact connected ecosystems. However, fly ash is usually stored in a contained area on the site of a biomass power plant, and periodically removed to be used as a resource for materials such as asphalt or blocks (e.g. embedded in materials) or dumped in a hazardous waste landfill. An on-site containment area for fly ash may originally be designed with a 1m high wall and is covered. There is a risk that a severe storm can cause flooding on site that exceeds 1m high wall,

which will then wash the fly ash into the local surface water resource, contamination it, and also impacting flora and fauna in the connected ecosystem.

The Magnitude of the impact can be quantified by the expected amount of fly ash stored, as dispersed over/into the surface water resource, where the Vulnerability for pollution is related to the probability and frequency of a severe storm causing more than 1m of flooding. In addition, the related Sensitive of impact on flora and fauna can be determined based on the expected concentration of fly ash in the surface water resource.

### 3.6.3 Development of mitigation and/or compensation measures

Once the significance of a potential impact or risk has been characterized, the next step is to evaluate what mitigation and/or compensation measures are warranted to reduce impact or risk. For the purposes of the ESIA report, it is recommended to adopt the following mitigation and/or compensation Hierarchy:

- **Avoid and Reduce at Source:** avoiding or reducing the impact or risk at the source through changes in the design of the Project (e.g. mitigating impact or risk by using other technology, siting or re-routing activity away from sensitive areas, or reducing impact or risk by restricting the working area or changing the time of the activity);
- **Abate on Site:** adding technology or operation measures to the design to abate the impact or risk (e.g., pollution control equipment, traffic controls, perimeter screening, landscaping, etc.);
- **Abate at Receptors:** if an impact or risk cannot be abated on-site then mitigation and control measures can be implemented off-site (e.g. noise barriers to reduce noise impact at a nearby residence, fencing to prevent animals straying onto the site, etc.);
- **Repair or Remedy:** some impacts or risks involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work

camps or materials storage areas) and these impacts can be addressed through repair, restoration, or reinstatement measures; and

- **Compensate in Kind, Compensate Through Other Means:** where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, building new wetlands, financial compensation for damaged crops, providing community facilities for loss of fisheries access, recreation and amenity space, etc.).

The priority in mitigation is to first apply mitigation measures to the source of the potential impact (i.e., to avoid or reduce the magnitude of the potential impact or risk from the associated Project activity), and then to address the resultant effect on the receptor via abatement or compensatory measures or offsets.



### 3.7 Development of environmental and social management plan

*An environmental and social management plan (ESMP) aims to provide the mechanism to implement the mitigation and compensation measures during the implementation and operation of the project.*

The ESMP is a living document and will be used throughout the construction phase and operational life for the biomass power plant and possibly at the point of decommissioning. The basic components of an ESMP are the:

1. Institutional ESMP setup with roles and responsibilities of parties involved
2. ESMP records keeping and reporting requirements
3. Stakeholder engagement plan (incl. grievance and redress mechanisms)
4. Evaluation and enhancement mechanisms of the ESMP to be conducted periodically during the life-cycle of the project
5. Description of environmental management, mitigation & compensation measures, and monitoring
6. Description of social management, mitigation & compensation measures, and monitoring
7. Restoration and improvement plan for areas only used temporarily
8. Emergency and preparedness plan

Identifying the institutional setup (1) for managing and reporting on the ESMP is important so that key stakeholder know their individual roles and responsibilities in the ESMP. The key stakeholders involved and their roles and responsibilities will change during the pre-construction, construction, and operation phases of the project life-cycle. The ESMP shall have a clear set of records keeping and reporting requirements (2) that are easy to follow for the stakeholders involved. These include when and how to keep records as well as who shall be responsible for them (see **Form 06 – ESMP (A) Management**).

Part of the ESMP is a stakeholder engagement plan (3) which should periodically engage with stakeholders during the project life-cycle, and be set up to address their grievances where possible. It is common for such plans to hold frequent engagements during the pre-construction, construction, and commissioning phases, usually monthly or quarterly, and then semi-annually or annually during the operation phase (see **Form 06 – ESMP (A) Management**).

An ESMP should have an evaluation and enhancement mechanism (4) established when it is prepared and approved. This often takes the form of periodic assessments and needed changes to the ESMP. At a minimum, this should take place shortly after commissioning, and typically on a biennial basis

thereafter but no later than 5-years after the last evaluation. The evaluation and enhancement mechanism should also include the need for capacity building to improve the ESMP and its performance, this may include the need to implement the ESMP as well (see **Form 06 – ESMP (A) Management**).

Specific to environmental (5) and social (6) mitigation & compensation measures and monitoring, the ESMP forms should include the receptor impacts, the proposed mitigation and compensation measures, the measuring parameters (baseline, measured, and target values), the method and frequency of measuring, and the party/person responsible (see **Form 07 – ESMP (B) Monitoring**). It is noted that many of these parameters will likely be required to measure in accordance with both environmental and social regulations in Viet Nam, so there should not be much additional work.

Some land used in projects for biomass power plants and their supply chains is temporary (7) used during construction or seasonally, the ESMP should take into account how this land is restored and/or improved upon before handing it back to the owners, and how this will be measured (see **Form 08 – ESMP (C) Land & Emergency**).

All biomass power plants have emergency and preparedness plans (8) which may be specific to health, safety, and environmental plans and procedures prepared during commissioning and in compliance with national and local regulations. The ESMP should track

that these are prepared, available to stakeholders, and that involved stakeholders are trained in them (e.g. employees and nearby community as applicable) (see **Form 08 – ESMP (C) Land & Emergency**).

For the benefit of all stakeholders it is also recommended (where possible) to identify the needs for technical assistance and capacity building to implement and operate the ESMP from the point of construction to decommissioning. Further guidance on preparing a simple ESMP can be found in resources provided by the International Union for Conservation of Nature (IUCN)<sup>1</sup>.

<sup>1</sup> IUCN (2019) 'Developing and Monitoring an Environmental and Social Management Plan (ESMP)



### 3.8 Stakeholder engagement and consultation

Stakeholder engagement and consultation aims to provide a mechanism through which people from a diversity of backgrounds and perspectives are provided with an opportunity to raise issues and to have these issues considered.

It is strongly encouraged to organize stakeholder engagement and consultations during all steps of ESIA. It is imperative that this be done in the screening & scoping baseline and impact & risks assessment, and appraisal steps. It is optional, but also beneficial to include in the mitigation and compensation and ESMP development steps. Please note that stakeholder engagement and consultation are also included as a continual process in the ESMP.

Special consideration should be taken with engagement and consultation when either a gender assessment or

indigenous people are included in the boundary of the project. These special groups should be included in the broader engagement and consultation along with the other stakeholders, but these special groups should also be engaged and consulted separately as a group without the other stakeholders present so that these special groups may provide more direct and honest feedback.

A brief overview of expected outputs and outreach methods of the engagement and consultation process is provided in **Table 3**. In Viet Nam there is a regulatory requirement for stakeholder consultation during the EIA process, and further international guidance on conducting engagement and consultation can be found in resources provided by the IFC<sup>1</sup> and United Nations Development Program (UNDP)<sup>2</sup>.

<sup>1</sup> IFC (2007) 'Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets'  
<sup>2</sup> UNDP 'Guidance Note UNDP Social and Environmental Standards (SES): Stakeholder Engagement' (2020)



Table 3-7. Stakeholder engagement and consultation

Purpose	Important stakeholder	Expected output	Method
<b>Screening, Scoping</b>	<ul style="list-style-type: none"> <li>Government authorities at the national, regional and local levels</li> </ul>	<ul style="list-style-type: none"> <li>Stakeholders are informed and educated about the proposed projects, its potential impacts, building capacity to participate</li> <li>Stakeholders contribute to issues of concern and suggestion for enhanced benefits identified</li> <li>Stakeholders provide comments, alternative solutions, and additional knowledge</li> </ul>	<ul style="list-style-type: none"> <li>One-to-one dialogue</li> <li>Focus group discussion</li> </ul>
<b>Baseline study and impact &amp; risk assessment</b>	<ul style="list-style-type: none"> <li>Government authorities at the national, regional and local levels</li> <li>Local communities within 50km from the project site, also depending on sources of biomass supply chain</li> </ul>	<ul style="list-style-type: none"> <li>More in-depth interaction with stakeholders</li> <li>Stakeholder's inputs and comments are verified and responded</li> </ul>	<ul style="list-style-type: none"> <li>One-to-one dialogue</li> <li>Focus group discussions</li> <li>Workshop, seminars</li> </ul>
<b>Development of mitigation and compensation measures</b>	<ul style="list-style-type: none"> <li>Government authorities at the national, regional and local levels</li> <li>Local communities within 50km from the project site, also depending on sources of biomass supply chain</li> </ul>	<ul style="list-style-type: none"> <li>Identify if proposed mitigation and compensation measures are appropriate for different stakeholder groups</li> <li>Stakeholder's inputs and comments are verified and responded</li> </ul>	<ul style="list-style-type: none"> <li>One-to-one dialogue</li> <li>Focus group discussions</li> </ul>



Purpose	Important stakeholder	Expected output	Method
<b>Development of ESMP (optional)</b>	<ul style="list-style-type: none"> <li>Government authorities at the national, regional and local levels</li> <li>Local communities within 50km from the project site, also depending on sources of biomass supply chain</li> <li>Employees</li> </ul>	<ul style="list-style-type: none"> <li>Identify if the proposed ESMP setup, measures, and implementation plan are appropriate for different stakeholder groups</li> <li>Stakeholder's inputs and comments are verified and responded</li> </ul>	<ul style="list-style-type: none"> <li>One-to-one dialogue</li> <li>Focus group discussions</li> </ul>
<b>Decision making and appraisal</b>	<ul style="list-style-type: none"> <li>Government authorities at the national, regional and local levels</li> <li>Local communities within 50km from project site, also depending on sources of biomass supply chain</li> <li>Employees</li> <li>Association, media</li> </ul>	<ul style="list-style-type: none"> <li>Stakeholders are provided with a final opportunity to comment</li> <li>Stakeholders are informed about final decision</li> </ul>	<ul style="list-style-type: none"> <li>Mass media</li> <li>Brochure, information sheets</li> </ul>

The results of each consultation and engagement shall be documented as one of the inputs for ESIA (see **Form 07 - Consultation**). A summary of the results of all the consultations and engagements shall be included in the ESIA report.

### 3.9 ESIA reporting

The results of the ESIA shall be consolidated into a ESIA report. This report should be a narrative that addresses the methodology used to perform the ESIA, the important project related information gained during the ESIA process, and the results from ESIA. It is recognised that ESIA may be performed under two different cases in the project development process, and this will dictate the final content of the ESIA report.

- Under Case 1**, a detailed design of the biomass power plant may not be available and related biomass supply chain not secured (or fully identified), in addition an EIA may have not been started or finalised. This case is usually applicable when the biomass power plant is tendered under an Engineering Construction and Procurement (EPC) process, which means the detailed and final design comes after financing is secured and supply contract signed. This case is also applicable when the biomass supply is not secured or finally decided. Usually this means that the EIA and the ESMP cannot be fully completed before the ESIA is completed, as they require the final design. In this Case 1, only ESMP recommendations can be prepared, and the full ESMP will need to be developed as a part of the EPC supplier's responsibility, which may include finalising the EIA as well.

- Under Case 2**, a detailed design of the biomass power plant is available, the related biomass supply chain is known, and EIA is either prepared in parallel to the ESIA or is already completed.

**Table 3** below presents an example of a standard ESIA report outline for these two cases. In which, Chapter 10 has a different structure based on the two cases as described above.

Table 3-8 ESIA report outline

Chapter	Content	
<b>Chapter 1</b>	Introduction	Brief information about the project <ul style="list-style-type: none"> <li>• Basic information Development and planning status</li> <li>• Developer information</li> <li>• Brief description of the Environmental and Social Management System</li> </ul>
<b>Chapter 2</b>	Project Description	Description of the Project development <ul style="list-style-type: none"> <li>• Site selection process and alternative sites</li> <li>• Project status and proposed schedule and a description of the facilities, equipment, and the associated activities that will be carried out during the site preparation, construction, and operation phases</li> <li>• Alternative solutions</li> </ul>
<b>Chapter 3</b>	Administrative Framework	Applicable requirements and standards associated with the project development <ul style="list-style-type: none"> <li>• National framework</li> <li>• International standards and good practice</li> </ul>
<b>Chapter 4</b>	Impact & Risk Assessment Methodology	Methodology used for <ul style="list-style-type: none"> <li>• Collection and analysis of primary data</li> <li>• Collection and analysis of secondary data.</li> </ul>
<b>Chapter 5</b>	Screening and Scoping	Methodology used for undertaking screening and scoping, and setting the ESIA boundary

Chapter	Content	
<b>Chapter 6</b>	Stakeholder Engagement	Description of the stakeholder consultations throughout the ESIA process and project development (to date) <ul style="list-style-type: none"> <li>• Engagement methodology</li> <li>• List and description of key stakeholders</li> <li>• Engagement and consultation activities</li> </ul>
<b>Chapter 7</b>	Baseline Assessment	Environmental and social baseline conditions within the Project area, its surroundings and along with the biomass supply chain <ul style="list-style-type: none"> <li>• Physical condition (topography and geology conditions, climate and meteorology, hydrology, water quality, air, soil)</li> <li>• Biodiversity</li> <li>• Social and economic conditions for the potentially community affected by the project</li> </ul>
<b>Chapter 8</b>	Impact & Risk Assessment	Impact and risks during construction, operation and disassembly <ul style="list-style-type: none"> <li>• Physical impact and risks</li> <li>• Biodiversity impact and risks</li> <li>• Socio-economic impact and risks</li> <li>• Potential impact and risks from unplanned events</li> </ul>
<b>Chapter 9 (optional)</b>	General Conclusions and Summary of Applicable IFC PS (can also be used instead as an executive summary)	A general narrative of the broad environmental and social impacts and a summary of mitigation recommendations <ul style="list-style-type: none"> <li>• Brief details of the project and major concerns Summary of impacts and risks</li> <li>• Summary of mitigation &amp; compensation recommendations</li> </ul> <p>(Note that impacts and risks and mitigation recommendations can also be listed per IFC PS)</p>



Chapter	Content	
<b>Chapter 10 (for Case 1)</b>	Recommendations for an Environmental and Social Management Plan (ESMP)	<p>Recommendations for the ESMP and potential mitigation and compensation measures to manage negative impacts</p> <ul style="list-style-type: none"> <li>• Recommended institutional ESMP setup with roles and responsibilities</li> <li>• Recommended environmental management, mitigation and compensation measures, and monitoring</li> <li>• Recommended social management, mitigation and compensation measures, and monitoring</li> </ul>
<b>Chapter 10 (for Case 2)</b>	Environmental and Social Management Plan (ESMP)	<p>The ESMP should be described and at a minimum include the following</p> <p>Institutional ESMP setup with roles and responsibilities</p> <ul style="list-style-type: none"> <li>• ESMP records keeping and reporting requirements</li> <li>• Description of environmental management, mitigation and compensation measures, and monitoring</li> <li>• Description of social management, mitigation and compensation measures, and monitoring</li> <li>• Stakeholder engagement plan (incl. grievance and redress mechanisms)</li> <li>• Restoration and improvement plan</li> <li>• Emergency and preparedness plan</li> <li>• Evaluation and enhancement mechanisms (of the ESMP)</li> </ul>



# 4.

## FORMS AND TEMPLATES

#### 4.1 Form 01 - Project information

Objective: To share first information with stakeholders  
 Prepared by: Project developer  
 Application: All stages of ESIA  
 Method : Pre-filled to share, to be updated before use

Date	<input type="text"/>	
1. Project's name	<input type="text"/>	
2. Location	<input type="text"/>	
3. Investor's name	<input type="text"/>	
Represented by	<input type="text"/>	
Position	<input type="text"/>	
4. Type of biomass	<input type="text"/>	
5. Power capacity (MW)	<input type="text"/>	
6. Type of project	<input type="checkbox"/> New	<input type="checkbox"/> Extension
7. Manager in charge of ESIA	Full name <input type="text"/>	Tel. <input type="text"/>
8. Staff in charge of ESIA	Full name <input type="text"/>	Tel. <input type="text"/>
9. Stage of investment	<input type="checkbox"/> Pre-FS	<input type="checkbox"/> FS
	<input type="checkbox"/> Construction	<input type="checkbox"/> Trial run
	<input type="checkbox"/> Operation	<input type="checkbox"/> Disassembly

#### 10. Availability of licenses, permits, supporting documents

Investment	<input type="checkbox"/> Investment policy agreement	<input type="checkbox"/> Investment certificate
Basic design	<input type="checkbox"/> Report	<input type="checkbox"/> Approved
Feasibility study	<input type="checkbox"/> Report	<input type="checkbox"/> Approved
Geological survey	<input type="checkbox"/> Report	<input type="checkbox"/> Approved
Biomass supply study	<input type="checkbox"/> Report	<input type="checkbox"/> Approved
Technical design	<input type="checkbox"/> Report	<input type="checkbox"/> Approved
Environmental protection	<input type="checkbox"/> EIA report	<input type="checkbox"/> EIA approval
	<input type="checkbox"/> License	<input type="checkbox"/>
Firefighting plan*	<input type="checkbox"/> Plan	<input type="checkbox"/> Approved
Electricity	<input type="checkbox"/> Power purchase agreement	<input type="checkbox"/> Electricity generation license
Construction	<input type="checkbox"/> Construction permit	<input type="checkbox"/> Operation permit
Report, timeline	<input type="text"/>	

Note: (\*) applied for a transformer station has voltage level from 110kV.



4.2 Form 02- Screening

Objective: To define if a project required ESIA  
 Prepared by: Independent evaluator  
 Application: Screening stage  
 Method: Consolidation with authority stakeholders

Date

1. Project's name

2. Compliance requirement?  
 EIA  Yes  No  
 Explain

3. Likely to have impact on natural resources (climate, topographic, geological, water (including hydrological), air and soil)?  
 Potential significant impact  Potential limited impact  
 Minimal or no impact  
 Explain-impact from mitigation

Explain - impact from compensation

Explain - impact from disclosure

4. Likely to have impact on biodiversity (flora (plants), fauna (animals, insects) and natural habitats such as terrestrial, underground, and aquatic & marine environments)?  
 Potential significant impact  Potential limited impact  
 Minimal or no impact  
 Explain-impact from mitigation

Explain - impact from compensation

Explain - impact from disclosure

5. Likely have impact on socio-economic resources (population (households and communities), society conditions, cultural heritage and customs, utilities, transportation and health systems, business and employment)?  
 Potential significant impact  Potential limited impact  
 Minimal or no impact  
 Explain-impact from mitigation

Explain - impact from compensation

Explain - impact from disclosure

6. ESIA to be carried out  
 Yes  No  
 Explain

### 4.3 Form 03 - Scoping

Objective:	To define boundary of ESIA
Prepared by:	Independent evaluator
Application:	During scoping
Method:	Desk study and site visit

#### Receptors in the content of EIA of a biomass power project

	NATURAL						ECOLOGY					SOCIO-ECONOMIC							
	Climate	Topographic	Geological	Water resources (including hydrology)	Air	Land resources	Noise	Flora (plants)	Fauna (Animals, insects)	Terrestrial habitat	Underground habitat	Underwater and marine habitats	Population (households and communities)	Society conditions	Cultural heritage and customs	Utilities	Transportation system	Health and safety (including services)	Business and employment
Land acquisition																			
Site clearance, excavation, levelling, fencing																			
Transportation of labour and equipment																			
Plant construction																			
Pre-processed and transportation of biomass (supply chain)																			
Pre-processed and storage of biomass (at site)																			
Equipment operation (boiler, gasifier, turbine, biomass feeding, etc)																			
Workforce mobilization																			
Consumption/supply of biomass, water, chemicals																			
Incident management (fire, spill, etc)																			
Wastes and fly ash management																			
Wastewater management																			
Other (specify)																			

+: important, o: uncertain, -: negligible



4.4 Form 04 - Baseline study

Objective: To define conditions of receptor within project areas and needs  
 Prepared by: Independent evaluator  
 Application : During baseline study, to be updated during impact assessment if needed  
 Method: Desk study, site visit and stakeholder consultation

Date					
<b>1. Project name</b>					
<b>2. Natural baseline data</b>	<b>ESIA boundary</b>	<b>Values</b>	<b>Unit</b>	<b>Source/method/ number of data</b>	<b>Note</b>
Air quality					
Parameter 1					
Parameter 2					
Noise and vibration					
Parameter 1					
Parameter 2					
Hydrology and soil					
Parameter 1					
Parameter 2					
Freshwater quality					
Parameter 1					
Parameter 2					

Groundwater quality

Parameter 1					
Parameter 2					

Other

Parameter 1					
Parameter 2					

Note (existing sources that may contribute to physical change)

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**3. Biodiversity baseline data**

Terrestrial, subterranean habitat

Modified habitat

	ESIA boundary	Name	Conditions	Sources/method	Note
Parameter 1					
Parameter 2					

Important habitat

Parameter 1					
Parameter 2					

Natural habitat

Parameter 1					
Parameter 2					

Legally protected and internationally recognized area					
Parameter 1					
Parameter 2					
Invasive alien species					
Parameter 1					
Parameter 2					
Aquatic and marine habitat					
Modified habitat					
Parameter 1					
Parameter 2					
Important habitat					
Parameter 1					
Parameter 2					
Natural habitat					
Parameter 1					
Parameter 2					
Legally protected and internationally recognized area					
Parameter 1					
Parameter 2					
Invasive alien species					
Parameter 1					
Parameter 2					

Note: Existing ecosystem services

**4. Socio-economic baseline data**

Livelihood

Parameter 1					
Parameter 2					

Land use

Parameter 1					
Parameter 2					

Cultural heritage

Parameter 1					
Parameter 2					

Infrastructure and public services

Parameter 1					
Parameter 2					

Community health and safety

Parameter 1					
Parameter 2					

Economy and employment

Parameter 1					
Parameter 2					

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ESIA boundary	Values	Unit	Sources/method	Note
---------------	--------	------	----------------	------



Traffic and transport

Parameter 1					
Parameter 2					
Parameter 1					
Parameter 2					

Gender integration

Note: Demographic change, economic change



### 4.5 Form 05 - Impact assessment

Objective: To consolidate and present impact level  
 Prepared by: Independent evaluator  
 Application: During impact assessment, can be attached to ESIA report  
 Method: Qualitative and quantitative (modelling)

Date

1. Project's name

		Sensitivity/ Vulnerability/ Importance	Impact type	Impact extent	Impact duration	Impact scale	Frequency, likelihood	Impact magnitude	Impact rating
2. Receptor's name	Impact/ risk name	(very low) Low Medium High (Very high)	Direct Indirect Induced Accumulated	(on site only) Local Regional National Internationals	Temporally Short term Medium term Long term (Permanent)	(Very large) Large Medium Small (Very small)	High Medium Low Impossible or no chance	Small Medium Large (very large)	Negligible Minor Moderate Major

1.									
2.									
3.									
4.									
...									

In this entire table, the parts outside the brackets are used to assess the impact in the projects, the parts in brackets are optional.

4.6 Form 06 - Environmental and Social Management Plan (A)

Project name			Date			
<b>1. Role and Responsibility</b>						
Name of the person in charge	Impact/risk type	Specific role or management responsibility	Stages	Responsiveness record keeping	Other describes	
1.						
2.						
3.						
4.						
5.						
<b>2. Recording data</b>						
Name of the person in charge	Impact/risk type	Specific records to be kept (fill in)	Stage	Frequency of information update	The last update date	Performance place
1.						
2.						
3.						
4.						
5.						

**3. Conduct consultations**

Consultant's name	Impact/risk type	Consultation content	Stage	Actions notes	Performance date	Performance place
1.						
2.						
3.						
4.						
5.						

**4. Evaluation and improvement of ESMP**

Name of the person in charge	Evaluation type	The improvement have been conducted to ESMP	Status change	Identified capacity building requirement	Evaluation date	Performance place
1.						
2.						
3.						
4.						
5.						





**4.9 Form 09 – Land Use and Emergency Response - Environmental and Social Management Plan (C)**

Date

Project's name

**1. Land use (including resettlement and/or compensation land)**

Land owner	Stage	Land use purposes	Recovery/or compensation plan	Has recovery and/or compensation completed?	Feedback	Date	Performance place
1.							
2.							
3.							
4.							

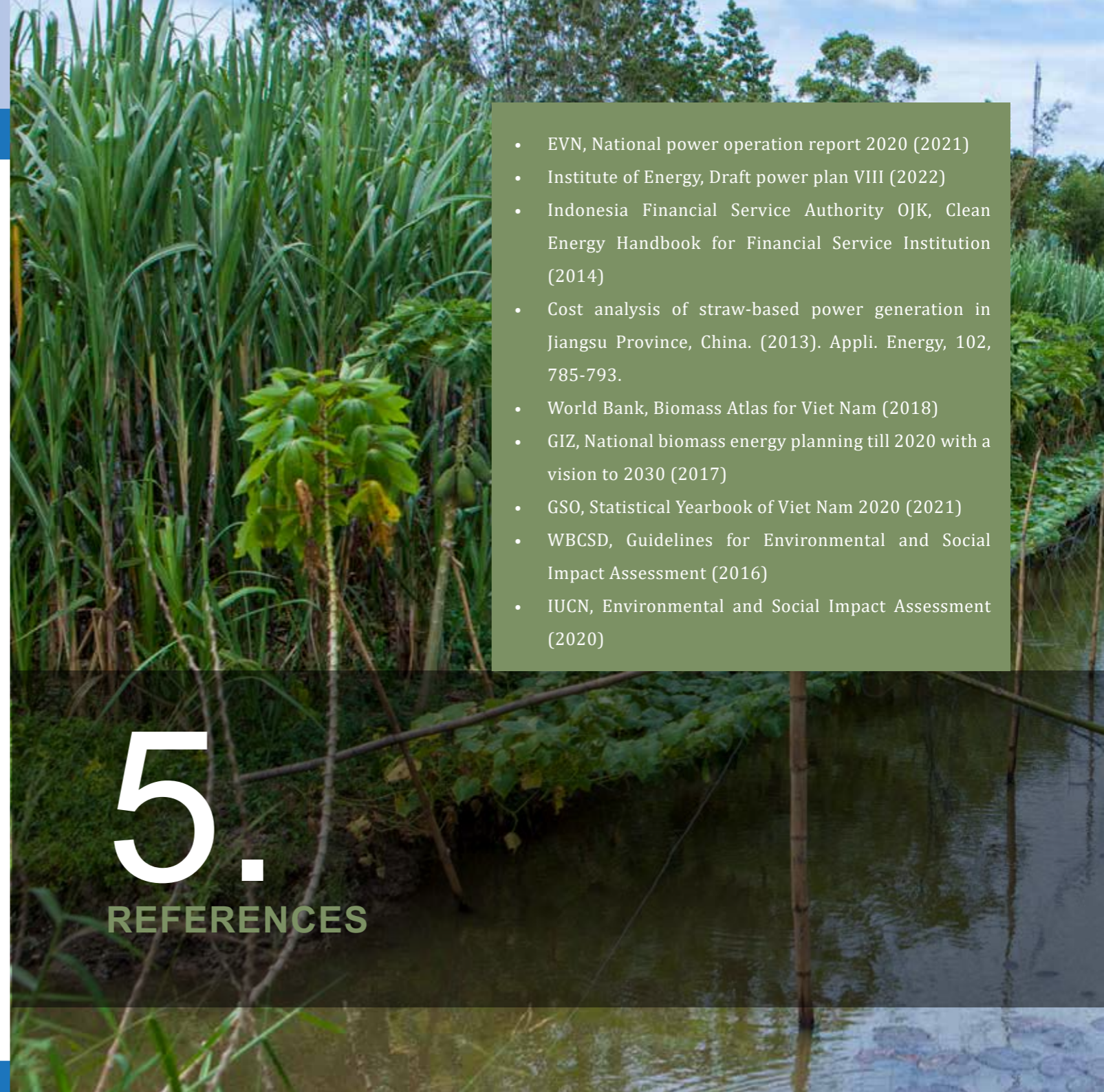
**2. Emergency preparedness and response plan**

Impact/risk type	Stage	Situation	Specified name of impact and risk	Emergency preparedness and response plan	Performance place	Implementing entity	The last update (date)
1.							
2.							
3.							
4.							

- EVN, National power operation report 2020 (2021)
- Institute of Energy, Draft power plan VIII (2022)
- Indonesia Financial Service Authority OJK, Clean Energy Handbook for Financial Service Institution (2014)
- Cost analysis of straw-based power generation in Jiangsu Province, China. (2013). Appli. Energy, 102, 785-793.
- World Bank, Biomass Atlas for Viet Nam (2018)
- GIZ, National biomass energy planning till 2020 with a vision to 2030 (2017)
- GSO, Statistical Yearbook of Viet Nam 2020 (2021)
- WBCSD, Guidelines for Environmental and Social Impact Assessment (2016)
- IUCN, Environmental and Social Impact Assessment (2020)

# 5.

## REFERENCES







6  
ANNEX



### 6.1 Annex 1. Current status of implementation of approved biomass power projects according to power planning VII

No.	Project name	Province	Energy source	Approved capacity, MW	Year of operation
1	Soc Trang	Soc Trang	Bagasse	12	1997
2	Nghe An	Nghe An	Bagasse	10	1997
3	Vietsugar	Khanh Hoa	Bagasse	60	1997
4	TTC-Gia Lai 1	Gia Lai	Bagasse	12	1997
	TTC-Gia Lai 2			23	1997
5	Bourbon	Tay Ninh	Bagasse	37	1998
6	Lam Son	Thanh Hoa	Bagasse	19	1999
7	La Nga	Dong Nai	Bagasse	1	2000
8	BHS-NH	Khanh Hoa	Bagasse	30	2006
9	KCP 1	Phu Yen	Bagasse	30	2017
	KCP2			30	not yet
10	An Khe 1	Gia Lai	Bagasse, agriculture residues (bean, peanut shells, rice husk...)	55	2018
	An Khe 2			55	2018
11	Son Duong	Tuyen Quang	Bagasse	25	2019
12	TTC - Tay Ninh	Tay Ninh	Bagasse	24	2020
13	Son La	Son La	Bagasse	9	not yet
14	Truong Minh 1	Yen Bai	Wood chips, pellets	29	not yet
15	LEE & Man	Hau Giang	Wood	125	cancelled
16	Hau Giang rice husk	Hau Giang	Rice husk	20	not yet
			<b>Total</b>	<b>605</b>	

### 6.2 Annex 2. Characteristic parameters of biomass materials

Parameter	Description
Moisture content	Moisture content of biomass is defined as the quantity of water in the material expressed as a percentage of the materials weight. Wet biomass is not preferred since it reduce the heating value of biomass and give difficulty of ignition. High moisture content biomass could be also the reasons of bad color of flue gas when combustion process is not proper. With the fluffy structure, biomass could be easy to become wet by suffering of weather condition. Suitable drying before combustion or gasification could be an option for using biomass as a fuel.
Ash content and ash composition	Ash is the inorganic or mineral content of the biomass, which remains after complete combustion. Ash content affect to the design of furnace as well as gasification reactor since it requires different way of ash removal method. Chemical composition of the ash is also important because it affect the melting behavior of the ash. Ash melting can cause slagging and channel formation in gasification reactor and furnace. Slag may ultimately block the ash removal system and make furnace or gasification reactor become full that prevent the new fuel coming in.
Elemental composition	The generic formula for biomass is CH <sub>1.4</sub> O <sub>0.6</sub> on dry ash free basic. The elemental composition of the fuel is important with respect to the heating value and the emission level in almost all applications. For ultimate analysis of fuel, C, H, N, S, O, ash and moisture should be considered. N, S content in biomass is low so with the proper combustion or gasification process, biomass is a clean and low emission fuel. other elements such as Cl, alkaline, heavy metal can affect to behavior of ash or give special emission in flue gas such as furan, dioxin.



Parameter	Description
Heating value	<p>This is defined as total amount of heat energy in term of kJ (or other type of energy unit such as kCal, Btu etc.) produced when burning one kg (or other type of mass unit such as pound) of fuel. The heating value is determined by the elemental composition, the ash content of biomass and in particularly on the fuel moisture content. on a dry and ash free basis, most biomass species have a heating value of 19 MJ/kg. the heating value of fuel could be measured in bomb calorimeter whereas fuel is combusted with oxygen. heating value could be identified and presented into 2 categories of higher heating value (HHV) or lower heating value (LHV).</p> <ul style="list-style-type: none"> <li>Higher heating value (HHV) or gross calorific value is maximum amount of energy could be obtained from combusting fuel including the heat energy from the condensation of steam in flue gas in combustion process.</li> <li>Lower heating value (LHV) or net calorific value is the energy obtained from combusting fuel excluding the heat energy from the condensation of steam in flue gas in combustion process.</li> </ul> <p>With the same fuel, LHV is lower compared to HHV and it affect to the methodology of calculating efficiency of the combustion equipment as well as efficiency of gasification reactor. in general, Europe calculates based on LHV and USA prefers to calculate based on HHV. with the same equipment, efficiency calculated based on LHV will be higher compare to efficiency calculated based on HHV.</p>
Volatile mater content	<p>When fuel is heated in an oxygen-free environment, the bonds of organic molecules are decomposed. that process is called thermal decomposition or pyrolysis. The products of thermal decomposition are gases called volatile matter (V), including hydrogen, hydrocarbon, carbon monoxide, carbonic. The volatile matter of solid fuel has a great influence on the fuel combustion process, the high content of volatile matter creates fast ignition and quickly burned out. The more volatile the fuel, the longer the flame because volatile gases easier to mix with oxygen in combustion process. Also high volatile fuel can give more tar in flue gases that may create brown color in flue gases in case of improper air supply in combustion process.</p>

Fixed carbon content	<p>Fixed carbon or char or coke is the remaining solid of fuel after remove volatile matter and minus the ash. Charcoal is type of fixed carbon of fuel. Fixed carbon is an important combustible component. Higher fixed carbon content of fuel give difficulty for ignition but stable heat and longtime of burning out. Biomass with higher fixed carbon also harder and consume more energy for grinding or cutting.</p>
Bulk density and morphology	<p>Bulk density refers to the weight of materials per unit of volume. It differs for various type of biomass. Together with heating value, it determines energy density of the using equipment i.e. The potential energy available per unit volume of feedstock. biomass of low density is expensive to handle, transport and store. Apart from handling and storing behavior, the bulk density is important for the performance of biomass as a fuel inside fixed bed reactors: high void age tends to result in channeling, bridging, incomplete conversion and decrease in capacity of the gasifier. Fluid bed gasifiers are more flexible to the bulk density but feeding remains problematic.</p> <p>The size and size distribution of the biomass are important in organizing the combustion process in a furnace. The bigger size can create a bigger void age and bad mixing for air – fuel in combustion. The requirement for excess air may increase with the big size of fuel. Smaller size fuel could be penetrated through the grate before burning. uniform particle size and favorable particle properties are important to avoid such problem.</p>

### 6.3 Annex 3. Preparing and conducting a stakeholder consultation

Preparing and conducting a Consultation during and after the ESIA<sup>1</sup>

Objectives	Description	Examples of validation methods
1. Company strategy, policy, or principles of engagement	Strategy, policy, or principles for on-going stakeholder engagement with explicit mention of affected communities and relevant standards.	Client's strategy, policy or principles or other supporting documents.
2. Stakeholder identification and analysis	As part of the environmental and social assessment process, identification of all affected communities, their disaggregation (numbers, locations) in terms of different levels of vulnerability to adverse project impacts and risks, and an analysis of the effect of adverse project impacts and risks on each group. As part of the environmental and social assessment process, this analysis should also look at communities and individuals that will benefit from the project.	Stakeholder analysis document as part of ESIA or SEA. Client's planning documentation for stakeholders engagement, e.g., communications strategy, consultation plan, public consultation and disclosure plans, and stakeholder engagement plan.

3. Stakeholders engagement	A process of consultation that is ongoing during the project planning process (including the process of environmental and social assessment), such that: (i) affected communities have been engaged in: (a) identifying potential impacts and risks; (b) assessing the consequences of these impacts and risks for their lives; and (c) providing input into the proposed mitigation measures, the sharing of development benefits and opportunities and implementation issues; and that (ii) new impacts and risks that have come to light during the planning and assessment process have also been consulted upon.	Client's schedule and record of stakeholder engagement. Client's record of discussions with recognized stakeholder representatives, respected key informants, and legitimate representatives of sub-groups (e.g., women, minorities).
4. Information disclosure	Timely disclosure by the client of project information by the client to affected communities about (i) the purpose, nature, and scale of the project; (ii) the duration of proposed project activities; (iii) any risks to and potential impacts on such communities and relevant mitigation measures; (iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism.	Disclosure should be in a form that is understandable and meaningful. Client's materials prepared for disclosure and consultation. Client's record of discussions with recognized stakeholders representatives; respected key informants; and legitimate representatives of subgroups.

<sup>1</sup> Annex C- An Example of Indicators and Validation Methods for Informed Consultation and Participation (ICP) Process of IFC Published January 1, 2012 (updated June 14, 2021).



Objectives	Description	Examples of validation methods
5. Informed participation	Evidence of the client's organized and iterative consultation, leading to the client's specific decisions to incorporate the views of the affected communities on matters that affect them directly, such as the avoidance or minimization of project impacts, proposed mitigation measures, the sharing of project benefits and opportunities, and implementation issues.	Client's schedule and record of stakeholder engagement. The client's documentation of measures taken to avoid or minimize risks to and adverse impacts on affected communities in response to stakeholders' feedback received during consultation. Drafts of relevant action plans.
6. Vulnerable groups – consultation and mitigation	Evidence that individuals or groups particularly vulnerable to adverse project impacts and risks have been party to effective free, prior, and informed consultation as well as informed participation, and evidence that the potential impacts and specific or exacerbated risks to them will be mitigated to the satisfaction of these parties.	Stakeholder analysis as part of ESIA or sea or socioeconomic baseline data. Client's record of stakeholder engagement, including record of discussions with legitimate representatives of vulnerable groups. Client's documentation of measures taken to avoid or minimize risks to and adverse impacts on vulnerable groups in response to feedback received during consultation. Drafts of relevant action plans.

7. Grievance mechanism – structure, procedure, and application	An effective grievance mechanism procedure that is fully functioning (i) throughout the process of environmental and social assessment; and (ii) that is suitable for the operational phase of the project to receive and address the affected communities' concerns about the client's environmental and social performance. The mechanism should be culturally appropriate, readily accessible to all segments of the affected communities, and available to affected communities at no cost and without retribution.	Client's organizational structure and responsibilities, and procedures for managing grievances. Client's record of grievances received about the project and addressed, including expressions in support or dissent. Client's record of discussions with recognized stakeholder representatives, respected key informants, and legitimate representatives of subgroups.
8. Feedback to affected communities	Documentation that the client provided the results of consultation to the affected communities, and either (i) demonstrated how the comments and recommendations made by the affected communities have been accommodated in the project design, mitigation measures, and/or sharing of development benefits and opportunities; or (ii) provided a rationale why these comments and recommendations have not been accommodated.	Client's record of stakeholder engagement. Client's documentation of measures taken to avoid or minimize risks to and adverse impacts on affected communities. Discussions with recognized stakeholder representatives, respected key informants, and legitimate representatives of subgroups. Client's ongoing reporting on implementation of relevant action plans. Revised management program or action plans.

#### 6.4 Annex 4. IFC performance standards (PSs)

Category	Description
PS1. Assessment and management of environmental and social risks and impacts	
Principles	<p>✓ Underscores the importance of the environmental and social management system (ESMS) that plays a significant role in resolving all incidents throughout the life of a biomass power project. It supports the management that involves engagement between the investors, its workers, local communities directly affected by the project (the affected community), and, where appropriate, other stakeholders, are those not directly affected by the projects, which have an interest in it. these could include national and local authorities, neighboring projects, or non-governmental organizations.</p>
Objectives	<p>✓ Introduction the importance and need of establishing an environmental and social management system for each biomass power project investment that will implement the missions:</p> <ul style="list-style-type: none"> <li>- Identification and evaluation of the environmental and social risks and impacts of the biomass power project.</li> <li>- Proposing solutions to prevent or minimize risks or impacts of the project on affected objects.</li> <li>- Resolving grievances from the communities affected by the biomass power projects.</li> <li>- Promoting and providing means for adequate engagement with affected communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.</li> </ul>

Scopes application	<p>✓ This PS applies to projects with environmental and/or social risks and/or impacts. For the purposes of this PS, the term “project” refers to a defined set of activities during the life cycle, including those where specific physical elements, aspects, and facilities likely to generate risks and impacts, have yet to be identified. Where applicable, this could include aspects from the early developmental stages through the entire life cycle (design, construction, commissioning, operation, decommissioning, closure or, where applicable, post-closure) of a physical asset. The requirements of this PS apply to all activities of a biomass power project.</p>
PS2. Labor and working conditions	
Principles	<p>✓ This PS recognizes that for any business, the workforce is an important factor, and a good worker-management relationship is a key ingredient in the sustainability of an investor. In contrast, a failure worker-management relationship can undermine worker commitment and retention, and can jeopardize a project investment. Conversely, through a constructive worker-management relationship, and by treating the workers fairly and providing them with safe and healthy working conditions, investors may create tangible benefits, such as enhancement of the efficiency and productivity of their operations.</p>
Objectives	<ul style="list-style-type: none"> <li>✓ To promote the fair treatment, nondiscrimination, and equal opportunity of workers.</li> <li>✓ To establish, maintain, and improve the worker-management relationship.</li> <li>✓ To promote compliance with national employment and labor laws.</li> <li>✓ To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the investor’s supply chain.</li> <li>✓ To promote safe and healthy working conditions, and the health of workers.</li> <li>✓ To avoid the use of forced labor.</li> </ul>



Category	Description
Scopes application	<ul style="list-style-type: none"> <li>✓ The application of this PS should be implemented during the environmental and social risks and impacts identification process. The implementation of the actions necessary to meet the requirements of this performance standard is managed through the environmental and social management, system (ESMS), the elements of which are outlined in performance standard 1.</li> <li>✓ The scope of application of this PS depends on the type of employment relationship between the investor and the employees. It applies to employees directly engaged by the investor (direct employees), employees engaged through third parties to perform work related to core business processes of the project for a substantial duration (contracted employees), as well as workers engaged by the investor's primary suppliers (supply chain employees).</li> </ul>
PS3. Resource efficiency and pollution prevention	
Principles	<ul style="list-style-type: none"> <li>✓ This PS recognizes that most of industrial project investment often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. Meanwhile, the current and projected atmospheric concentration of greenhouse gases (GHG) threatens the public health and welfare of current and future generations. This PS outlines a project-level approach to resource efficiency, pollution prevention, and control in line with internationally disseminated technologies and practices. In addition, this PS promotes the ability of private sector companies to adopt such technologies and practices as far as their use is feasible in the context of a project that relies on commercially available skills and resources.</li> </ul>
Objectives	<ul style="list-style-type: none"> <li>✓ To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.</li> <li>✓ To promote more sustainable use of resources, including energy and water.</li> <li>✓ To reduce project-related GHG emissions.</li> </ul>

Scopes application	<ul style="list-style-type: none"> <li>✓ The application of this PS should be implemented during the environmental and social risks and impacts identification process.</li> <li>✓ The implementation of the actions necessary to meet the requirements of this PS is managed through the system or policies of investor's environment and society.</li> <li>✓ management system, the elements of which are outlined in PS 1.</li> </ul>
PS4. Community health, safety, and security	
Principles	<ul style="list-style-type: none"> <li>✓ This PS recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. While communities are directly impacted by the climate change may also experience an acceleration and/or intensification of impacts due to project activities. This PS addresses the investor's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups.</li> </ul>
Objectives	<ul style="list-style-type: none"> <li>✓ To anticipate and avoid adverse impacts on the health and safety of the affected community during the project life from both routine and non-routine circumstances.</li> <li>✓ To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the affected communities.</li> </ul>
Scopes application	<ul style="list-style-type: none"> <li>✓ The application of this PS should be implemented during the environmental and social risks and impacts identification process.</li> <li>✓ This performance standard addresses potential risks and impacts to the affected communities from project activities. Occupational health and safety requirements for workers are included in PS2, and environmental standards to avoid or minimize impacts on human health and the environment due to pollution are included in PS3.</li> </ul>

Category	Description
PS5. Land acquisition and involuntary resettlement	
Principles	<ul style="list-style-type: none"> <li>✓ This PS recognizes that project-related to land acquisition and involuntary resettlement that refers both to relocation (or loss of shelter) and loss of assets or access to assets that leads to loss of income sources or other means of livelihood as a result of project-related land acquisition and/or restrictions on land use. Resettlement is considered involuntary when affected persons or communities do not have the right to refuse land acquisition or restrictions on land use that result in physical or economic displacement. This occurs in cases of (i) lawful expropriation or temporary or permanent restrictions on land use and; (ii) negotiated settlements in which the buyer can resort to expropriation or impose legal restrictions on land use if negotiations with the seller fail.</li> </ul>
Objectives	<ul style="list-style-type: none"> <li>✓ To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs.</li> <li>✓ To avoid forced peoples to leave the land.</li> <li>✓ To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost; and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.</li> <li>✓ To improve, or restore, the livelihoods and standards of living of displaced persons.</li> <li>✓ To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.</li> </ul>

#### Scopes application

- ✓ The application of this PS should be implemented during the environmental and social risks and impacts identification process.
- ✓ This PS applies to relocation or loss of shelter and loss of assets or access to assets that leads to loss of income sources or other means of livelihood resulting from the following types of land related transactions: (i). *Land rights or land use rights acquired through expropriation or other compulsory procedures in accordance with the legal system of the host country;* (ii). *Land rights or land use rights acquired through negotiated settlements with property owners or those with legal rights to the land if failure to reach settlement would have resulted in expropriation or other compulsory procedures;* (iii). *Project situations where involuntary restrictions on land use and access to natural resources cause a community or groups within a community to lose access to resource usage where they have traditional or recognizable usage rights;* (iv). *Certain project situations requiring evictions of people occupying land without formal, traditional, or recognizable usage rights;* (v). *Restriction on access to land or use of other resources including communal property and natural resources such as marine and aquatic resources, timber and non-timber forest products, freshwater, medicinal plants, hunting and gathering grounds and grazing and cropping areas.*
- ✓ This PS does not apply to resettlement resulting from voluntary land transactions (i.e., market transactions in which the seller is not obliged to sell and the buyer cannot resort to expropriation or other compulsory procedures sanctioned by the legal system of the host country if negotiations fail). It also does not apply to impacts on livelihoods where the project is not changing the land use of the affected groups or communities.
- ✓ Where project impacts on land, assets, or access to assets become significantly adverse at any stage of the project, the investor should consider applying requirements of this PS, even where no land acquisition or land use restriction is involved.

Category	Description
PS6. Biodiversity conservation and sustainable management of living natural resources	
Principles	<ul style="list-style-type: none"> <li>✓ This PS recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements set out in this performance standard have been guided by the convention on biological diversity, which defines biodiversity as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems.”</li> <li>✓ Ecosystem services are the benefits that people, including businesses, derive from ecosystems. ecosystem services are organized into four types: <i>(i) provisioning services, which are the products people obtain from ecosystems; (ii) regulating services, which are the benefits people obtain from the regulation of ecosystem processes; (iii) cultural services, which are the nonmaterial benefits people obtain from ecosystems; and (iv) supporting services, which are the natural processes that maintain the other services.</i></li> <li>✓ Ecosystem services valued by humans are often underpinned by biodiversity. Impacts on biodiversity can therefore often adversely affect the delivery of ecosystem services. This PS addresses how investors can sustainably manage and mitigate impacts on biodiversity and ecosystem services throughout the project’s lifecycle.</li> </ul>
Objectives	<ul style="list-style-type: none"> <li>✓ To protect and conserve biodiversity.</li> <li>✓ To maintain the benefits from ecosystem services.</li> <li>✓ To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.</li> </ul>

Scopes application	<ul style="list-style-type: none"> <li>✓ The application of this PS should be implemented during the environmental and social risks and impacts identification process.</li> <li>✓ Based on the risks and impacts identification process, the requirements of this performance standard are applied to projects <i>(i) located in modified, natural, and critical habitats; (ii) that potentially impact on or are dependent on ecosystem services over which the client has direct management control or significant influence; or (iii) that include the production of living natural resources (e.g., agriculture, animal husbandry, fisheries, forestry).</i></li> </ul>
PS7. Indigenous peoples	
Principles	<ul style="list-style-type: none"> <li>✓ This PS recognizes that indigenous peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. Indigenous peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also come under threat. As a consequence, indigenous peoples may be more vulnerable to the adverse impacts associated with project development than nonindigenous communities. This vulnerability may include loss of identity, culture, and natural resource-based livelihoods, as well as exposure to impoverishment and diseases.</li> <li>✓ Private sector projects can create opportunities for indigenous peoples to participate in, and benefit from project related activities that may help them fulfill their aspiration for economic and social development. Furthermore, indigenous peoples may play a role in sustainable development by promoting and managing activities and enterprises as partners in development. government often plays a central role in the management of indigenous peoples’ issues, and clients should collaborate with the responsible authorities in managing the risks and impacts of their activities.</li> </ul>



Category	Description
Objectives	<ul style="list-style-type: none"> <li>✓ To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of indigenous peoples.</li> <li>✓ To anticipate and avoid adverse impacts of projects on communities of indigenous peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts. To promote sustainable development benefits and opportunities for indigenous peoples in a culturally appropriate manner.</li> <li>✓ To establish and maintain an ongoing relationship based on the comprehensive consultation (ICP) with the indigenous peoples affected by a project throughout the project's life-cycle.</li> <li>✓ To ensure voluntary prior informed consent (VPIC) of the affected communities of indigenous peoples when the circumstances described in this PS.</li> <li>✓ To respect and preserve the culture, knowledge, and practices of indigenous peoples.</li> </ul>
Scopes application	<ul style="list-style-type: none"> <li>✓ The application of this PS should be implemented during the environmental and social risks and impacts identification process.</li> <li>✓ There is no universally accepted definition of "indigenous peoples." Indigenous peoples may be referred to in different countries by such terms as "indigenous ethnic minorities," "aboriginals," "hill tribes," "minority nationalities," "scheduled tribes," "first nations," or "tribal groups."</li> <li>✓ In this PS, the term "indigenous peoples" is used in a generic sense to refer to a distinct social and cultural group possessing the following characteristics in varying degrees: (i). <i>self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;</i> (ii). <i>collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;</i> (iii). <i>customary cultural, economic, social, or political institutions that are separate from those of the mainstream society or culture;</i> (iv). <i>a distinct language or dialect, often different from the official language or languages of the country or region in which they reside.</i></li> </ul>

- ✓ This PS applies to communities or groups of indigenous peoples who maintain a collective attachment, i.e., whose identity as a group or community is linked, to distinct habitats or ancestral territories and the natural resources therein. It may also apply to communities or groups that have lost collective attachment to distinct habitats or ancestral territories in the project area, occurring within the concerned group members' lifetime, because of forced severance, conflict, government resettlement programs, dispossession of their lands, natural disasters, or incorporation of such territories into an urban area.



Category	Description
PS8. Cultural heritage	
Principles	√ This PS recognizes the importance of cultural heritage for current and future generations. consistent with the convention concerning the protection of the world cultural and natural heritage, this performance standard aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this performance standard on a project's use of cultural heritage are based in part on standards set by the convention on biological diversity.
Objectives	√ To protect cultural heritage from the adverse impacts of project activities and support its preservation. √ To promote the equitable sharing of benefits from the use of cultural heritage.
Scopes application	√ The application of this PS should be implemented during the environmental and social risks and impacts identification process. √ For the purposes of this PS, cultural heritage refers to: (i) <i>tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values; (ii) unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls; and (iii) certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.</i> √ The requirements of this PS apply to cultural heritage regardless of whether or not it has been legally protected or previously disturbed. the requirements of this PS do not apply to cultural heritage of indigenous peoples; PS 7 describes those requirements.

## 6.5 Annex 5. Check list for potential elements for address during scoping, baseline, and assessment

The following is a non-all-inclusive list of different potential elements which are commonly addressed during scoping, baseline, and assessment phases of the ESIA. The potential elements are divided into the three phases of pre-construction, construction, commissioning & operation, and the biomass supply chain. Not all potential elements are applicable to every biomass power project, and some biomass power projects will require the addressing other potential elements not in this list. Therefore, professional judgment should be applied when using this check list.

IFC PS	Impact items	Pre-construction	Construction	Commissioning & operation	Biomass supply chain
PS1. Assessment and Management of Environmental and Social Risks and Impacts	Existing policy and procedure for environmental and social management of the plant owner	x			
	Existing policy and procedure for environmental and social management of the national & regional government	x			
	Existing policy and procedure for environmental and social management of the local government / community	x			
	Existing regulatory reporting needs (local and national)	x	x	x	x
	Community consultation processes	x			
	Existing anti-corruption practice	x			
	Existing grievance structures	x			
	Managing risk reduction		x	x	x
	Managing impacts		x	x	x
	Community consultation processes		x	x	x
	Corruption / anti-corruption		x	x	x
Grievance policy / procedures		x	x	x	

IFC PS	Impact items	Pre-construction	Construction	Commissioning & operation	Biomass supply chain
PS2. Labour and Working Conditions	Community labour force and practices	x			
	National labour regulations	x			
	National non-discrimination and diversity regulations	x			
	Existing health, safety and security procedures on-site	x			
	Existing safety and security signage on-site	x			
	Use of child and youth labour		x	x	x
	Use of older workers		x	x	x
	Use of migrant labour		x	x	x
	Freedom of association		x	x	x
	Collective bargaining		x	x	x
	Forced or compulsory labour		x	x	x
	Discrimination (by gender, age, ethnicity, and job position, insurance, remuneration, etc)		x	x	x
	Diversity of labour (by gender, age, ethnicity, and job position)		x	x	x
	Areas of standing or stored water		x	x	x
	Safety & security restrictions (fencing, walls, barriers)		x	x	x
	Safety from accidents on site		x	x	x
	Security from theft		x	x	x
	Safety from accidents for surrounding communities		x	x	x
	Climate disaster risk		x	x	x
	Fire risk in on site (excl. facilities)		x		
Fire risk in facilities		x	x		

	Fire risk during supply of equipment		x	x	
	Fire risk of on-site transport			x	
	Fire risk of on-site biomass			x	
	Sexual abuse and harassment		x	x	
	Study and potential promotion			x	
PS3. Resource Efficiency and Pollution Prevention *	Existing contamination from chemical spills into soil and water resources, and fumes (and exposure)	x			
	Existing contamination from biomass and waste leachate	x			
	National and local environmental regulations	x			
	Dust exposure		x	x	x
	Water runoff (and sediment)		x	x	x
	Chemical spillage into soil and water resources (and exposure)		x	x	x
	Chemical fumes		x	x	x
	Hazardous waste (solid and liquid)		x	x	x
	Noise		x	x	x
	Use of water resources		x	x	x
	Climate disaster risk		x	x	
	Domestic wastewater		x		
	Exhaust from transportation vehicles			x	x
	Leachate runoff (biomass storage)			x	
	Particle emissions from flue gas			x	
	GHG, SOX, NOX emissions from flue gas			x	
	Particle emissions from biomass fires				x
	Illegal conversion of land use purposes				x
	Illegal logging				x
	Exhaust from biomass transportation				x
Food security				x	
Biodiversity				x	



IFC PS	Impact items	Pre-construction	Construction	Commissioning & operation	Biomass supply chain
PS4. Community Health, Safety, and Security *	Existing health & safety procedures for accidents for surrounding communities	x			
	Community emergency & fire planning and procedures	x			
	Community disaster risk management planning and procedures	x			
	Community programmes against violence (incl. women & youth)	x			
	Community safe access planning	x			
	Activates at adjacent industrial operations	x			
	Adjacent schools, health facilities, community centres...etc.	x			
	Areas of standing or stored water		x	x	x
	Safety & security restrictions (fencing, walls, barriers)		x	x	x
	Safety from accidents for surrounding communities		x	x	
	Community actions against violence (incl. women & youth)		x	x	x
	Community safe access to adjacent lands & facilities		x	x	x
	Adjacent schools, health facilities, community centres...etc.		x	x	
	Climate disaster risk		x		
	Fire risk of off-site transport				x
	Fire risk of off-site biomass				x
	Climate disaster risk			x	x
	Pandemic		x		
	Flue gas			x	
	Noise and exhaust from transportation vehicles		x		x
Electrical transmission			x		

PS5. Land acquisition and involuntary resettlement	Existing food crops & related land	x			
	Fruit trees & perennials	x			
	Existing households	x			
	Current livelihood	x			
	Existing schools, health facilities, community centres...etc.	x			
	Existing industrial and commerce facilities	x			
	Existing rights-of-way for utilities and transport	x			
	Existing fair and equitable compensation regulation and local practices	x			
	National rules on imminent domain	x			
	Land surveys	x			
	Geotechnical studies	x			
	Existing land use and zoning regulations (local and national)	x			
	Existing surface water system	x			
	Aquaculture area	x			
	Spirituality (graves, tombs)	x			
	Religion and cultural land	x			
	Taking over Food crops & related land		x		x
	Taking over fruit trees & perennials		x		x
	Removal of Households		x		x
	Losing livelihood		x		x
Removal of schools, health facilities, community centres...etc.		x		x	
Removal of industrial and commerce facilities		x		x	
Removal of rights-of-way for utilities and transport		x		x	

IFC PS	Impact items	Pre-construction	Construction	Commissioning & operation	Biomass supply chain
	Fair and equitable compensation (both monetary and physical – land, equipment and structures)		x		x
	Removal of cultural land (see PS8)		x		x
	Removal of graves or tombs		x		x
	Taking over aquaculture area		x		x
	Elements should have been address in pre-construction and construction phases			x	
	Replenishment of land used during construction and given back to owner after commissioning			x	
	Reverse land acquisition (e.g. selling land after commissioning)			x	
	Reverse land acquisition (e.g. selling land after commissioning)				x
PS6. Biodiversity Conservation and Sustainable Management of Living Natural Resources	Existing natural and manmade ecosystems (wetlands, grasslands... etc.)	x			
	Existing local vegetation and fauna (incl. endangered species)	x			
	Existing invasive insects (in biomass)	x			
	Existing natural forests	x			
	Existing managed forests / plantations	x			
	Existing food crops & related land (biomass resources)	x			x
	Land surveys	x			
	Geotechnical studies	x			
	Existing land use and zoning regulations (local and national)	x			

	Natural and manmade ecosystems (wetlands, grasslands...etc.)		x	x	x
	Local vegetation and fauna (incl. endangered species)		x	x	x
	Invasive insects		x	x	x
	Invasive plants		x	x	x
	Invasive animals		x	x	x
	Natural forests		x	x	x
	Managed forests / plantations		x	x	
	Revegetation practices		x	x	
	Revegetation & sustainable biomass practices				x
	Land and geotechnical composition		x	x	x
PS7. Indigenous Peoples **	Existing policy and procedure for environmental and social management held by indigenous communities	x			
	Existing indigenous community consultation processes & customs	x	x	x	x
	Existing land, water and agricultural resources use by indigenous communities	x			
	Existing accesses to utilities and public services	x			
	Review equalities faced by indigenous communities	x			
	Indigenous owned businesses	x			
	Education and training	x			
	Indigenous equality and rights	x			
	Intangible culture of indigenous people	x			
	Religious beliefs of indigenous people	x			
	Customs related biodiversity and natural resources		x	x	x
Customs related land access & use		x	x	x	

IFC PS	Impact items	Pre-construction	Construction	Commissioning & operation	Biomass supply chain
	Customs related water and agricultural resources use		x	x	x
	Employment		x	x	x
	Professional and unskilled knowhow (& training)		x	x	x
	Indigenous owned businesses		x	x	x
	Use of indigenous language		x	x	
	Respect the intangible culture of indigenous people		x	x	x
	Respect religious beliefs of indigenous people		x	x	x
	Accesses to utilities and public services		x	x	x
	Ensure the right to educate and training		x	x	x
	Indigenous equality and rights		x		x
PS8. Cultural Heritage **	Existing cultural structures (incl. burial sites)	x	x	x	x
	Existing cultural link to lands (incl. burial sites)	x	x	x	x
	Existing cultural link to biodiversity & fauna	x	x	x	x
	Existing cultural link to ecosystems	x	x	x	x
	Existing cultural customs	x	x	x	x
	Existing historical sites		x	x	x
	Visual and aesthetic values		x	x	x

\* note that several pollution and health & safety elements are applicable in both PS3 and PS4.

\*\* note that that several elements related to indigenous peoples (PS7) may also be applicable to their cultural heritage (PS8)

## 6.6 Annex 6. Example of organisations providing international finance in Viet Nam

### International Finance Institutions (IFIs)

(WB) World Bank

(IDA) International Development Association [WB]

(IBRD) International Bank for Reconstruction and Development [WB]

(EBRD) European Bank for Reconstruction and Development

(EIB) European Investment Bank

(ADB) Asian Development Bank

(IFC) International Finance Corporation [WB]

(GCF) Green Climate Facility

### Bilateral-partners financing organisations

(KfW) Bank Aus Verantwortung - Germany

(EXIM USA) Export-Import Bank of the United States

(AFD) Agence Francaise de Development - France

(IFU) – Investment Fund for Developing Countries – Denmark

(EKF) Denmark's Export Credit Agency

(K-sure) Korea Trade Insurance Corporation

(KOICA) Korea International Cooperation Agency

(NEXI) Nippon Export and Investment Insurance



## 6.7 Annex 7. List of Viet Nam's regulations

Legal frameworks	Scope	Contents	Notes
Performance standard 1. assessment and management of E&S risks and impacts			
Law on environmental protection No.72/2020/QH14 dated November 17, 2020	Environmental impact assessment	<ul style="list-style-type: none"> <li>- Environmental impact assessment is required for a biomass power project.</li> <li>- Investment projects under the authority to decide and approve investment policies of the national assembly and the prime minister.</li> <li>- Investment project with capital investment at least 2,300 billion VNĐ (group A).</li> <li>- Using land, land with surface water (except for forest development projects) at least 50 ha or more.</li> <li>- Using land, land with surface water of natural reserve area with of at least 1ha, requiring conversion of land use.</li> <li>- Using land, land with surface water of biosphere reserves area of at least 1ha, requiring conversion of land use.</li> <li>- Using (converting) land, land with water surface of the buffer zone of world natural heritage, important wetland of at least 20 ha (5 ha) or more.</li> <li>- Using (converting) land, wetland of natural forest of at least 20ha (3ha) or more.</li> <li>- Using (converting) land, wetland of protected forest of at least 50ha (20ha) or more.</li> <li>- Using land, land with surface water of historical, cultural relics or scenic spots that have been ranked national or special national from 2ha, ranked as world heritage sites or scenic areas ranked national, special national from 10ha or more.</li> <li>- Investment project discharges at least 500m3 of wastewater/day.</li> </ul>	Decree no. 08/2022/NĐ-CP dated January 10, 2022

		<ul style="list-style-type: none"> <li>- Investment projects that require migration or resettlement from 1,000 people in mountainous areas or from 2,000 people in other areas or more.</li> <li>- Changing land use purposes of rice cultivation.</li> </ul>	
		An environmental impact assessment report is prepared for each investment project environmental impact assessment report shall be conducted together with preparing feasibility study report or equivalent document.	Article 31
	Management and environmental supervision	<p>The contents of an environmental impact assessment report</p> <ul style="list-style-type: none"> <li>- Preface.</li> <li>- Chapter 1. Project information.</li> <li>- Chapter 2. Natural, social-economic condition and current status of environment in the project area.</li> <li>- Chapter 3. Evaluation and prediction of environmental impacts and propose the measures, environmental protection facilities and respond to environmental incidents.</li> <li>- Chapter 4. Environmental improvement and restoration plans, and compensation for biodiversity plans (applicable only to projects with biodiversity compensation plans).</li> <li>- Chapter 5. Environmental management and monitoring programs.</li> <li>- Chapter 6. Consultant results.</li> <li>- Conclusion, recommendation and commitment.</li> <li>- Annex, drawings, compilations, consultant meeting records.</li> </ul>	

Legal frameworks	Scope	Contents	Notes
	Environmental monitoring	<ul style="list-style-type: none"> <li>- Automatic monitoring boiler system: capacity at least 50mw.</li> <li>- Periodic boiler monitoring: capacity less than 50mw.</li> </ul>	Decree no. 08/2022/NĐ-CP dated January 10, 2022
	Annual report	Investment project owner, enterprises shall prepare and submit an environmental protection report to competent authority as prescribed by law. this clause is guided in Article No.65, 66 of Circular No.02/2022/TT-BTNMT dated January 10, 2020.	Article 119
<b>Performance standard 2. Labor and working conditions</b>			
Labor code No.45/2019/QH14 dated November 20, 2019	Forbidden actions	<ul style="list-style-type: none"> <li>- Labor discrimination.</li> <li>- Maltreatment of employees, forced labor.</li> <li>- Sexual harassment in the workplace.</li> <li>- Illegal employment of minors.</li> </ul>	Article 8
	Responsibilities of the employer	<ul style="list-style-type: none"> <li>- Ensure gender equality and implementation of measures to promote gender equality in recruitment, job assignment, training, working hours and rest periods, salaries and other policies.</li> <li>- Consult with female employees or their representatives when taking decisions which affect their rights and interests.</li> </ul>	Article 136
	Welfare	<ul style="list-style-type: none"> <li>- Provide appropriate bathrooms and toilets at the workplace for female employees.</li> <li>- Assist in building day care facilities and kindergartens, or cover a part of the childcare expenses incurred by employees.</li> </ul>	Article 136

	Maternity protection	An employer must not require a female employee to work at night, work overtime or go on a long distance working trip.	Article 137
	Minor employees	<ul style="list-style-type: none"> <li>- Minor employees may only do works that are suitable for their health in order to ensure their physical health, mental health and personality development.</li> <li>- The employer who has minor employees has the responsibility to take care of their work, health and education in the course of their employment.</li> <li>- When an employer hires a minor employee, the employer must have the consent of his/her parent or guardian; prepare a separate record which writes in full of his/her name, date of birth, the work assigned, results of periodical health check-ups, and shall be presented at the request of the competent authority.</li> <li>- Employers shall enable minor employees to have educational and vocational training.</li> <li>- Employers shall enable minor employees to have educational and vocational training.</li> <li>- Working hours, prohibited works and workplaces for employees aged 15 to under 18.</li> </ul>	Article 144, 145, 146, 147
	Employment of elderly people	<ul style="list-style-type: none"> <li>- Employer must not assign elderly employees to do laborious, toxic or dangerous works, or highly laborious, toxic or dangerous works that are harmful to their health, unless safety is ensured.</li> <li>- Employers are responsible for taking care of the health of elderly employees at the workplace.</li> </ul>	Article 149
	Insurance	Employers and employees shall participate in compulsory social insurance, compulsory health insurance and unemployment insurance and enjoy the benefits in accordance with provisions of the law on social insurance, health insurance and unemployment insurance.	Article 168

Legal frameworks	Scope	Contents	Notes
Law on occupational safety and hygiene No. 84/2015/QH13, dated June 25, 2015	Rights and obligations of employers in terms of occupational safety and hygiene	<ul style="list-style-type: none"> <li>- Assurance of occupational safety and hygiene at the workplace within their responsibility to employees and relevant persons.</li> <li>- Pay insurance premiums for employees.</li> <li>- Provide training in regulations, internal regulations, and measures for occupational safety and hygiene; provide adequate occupational equipment or tools to ensure occupational safety and hygiene.</li> <li>- Appoint employees in charge of supervision and inspection of implementation of internal regulations, process and measures for assurance of occupational safety and hygiene at the workplace as prescribed.</li> </ul>	Article 7
		Internal regulations and process for assuring occupational safety and hygiene.	Article 15
		The employer shall inspect and control dangerous or harmful factors at the workplace to introduce technical measures for occupational safety and hygiene and healthcare for employees; and carry out measures for decontamination and sterilization applicable to employees who works in a contaminated or infected place.	Article 18
		The employer shall have plans for actions against serious safety threat and emergency rescue and periodically organize manoeuvres as prescribed; provide technical and medical equipment to ensure rescue and first aid when a serious safety threat or an occupational accident occurs.	Article 19
		The employer must regularly cooperate with executive board of internal trade union to enable employees to improve their working condition and foster safety culture.	Article 20

	Health check-ups and treatment for occupational diseases applicable to employees	Annually, an employer shall organize health check-ups at least once a year for employees; and health check-ups at least twice a year for employees doing heavy and harmful jobs and disabled, underage and elderly employees.	Article 21
		Carry out measures pertaining to technology, engineering and equipment for elimination or limitations on dangerous or harmful factors and improvement of working condition.	Article 23
		<ul style="list-style-type: none"> <li>- The employer shall give work assignment to its employees according to health standards prescribed for each type of occupation and the results of employees' health check-ups.</li> <li>- The employer shall prepare and manage health documents of employees, occupational disease patients; send notifications of results of health check-ups and occupational disease check-ups to employees; and send reports on management of employee's health to health authorities annually.</li> </ul>	Article 27
Law on construction No. 62/2020/QH14 dated June 17,2020	Safety in construction	Construction contractors shall buy insurance for construction workers working on the construction sites and civil liability insurance for third party.	article 9
		Taking separate safety technical measures for construction items and jobs subject to strict requirements on labor safety and fire and explosion prevention and fighting.	article 111
		Construction contractors shall ensure safety for people, construction works, assets, equipment and vehicles in the course of construction, fire and explosion prevention and fighting, and environmental protection. construction safety assessment is guided by section 3 chapter iii decree 06/2021/NĐ-CP effective from January 26, 2021.	Article 115



Legal frameworks	Scope	Contents	Notes
Standards technical regulation and on working places	QCVN 27:2016/ BYT	- National technical regulation on vibration - permissible levels of vibration in the workplace.	
	QCVN 26:2016/ BYT	- National technical regulation on microclimate- permissible value of microclimate in the workplace.	
	QCVN 18: 2014/ BXD	- National technical regulation safety in construction.	
Performance standard 3. Resource efficiency and pollution prevention			
Law on environmental protection No.72/2020/ QH14 dated November 17, 2020	Prohibited acts	<ul style="list-style-type: none"> <li>- Failure to transport, bury, discharge and burn solid hazardous waste in accordance with technical process and regulations of law on environmental protection</li> <li>- Discharging wastewater and exhaust gases that have yet to be treated according to technical regulations on environment into the environment.</li> <li>- Generating noise and vibration in excess of the permissible level stipulated in technical regulations on environment; discharging smokes, dusts and noxious gases into the air.</li> </ul>	Article 6
	Environmental license	Business activities that generate waste water, dust and exhaust gases that must be treated into the environmental or generate hazardous waste that must be managed in accordance with regulation on waste management before officially being put into operation.	Article 39

Emission limit	<ul style="list-style-type: none"> <li>- Emission limit is stipulated in the environmental license, including sources of emission, flow rate (waste water, exhaust gases), sources and permissible limit (noise, vibration) and environmental protection requirements (collecting and treating wastewater and exhaust gases, reducing noise level, storage area of scraps, recycling equipment, environmental management and supervision plans, environmental emergency prevent and response plans, environmental monitoring, domestic solid waste, normal industrial solid waste and hazardous wastes management. improve and remediate environmental and carry out biodiversity offsets.</li> <li>- The environmental license shall be valid for 7 - 10 years, depending on the project scales.</li> </ul>	Article 40
Hazardous wastes from thermal power and incineration enterprises	<ul style="list-style-type: none"> <li>- 040102. Waste sulfuric acid.</li> <li>- 040104. Bottom ashes, slags and dusts from boiler.</li> <li>- 040106. Fly ashes from coal and woods burning and untreated.</li> <li>- 040107. Wastes (solid, sludge) containing sulfur from flue gas desulfurization by reaction with calcium.</li> </ul>	Circular no. 02/2022/ TT-BTNMT dated January 10,2022
Use of slags and ashes of the thermal power	Ash, slag and gypsum (including gypsum obtained from furnace fumes emitted from thermal power plants, abbreviated as FGD (flue gas desulfurization) gypsum; gypsum discharged from chemical and fertilizer plants, abbreviated as PG (phosphogypsum) gypsum) must be treated and used in an effective manner.	Decision no.425/QĐ-TTg dated April 12,2017

Legal frameworks	Scope	Contents	Notes
		Using ash, slag, FGD and PG gypsum for production of building materials and in construction projects is to serve the purpose of environmental protection and reduction in use of land areas as storage yards and in use of natural resources and minerals for production of building materials as well as assurance of sustainable development.	
Law on water resources No.17/2012/QH13 dated June 21, 2012	The strictly prohibited acts	<ul style="list-style-type: none"> <li>- To discharge wastes, rubbish, discharge or leak toxic substances into water sources and other acts causing pollution, deterioration, depletion for water sources.</li> <li>- To discharge sewage, bring waste into hygiene protection zone of area supplying living water, discharge sewage not yet processed or processed but not met technical regulations and standards into water sources.</li> <li>- To discharge toxic exhaust directly into water sources; to discharge sewage into soil through drilling wells, digging wells and other forms aiming to bring sewage into subterranean; have frauds in discharging sewage.</li> </ul>	Article 9
	Water exploitation and consumption	Organizations, individuals exploiting, using water resources, discharging sewage into water sources shall observe, supervise their exploitation, use of water and discharging sewage as prescribed.	Article 28
	Incentives for economical and efficient water use activities	Reuse, cyclic use of water: <ul style="list-style-type: none"> <li>- Borrowing incentive capital under the provisions of law on investment credit of the state.</li> <li>- Exemption or reduction of corporate income tax in accordance with regulations of law on taxation..</li> </ul>	Decree no. 54/2015/NĐ-CP dated June 8, 2015

Law no. 50/2010/QH12 dated June 28, 2010 of the national assembly on economical and efficient use of energy dated June 17, 2010	Incentives for economical and efficient use of energy	Projects promoting economical and efficient use of energy shall be considered for financial support from the national program on economical and efficient use of energy.	Article 41
		Development of cogeneration technology, raising use coefficients of thermal turbine units; technological solutions to increasing coefficients of mixed thermal energy use.	Article 42
National regulation and standards of ambient environmental quality	QCVN 14:2015/BTNMT	National technical regulation on domestic wastewater.	
	QCVN 08-MT:2015/BTNMT	National technical regulation on surface water.	
	QCVN 09-MT:2015/BTNMT	National technical regulation on ground water quality.	
	QCVN03:2015/BTNMT	National technical regulation on the allowable limits of heavy metals in the soils.	
	QCVN40:2011/BTNMT	National technical regulation on industrial wastewater.	
	QCVN 22:2009/BTNMT	National technical regulation on emission of thermal power industry.	

Legal frameworks	Scope	Contents	Notes
	QCVN 19:2009/ BTNMT	National technical regulation on industrial emission of inorganic substances and dusts.	
	QCVN05:2013/ BTNMT	National technical regulation on ambient air quality.	
	QCVN27:2010/ BTNMT	National technical regulation on vibration.	
	QCVN 26:2010/ BTNMT	National technical regulation on noise.	
Standards and regulations on equipment	TCVN 8630:2019	Boilers- energy efficiency and method for determination.	
	TCVN 12728:2019	Boilers – technical requirement of design, manufacture, installation, operation and maintenances.	
Performance standard 4. Community health, safety, and security			
Law on forestry No.16/2017/ QH14 dated November 15, 2017	The strictly prohibited acts	<ul style="list-style-type: none"> <li>- Illegal cutting, destroying, exploiting, encroaching and occupying forests.</li> <li>- Illegal putting wastes, toxic chemical reagents, explosives, inflammables, combustibles, tools and means entering the forest.</li> </ul>	Article 9
	Prevent and fight forest fires	Organizations, households and individuals conducting activities in forests or building works in forests or along forests must comply with regulations on fire prevention and fighting; implement measures to prevent and fight forest fires by forest owners.	Article 39

Law on environmental protection No.72/2020/ QH14 dated November 17,2020	Consultant in environmental impact assessment process	<ul style="list-style-type: none"> <li>- Consultees: residential communities and individual under direct impact of the investment project, agencies and organizations directly related to the investment project.</li> <li>- Contents of a consultant: biodiversity compensation plan for projects with biodiversity compensation plan - consultant methods: publishing on website, holding a meeting to collect comments, collecting written comments.</li> </ul>	Decree No.08/2022/ NĐ-CP dated January 10, 2022, Elaboration of several articles of the law on environmental protection
The law amending and adding a number of articles of the law on fire prevention and fighting No.40/2013/ QH13 dated November 22, 2013	Facilities management	<p><b>Facilities requiring fire management:</b></p> <ul style="list-style-type: none"> <li>- Power plants; electrical substations with voltage of at least 110 kV.</li> <li>- Industrial facilities with grade A, B, C, D, E risk of fire and explosion.</li> </ul> <p><b>where, facilities at risk of fire or explosion are:</b></p> <ul style="list-style-type: none"> <li>- Garages capable of accommodating at least 10 automobiles.</li> <li>- Industrial facilities with grade A or B risk of fire and explosion (total volume of all buildings housing the main production lines at least 5000m<sup>3</sup>), grade C (at least 10.000m<sup>3</sup>), grade D, E (at least 15.000m<sup>3</sup>).</li> <li>- Power plants; electrical substations with voltage of at least 110 kV.</li> </ul>	Decree No. 136/2020/ NĐ-CP dated November 24, 2020
	Fire safety and firefighting in the operation stage	If the total sum insured for all assets in a single location of facilities facing a risk of conflagration (except nuclear facilities) is at least 1,000 billion VNĐ: insurance enterprises and policyholders shall agree on insurance premiums on the basis of approval of reinsurers. in any case, insurance premiums must not be lower than the product of 1,000 billion VNĐ multiplying with insurance rate (0,12%/year).	Decree No. 97/2021/ NĐ-CP dated November 8, 2021



Legal frameworks	Scope	Contents	Notes
		<ul style="list-style-type: none"> <li>- There are fire safety regulations, signs, diagrams or escape plan that are suitable for the operation of the facility.</li> <li>- There are persons in charge of fire safety and firefighting in the facility.</li> <li>- The electricity system, lightning protection system, antistatic system, electric devices, spark-generating devices, heat-generating devices, the use of fire sources and heat sources must ensure fire safety.</li> <li>- There are fire safety procedures that are suitable for the operation of the facility.</li> <li>- There is an internal firefighting team that is trained in fire safety and firefighting that is ready to deal with conflagration on the spot.</li> <li>- There is a firefighting plan and escape plan approved by a competent authority.</li> <li>- There is adequate traffic system, water supply system and communication system serving fire-fighting; fire alarm system, firefighting system, fire blocking system, other fire safety and firefighting equipment, and rescue equipment that are suitable for the facility and conformable with technical standards on fire safety and firefighting or regulations of the ministry of public security.</li> <li>- There are documents about fire safety design acceptance and approval issued by the fire department if the facility is one of the works specified.</li> <li>- The fire safety and firefighting activities are monitored in writing as prescribed by the ministry of public security.</li> </ul>	Decree No. 79/2014/NĐ-CP dated July 31, 2014

		<ul style="list-style-type: none"> <li>- Formulating the fire -fighting plan, use on-site forces.</li> <li>- Coordinating with the police agencies of fire prevention and fighting to formulate practice the fire fighting for facilities area.</li> </ul>	Article 31
		At the facilities, it is required to establish the grassroots fire prevention and fighting team which is established and managed by the decision of the head of agency or organization.	Article 44
		The local militia team, the specialized fire prevention and fighting team and the grassroots fire prevention and fighting team are provided with the training and retraining of techniques of fire prevention and fighting and are under the direction, inspection and professional guidance of police agency of fire prevention and fighting and are under the transfer of the competent authority to participate in the activities of fire prevention and fighting.	Article 46
Electricity law No. 24/2012/QH13 dated December 3, 20142004	Safety in electrical generation	In case of dangers threatening human lives and equipment safety, to cease or reduce the electricity generation if there is no other alternative.	Article 39
		Power plants, electricity-generating stations must be strictly protected, surrounded by protection walls, signboards for electric safety, fire prevention and fighting; unauthorized persons are not allowed to enter power plants, electricity-generating stations.	Article 54

Legal frameworks	Scope	Contents	Notes
Law on road traffic No.23/2008/QH12 dated November 13, 2008	Prohibited acts	<ul style="list-style-type: none"> <li>- Putting motor vehicles and special-use machines which fail to satisfy technical safety and environmental protection criteria into operation on roads.</li> <li>- Operating an automobile, tractor or special-use vehicle on the road while there is a concentration of alcohol in the operator's blood or breath.</li> <li>- Operating a motor vehicle at a speed beyond the prescribed speed limit, recklessly passing or overtaking.</li> </ul>	Article 8
	Loading of cargoes on vehicles	Cargoes loaded on a vehicle must be neatly arranged and firmly fastened, must not fall on to the road, and must not be trailed on the road and affect the driving of the vehicle.	Article 20
		Operators shall comply with regulations on load-bearing capacity and size limits of roads and submit to the inspection by competent agencies.	Article 28
		Automobiles and trailers or semi-trailers pulled by automobiles joining in road traffic must be periodically inspected in terms of technical safety and environmental protection (below referred to as inspection).	Article 55
Law on construction No.62/2020/QH14 dated June 17, 2020	Safety in construction	If any danger zones in construction cause significant effects on the community safety, project owners shall report approved measures to ensure safety to specialized construction agencies for inspection in the course of construction.	Article 115

Standard and national regulations on transmission and electrical safety	TCVN 6438:2018	Road vehicles - maximum permitted limits of exhaust gases.	
	TCVN 7880:2016	Road vehicles - noises emitted from automobiles - Requirements and test methods in type approval.	
	QCVN 01:2020/BCT	National technical regulation on electric safety.	
Performance standard 5. Land acquisition and involuntary resettlement			
Land law No. 45/2013/QH13 dated November 29, 2013	Strictly prohibited acts	<ul style="list-style-type: none"> <li>- Encroaching, occupying or destroying land.</li> <li>- Violating publicized master plans and plans on land use.</li> <li>- Failing to use land, or using land for improper purposes.</li> </ul>	Article 12
		Do not arbitrarily change of land use purpose without permission by competent state agencies: <ul style="list-style-type: none"> <li>- Change of land for rice cultivation to land for perennial crops, forests.</li> <li>- Change of special-use forest land, protective forests or production forests to land for other purposes within the type of agricultural land.</li> </ul>	Article 57
	Residential and agricultural land applicable to ethnic minorities	<ul style="list-style-type: none"> <li>- To adopt policies on residential land and land for community activities for ethnic minorities in conformity with their customs, practices and cultural identities and the practical conditions of each region.</li> <li>- To adopt policies to facilitate for ethnic minorities who are directly engaged in agricultural production in rural areas to have land for agricultural production.</li> </ul>	Article 27

Legal frameworks	Scope	Contents	Notes
	Compensation when land acquisition	<ul style="list-style-type: none"> <li>- Not the leased land with annual rental payment, having a certificate of land use rights or being eligible to be granted a certificate under this law but not being granted that certificate yet.</li> <li>- Land which is not allocated or leased land by the state and having a certificate, or being eligible to be granted a certificate of land use rights but not being granted that certificate yet.</li> <li>- Allocated land with land use levy by the state, or are leased land with full one-off rental payment for the entire lease period.</li> </ul>	
		<ul style="list-style-type: none"> <li>- Allocated land with use levy by the state, or are leased land with full one-off rental payment for the implementation of investment projects on the construction of houses for sale or in combination with lease.</li> </ul>	Article 75
	Support when land acquisition	<ul style="list-style-type: none"> <li>- Support for stabilizing livelihood and production.</li> <li>- Support for resettlement in case of recovery of land from households, individuals and overseas Viet Nameese who have to be relocated.</li> <li>- Support for training, occupation change and job seeking.</li> </ul>	Article 83, 84
	Resettlement when land acquisition	<ul style="list-style-type: none"> <li>- In case people having land recovered are resettled while the amount of compensation and support is not enough to buy the minimum resettlement plot, the state shall make up the deficit.</li> <li>- For investment projects that are decided by the national assembly or approved in principle by the prime minister and require relocation of all population in the community, affecting all the livelihood, socio-economic</li> </ul>	Article 86, 87

		activities, and cultural traditions of the community, and for projects of which the recovered land is located in several provinces and centrally run cities, the prime minister shall decide on the policy framework for compensation, support and resettlement.	
	Compensation for damage to houses and construction facilities	<ul style="list-style-type: none"> <li>- Compensation for damage to houses and construction facilities on land.</li> <li>- Compensation for plants and livestock.</li> <li>- Compensation for transportation costs when state recovers land.</li> <li>- Compensation for land-attached assets.</li> </ul>	Article 89, 90, 91, 92
Performance standard 6. Biodiversity conservation and sustainable management of living natural resources			
Law on biodiversity 20/2008/ qh12 dated November 13,2008	Prohibited acts related to biodiversity	<ul style="list-style-type: none"> <li>- Encroaching upon land, destroying landscape, deteriorating ecosystems and rearing or planting invasive alien species in conservation zones.</li> <li>- Building structures or houses in strictly protected sections of conservation zones, except works for defense and security purposes; illegally building works and houses in ecological restoration sections of conservation zones.</li> <li>- Illegally changing use purposes of land in conservation zones.</li> </ul>	Article 7
	List of conservation areas	<ul style="list-style-type: none"> <li>- List of protected areas under law on biodiversity.</li> </ul>	Decision No.1107/QĐ-BTNMT dated May 12, 2015



Legal frameworks	Scope	Contents	Notes
		<ul style="list-style-type: none"> <li>List of protected areas, national biodiversity conservation master plan to 2020, vision to 2030.</li> <li>List of biodiversity facilities, national biodiversity conservation master plan to 2020, vision to 2030.</li> <li>List of biodiversity corridors, national biodiversity conservation master plan to 2020, vision to 2030).</li> </ul>	
		List of endangered, rare and precious species getting priorities for conservation.	Decree no. 64/2019/NĐ-CP dated July 16, 2019
		List of endangered, rare and precious species of forest fauna and flora and.	Decree no. 84/2021/NĐ-CP dated September 22, 2021

#### Performance standard 7. Indigenous peoples

The constitution of the socialist republic of Viet Nam 2013 dated November 28, 2013	Ethnicities equality	All the ethnicities are equal and unite with, respect and assist one another for mutual development; all acts of discrimination against and division of the ethnicities are prohibited.	Article 5
		<ul style="list-style-type: none"> <li>All people are equal before law.</li> <li>No one is subject to discriminatory treatment in political, civil, economic, cultural or social life.</li> </ul>	Article 16
		Everyone has the right to freedom of belief and religion, and has the right to follow any religion or to follow no religion. all religions are equal before law.	Article 24
		Citizens have the right to social security.	Article 34

#### Performance standard 8. Cultural heritages

Law on cultural heritage No. 28/2001/qh10 dated June 29, 2001	Acts are strictly prohibited	<ul style="list-style-type: none"> <li>Appropriating or deviating cultural heritages.</li> <li>Ruining or posing a danger of ruining cultural heritages.</li> </ul>	Article 13
	List of cultural heritages	Website of department of cultural heritage, ministry of culture, sport, and tourism <ul style="list-style-type: none"> <li>Special national sites: <a href="http://dsvh.gov.vn/danh-muc-di-tich-quoc-gia-dac-biet-1752">http://dsvh.gov.vn/danh-muc-di-tich-quoc-gia-dac-biet-1752</a></li> <li>Intangible cultural heritage: <a href="http://dsvh.gov.vn/di-san-van-hoa-phi-vat-the-1748">http://dsvh.gov.vn/di-san-van-hoa-phi-vat-the-1748</a></li> </ul>	
Land law No.45/2013/QH13 dated November 29, 2013	Management and conservation of cultural heritage	Land with historical-cultural relics, scenic spots that have been ranked or decided to protect by the provincial-level people's committees must be strictly managed.	Article 158



