

**Promoting Investment in Wood-based Energy Development**



**ITTO Project PD 737/14 Rev.2 (I)**

Developing Supply Capacity of Wood-Based Biomass Energy  
through Improved Enabling Conditions and Efficient Utilization of Degraded Forest Lands  
involving Local Communities in North Sumatra Province of Indonesia

**Jakarta, November 2021**

The Ministry of Environment and Forestry of Indonesia (MoEF)  
Directorate General of Sustainable Forest Management (PHL)  
Directorate of Production Forest Development (UHP)  
Indonesian Sawmill and Woodworking Association (ISWA)  
The International Tropical Timber Organization (ITTO)



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Directorate General of Sustainable Production Forest Management (PHPL)  
The Ministry of Environment and Forestry of Indonesia (MoEF)

**In collaboration with:**

The Indonesian Sawmill and Woodworking Association (ISWA)

**With the assistance of:**

The International Tropical Timber Organization (ITTO)

**Jakarta, November 2021**



Project Title : Developing Supply Capacity of Wood-Based Biomass Energy through Improved Enabling Conditions and Efficient Utilization of Degraded Forest Lands Involving Local Communities in North Sumatra Province of Indonesia

Serial Number : PD 737/14 Rev.2 (I)

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## List of Abbreviations and Acronyms

B/C Ratio	Benefit Cost Ratio
CPO	Crude Palm Oil
DG	Director General
DM	Desa Mandiri Energi (Energy Self-sufficient Villages)
EBT	Energy Baru Terbarukan (New Renewable Energy)
EFORDIA	Environment and Forestry Research Development and Innovation Agency
EFP	Energy Forest Plantation
EIS	Environmental Impact Statements
FGD	Focus Group Discussion
FMU	Forest Management Unit (KPH)
FOKKASU	North Sumatera Forum for Rubber Communication
IDR	Indonesian Rupiah
Inpres	Instruksi Presiden (President's Instruction)
IRR	Internal Rate of Return
ITTO	International Tropical Timber Organization
KTH	Kelompok Tani Hutan (Forest Farmer Group)
MoCSME	Ministry of Cooperative, Small and Medium Enterprises
MoEF	Ministry of Environment and Forestry
MoEMR	Ministry of Energy and Mineral Resources
NGO	Non-Government Organization
NPV	Net Present Value
NSPFA	North Sumatera Province Forestry Agency
PHPL	Sustainable Production Forest Management
PLN	Perusahaan Listrik Negara (State Electricity Company)
PLTBM	Biomass Electricity Power Generation
PMU	Project Management Unit
PP	Peraturan Pemerintah (Government Regulation)
PSC	Project Steering Committee
R & D	Research and Development
RUEN	National Energy Strategic Plan
SCF	Stakeholder Coordination Forum
SEZ	Special Economic Zone
USD	US dollar
WBBE	Wood-Based Biomass Energy

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## Summary

ITTO Project PD 737/14 Rev. 2 (I) entitled “Developing supply capacity of wood-based biomass energy through improved enabling conditions and efficient utilization of degraded forest lands involving local communities in North Sumatra Province of Indonesia” was implemented by Directorate of Production Forest Development (UHP) of DG of Sustainable Production Forests Management (PHPL) of the Ministry of Environment and Forestry (KLHK) in collaboration with the Indonesian Sawmill and Woodworking Association (ISWA) from October 2017 till September 2021. The project was aimed to increasing the contribution of the forest sector to renewable energy supply and regional economic development through increased supply of wood-based biomass energy. Its specific objective was to improve enabling conditions for building up capacity to supply wood-based biomass energy in North Sumatra region which was planned to be achieved through delivery of three outputs, one of which (the third output) was “Investment in wood-based energy industry development promoted”.

The project proponent hypothesized that this third output would be delivered through full implementation of six relevant activities, namely:

- Activity 3.1 : To disseminate information on technology and market for wood-based energy through website and other means
- Activity 3.2 : To organize one regional workshop on wood-based energy development
- Activity 3.3 : To examine calorific properties of the energy wood species planted
- Activity 3.4 : To conduct a study on feasibility of investment in commercial manufacturing of wood-based energy including electricity and wood pellets
- Activity 3.5 : To review existing policy on wood-based biomass energy development in view of strengthening incentive for investment
- Activity 3.6 : To form and operate a consultation forum on renewable energy for enhancing communication and coordination between stakeholders.

As all of the above listed activities had been fully implemented, the third output must have been delivered, at least conceptually. Activity 3.1 had been able to develop and operate the project website since the first year of operation; Activity 3.2, the workshop, had been successfully organized in Pematangsiantar City on 4 December 2017; Activity 3.3, analysis of calorific content of the wood species, was able to generate calorific values of the species; Activity 3.4, the feasibility study on wood pellet investment, had been completed and findings disseminated; Activity 3.5, the review of policy on wood-based energy development, had been successfully completed, and Activity 3.6, the formation of stakeholders forum, had been accomplished with the assistance of a competent national consultant and the primary stakeholders.

As each of the project activity had produced the expected outcome(s) as defined in the logical framework, delivery of the output was confirmed. Hence, Output 3 had been conceptually delivered, not in practice. Till the end of project operations in September 2021, no investment in wood-based energy development had been realized in North Sumatra region. For social, economic and environmental reasons, the government was strongly advised to realize investment in wood pellet industry through adoption of, perhaps, a non-popular, special sectoral development policy.



# 1. Introduction

## 1.1. Background Information

ITTO Project PD 737/14 Rev.2 (I): “Developing Supply Capacity of Wood-Based Biomass Energy through Improved Enabling Conditions and Efficient Utilization of Degraded Forest Lands involving Local Communities in North Sumatra Province of Indonesia” had been implemented by Directorate of Production Forest Development (UHP) of Directorate General of Sustainable of Production Forest Management (PHPL) of the Ministry of Environment and Forestry (MoEF) of Indonesia in collaboration with the Indonesian Sawmill and Woodworking Association (ISWA) since October 2017 based on the project agreement duly signed by the Government of Indonesia (GoI) and The International Tropical Timber Organization (ITTO) in March 2017 and the Memorandum of Understanding on the implementation of the project duly signed by PHPL, the Executing Agency, and ISWA, the Collaborating Agency, on 18 September 2017.

The project was aimed at increasing contribution of the forest sector to renewable energy supply and regional economic development through increased supply of wood-based biomass energy. Its specific objective was to improve enabling conditions for building up capacity to supply wood-based biomass energy in North Sumatra region which was planned to be achieved through delivery of three outputs, namely:

- i. Development of sustainable supply of energy wood initiated
- ii. Skillful manpower for development of wood-based biomass energy available
- iii. Investment in wood-based energy industry development promoted



This report concerns with above-mentioned third output (Output 3) only, which was planned to be delivered through implementation of six pertaining activities, namely:

- Activity 3.1 :To disseminate information on technology and market for wood-based energy through website and other means
- Activity 3.2 : To organize one regional workshop on wood-based energy development
- Activity 3.3 : To examine calorific properties of the energy wood species planted
- Activity 3.4 : To conduct a study on feasibility of investment in commercial manufacturing of wood-based energy including electricity and wood pellets
- Activity 3.5 : To review existing policy on wood-based biomass energy development in view of strengthening incentive for investment
- Activity 3.6 : To form and operate a consultation forum on renewable energy for enhancing communication and coordination between stakeholders.

The project proponent hypothesized that the full implementation of above-listed six activities would deliver the third output defined.

It is worth noting at this juncture that this project was formulated by ISWA in the first place in response to the issues confronting the national energy market identified by the Ministry of Energy and Mineral Resources (MoEMR) of Indonesia back in early 2014 which included: i) the ever growing domestic consumption of energy and sluggish development of supply capacity, ii) high dependence of supply on fossil energy, iii) growing government subsidy on energy overtime, iv) sub-optimal utilization of renewable energies and weak energy conservation program, and v) weak mitigation of climate change relating to energy production and consumption processes.

In its efforts to overcome the national energy problems, the MoEMR decided to implement policies on the supply side that focused on increasing share of renewable energy in the national energy mix from the current 7 percent to 23 percent in 2025. The government also claimed that the forest sector had a great potential to contribute to achieving the targeted share of renewable energy by utilizing available forest resources in an efficient and a sustainable manner. On the demand side, the policy adopted was focusing on: improving efficiency of energy utilization from up-stream to down-stream, i.e. industries, transportation, household and commercial sectors.

## **1.2. Organization of the Report**

This report is organized, to the extent possible, in accordance with the relevant, applicable ITTO Manual. The first Part of the report provides a brief background information on the project including the rationale for its formulation and its basic elements. The second part elaborates on the methodologies applied in implementing individual activities. The data collected or generated and results of individual activities are presented in Part 3 while discussions on data and results are conveyed in Part 4. Conclusions and recommendations are presented in Part 5 while Part 6 provides highlight on practical implication of findings.



## 2. Applied Methodologies

The third output of the project to be delivered was “investment in wood-based energy industry development promoted” through the full implementation of six pertaining activities as listed in the previous section. The methodologies applied in implementing individual activities are highlighted in the following sections.

### **2.1. Activity 3.1: To disseminate information on technology and market for wood-based energy through website and other means**

#### The targeted outcomes:

- All processes on implementation of Project PD 737/14 Rev. 2 (I) documented and uploaded to the project website;
- Information on technologies and markets for wood-based energy collected and widely disseminated;
- Any data and information generated under the project documented and uploaded to the website for wide dissemination; and
- Progress and technical reports as well as technical documents uploaded.

#### The executor

The activity was executed by the PMU; for this purpose, an experienced technician in information technology was assigned to take care of the information for the entire project duration. The website was developed with the assistance of an experienced professional designer.

#### The operational strategy

- To develop SOP for website operation;
- To collect data on wood biomass energy from different sources and upload to the website;
- To provide data and information for PC and Partners as needed;

- To ensure a proper operation of the website; and
- To assist the procurement and instalment of needed IT devices.

## **2.2. Activity 3.2: To organize one regional workshop on wood-based energy development**

### The targeted outcomes:

- Information on the project's objectives disseminated and elucidated;
- Regional stakeholders used the same platform of perception for the promotion of wood-based renewable energy development;
- Participants provided inputs for a fruitful and efficient implementation of the project; and
- Some fifty people representing different stakeholders in North Sumatera province (government sector, forest companies, local communities, universities, forestry R&D, practitioners, NGOs, etc.) were invited to the workshop.

### The executor:

The workshop was executed by the Project Management Unit (PMU) in collaboration with the North Sumatera Provincial Forestry Agency (NSPFA).

### The operational strategy

- The workshop was a one-day gathering of stakeholders with all deliberations and discussions arranged in plenary format;
- The participants were given opportunity to raise questions or make comments by end of each individual presentations; and
- The papers presented by individual speakers to the workshop were prepared in accordance with the terms of reference defined by the PMU to ensure that the information presented was relevant to achieving planned objectives of the workshop.

## **2.3. Activity 3.3: To examine calorific properties of the energy wood species planted**

### The targeted outcome:

Data on calorific content of gamal and kaliandra aging 30 and 36 month grown at 3 FMUs in North Sumatera acquired through laboratory analysis using scientific procedures and techniques.

### The executor:

Calorific analysis was accomplished with the assistance of the Environment and Forestry Research and Development and Innovation Agency (EFORDIA) located in Gunung Batu, Bogor.

### The operational strategy

- Wood specimens for laboratory analysis were obtained from Simalungun and Tapanuli Selatan FMUs; lamtoro was excluded from the analysis as it did not survive age of 24 months at all FMUs;
- Only gamal and kaliandra planted at Simalungun and Tapanuli Selatan were analysed as all three species failed to survive longer than two years at Humbang-Hasundutan demo plot;
- For each age of gamal and kaliandra at 2 FMUs, 12 specimens were cut from living trees grown at 3 different spacings;
- Each specimen, weighed around 50 grams was produced in the form of air dried chips; and
- Laboratory analysis was performed by professional laborants of EFORDIA.

#### **2.4. Activity 3.4: To conduct a study on feasibility of investment in commercial manufacturing of wood-based energy including electricity and wood pellets**

##### The targeted outcomes:

- Potential demand for electricity in North Sumatera and for wood pellet in world markets assessed;
- Availability of suitable lands for energy forest plantations in North Sumatera identified as well as potential sustainable supply of energy wood estimated; and
- Technical and economic feasibility of developing a wood pellet industry in North Sumatera assessed.

##### The executor:

The study was executed by a team of professionals comprising wood industry specialist (Dr Dede Hermawan), forest investment analyst (Dr Sudarsono Soedomo), silviculture specialist (Dr Aswandi) and senior forestry professional (Dr Hiras Sidabutar).

##### The operational strategy

- To estimate sustainable supply of energy wood from gamal, kaliandra and lamtoro plantations as well as from non-forest sources in North Sumatera
- To identify most suitable sites for construction of processing plants taking factors of energy wood supply and infrastructure into account.
- To identify most efficient technology for conversion of energy wood to electricity or wood pellet
- To make realistic assumptions on inputs costs and products prices
- To assess profitability of investment for electricity and wood pellet using B/C ratio, NPV, IRR and payback period as the criteria.

#### **2.5. Activity 3.5: To review existing policy on wood-based biomass energy development in view of strengthening incentive for investment**

##### The targeted outcomes:

- Comprehension on wood-based biomass energy value chains as regards definition, sources, processing and utilization;
- A list of MoEMR's and PLN's policies on renewable energy development in general, wood-based biomass energy in particular reviewed;
- Estimate on expected share of wood-based energy in national energy mix in the long-run; and
- Constraints to developing wood-based biomass energy supply capacity identified.

##### The executor:

The activity was implemented with the assistance of Dr Subarudi, a competent expert of EFORDIA.

##### The operational strategy

- Review of existing policies on wood-based biomass energy development at the central, provincial and local levels;
- Review of sources of wood energy for raw material from forest plantations, wood wastes and non-forest sources;
- Review of constraints and challenges;
- Conduct of field observations and discussions; and
- Provide recommendations to enhance policy on wood-based energy development.

**2.6. Activity 3.6: To form and operate a consultation forum on renewable energy for enhancing communication and coordination between stakeholders.**

The targeted outcomes:

- Information on stakeholders of wood-based energy industry development gathered;
- Main tasks and function of the major stakeholders defined;
- Forum for coordination and communication of stakeholders established; and
- Mid-term operational plan for the forum developed.

The executor:

The activity was implemented with the assistance of Dr Subarudi, a competent expert of EFORDIA.

The operational strategy

- To perform a stakeholders analysis covering their need, interest and role in wood-based energy development;
- To identify options for forum model to facilitate an effective coordination and communication among stakeholders;
- To select the most feasible model of forum involving stakeholders; and
- To form the chosen forum and develop its mid-term operational plan



### 3. Presentation of Data and Findings

#### 3.1. Dissemination of Information on Processing Technology and Market for Wood-based Energy

##### a. ISWA website vs ITTO Project

- ITTO Project PD 737/14 Rev.2 (I) menu is positioned as the main menu in the ISWA website as shown in Figure 1
- When the page is click, it will connect with the project menu that consists of eleven sub-menus, namely:
  - i. Project identify
  - ii. Project Steering Committee
  - iii. Project Management Unit
  - iv. Project Design
  - v. Logical Framework
  - vi. Progress in Implementation
  - vii. Periodical Reports
  - viii. Particular Reports
  - ix. General Information
  - x. Miscellaneous
  - xi. Documentation

##### b. Content of the ITTO Project menus

###### Project Identity

Stores information on project's serial number, title, address, executing agency, collaborating agency, etc.

#### Project Steering Committee (PSC)

Contains the executive decision on the formation, membership, tasks and responsibilities, etc.

#### Project Design

Holds information on: project's objectives, outputs and activities

#### Logical Framework

Presents indicators of achievement of the project interventions; pre-defined indicators are the tool used to measure to what extent planned outputs have been delivered and the specific objective as well as development objective have been achieved.

#### Progress in Implementation

- Any report received from the field supervisor, consultant and partner is documented or uploaded to the website
- Every six months, the Project Coordinator has to report to the ITTO progress in implementation of the project; the progress reports prepared are also uploaded to the website.

#### Periodical Reports

Among the periodical reports documented in the website include: Bi-annual progress reports, Yearly Plans Operation and Yearly financial audit reports.

#### Particular Reports

Documents that are accidentally requested by the ITTO Secretariat, final technical reports, final financial audited report and PSC meeting reports are among documents identified as particular reports.

#### General Information

Presents any information collected on technology and market for wood-based biomass energy. Samples of general information are articles entitled: i) cost of buying coal by PLN at USD 1.07 B, equivalent to required investment for the construction of 1,200 MW renewable energy power plant (in Jakarta Daily News 26 February 2018), and ii) Existing regulation on renewable energy development, contra productive; needs to employ a revolutionary policy to realize a 23% share of renewable energy in national energy mix in 2025 (Kompas Daily News 14 November 2019).

#### Miscellaneous

Technical reports on the implementation of individual project activities, technical documents on conduct of technical meetings, consultations, dialogues, visits by high rank officers, etc.

### **3.2. Organization of a Regional Workshop on Wood-based Energy Development**

#### a. Venue, date and participants

- The workshop was conducted at Horison Hotel in Pematangsiantar City on 4 Desember 2017.



*Workshop on wood-based energy at Pematangsiantar City (Photos by PMU)*

- The workshop was attended by 54 people representing different groups of stakeholder including North Sumatera provincial government, district governments, Forest Management Units, Operational Units of MoEF, Community Leaders, Ministry of Energy and Mineral Resources, North Sumatera Provincial Forestry Agency as co-organizer, the Executing Agency and Project Management Unit.
- b. Conclusions and Recommendations of the Workshop
- By end of the workshop, the participants understood well on the objectives of the project, what it intends to do and what support it needs from stakeholders.
  - The workshop made clear to the participants that the project did not plan to construct any energy generating plant but to initiate development of new renewable energy (EBT) in the forest sector of North Sumatera province by improving the enabling conditions for EBT development.
  - Improved enabling conditions, i.e. skillful local people in energy forest development and secured supply of energy wood in the long-run is a strong incentive for private sector to invest in wood-based energy industry.
  - Operation of an energy industry will provide a steady market for energy wood produced by the FMUs and local communities.
  - Participants of the workshop had come to acknowledge and appreciate the presence of ITTO Project PD 737/14 Rev. 2 (I) for the social, economic and environmental benefits promised to generate.

### 3.3. Calorific Properties of Planted Wood Species

Results of the laboratory analysis of calorific contents of gamal and kaliandra at two different ages are presented in Table 1.

Table 1. Calorific values of gamal and kaliandra

No.	Sample code	Age of the wood samples	
		30 months	36 months
1	GS 1	4,011	4,068
2	GS 2	3,927	4,049
3	GS 3	3,945	3,998
4	GT 1	4,049	4,102
5	GT 2	4,162	3,984
6	GT 3	4,098	4,086
7	KS 1	4,161	4,144
8	KS 2	4,197	4,356
9	KS 3	4,171	4,252
10	KT 1	4,169	4,091
11	KT 2	4,190	4,242
12	KT 3	4,050	4,265

The wood samples analysed as shown in Table 1 deserve clarification. G for gamal, S refers to Simalungun FMU, K refers to Kaliandra, T refers to Tapanuli Selatan FMU while 1,2 and 3 are replication of samples, coincided with three different spacings used.

The calorific value of gamal wood at age 30 months ranged from 3,927 to 4,162 Kcal/Kg, slightly lower than kaliandra's at 4,050 to 4,197 Kcal/Kg. At age 36 months, the



calorific values for gamal and kaliandra ranged from 3,984 to 4,102 Kcal/Kg and from 4,091 to 4,356 Kcal/Kg, respectively.

Below are the main result of the statistical test on the calorific values presented in Table 1:

- The calorific values of the wood aging 30 months and 36 months were not significantly different at 95% confident level;
- The calorific values of gamal and kaliandra species at Simalungun demplots were significantly larger than those at Tapanuli Selatan demplots, at 95% level of confident;
- Calorific values of kaliandra was found larger than gamal's at all sites, at 95% level of confident.

### 3.4. Study on Feasibility of Investment in Commercial Manufacturing of wood-based Energy

a. The product defined

- Based on Ministry of Energy and Mineral Resources Decree No. 55/2019, the value of BP3 in North Sumatera is IDR 1,451/kWh or 10.18 cents USD/kWh; hence, the purchase price of PLN is  $0.85 * \text{IDR } 1,451 = \text{IDR } 1,233.35/\text{kWh}$ .
- The price of wood pellet in domestic markets ranged from IDR 1,500 to IDR 1,800 per kilogram at the factory warehouses.
- Comparing the purchasing price of electricity by PLN and selling price of wood pellet at the factories it was obvious that investment in generation of electric power using wood biomass is not feasible in North Sumatera region except in Nias Island. Consequently, this study had covered only investment in the manufacturing of wood pellets.



*Workshop on feasibility study on investment of wood-based energy (Photos by PMU)*

b. Availability of suitable lands for energy forest plantation (EFP)

- The tree species considered to be used in EFP development were gamal, kaliandra and lamtoro
- If EFP is to be established on production forest lands, available lands suitable for the species considered were 1,422 M hectares or 46.53% of total forest land area in North Sumatera province
- If EFP is to be established to secure wood energy for wood-pellet industries at Sei Mangkei and Gunung Tua, respectively, available suitable lands were 73,910 hectares and 195,366 hectares, respectively.

c. Sites of wood pellet factories

Based on potential sustainable supply of wood energy, proximity of the factories to wood-energy sources as well as availability and quality of needed infrastructure including harbours, two most potential sites identified were: Sei Mangkei Special Economic Zone and Gunung Tua.

d. Financial feasibility of investment

Investment in wood pellet industry at two selected sites was feasible under different criteria as shown below:

<u>Criterion</u>	<u>Unit</u>	<u>Sei Mangkei</u>	<u>Gunung Tua</u>
NPV	Million IDR	81,684	60,863
IRR	%	32.78	26.68
BCR	-	1.21	1.17
Payback period	Year	2.90	3.40

### 3.5. Review of Existing Policy on Wood-based Biomass Energy Development

a. Wood-based biomass energy (WBBE) defined

- WBBE is a form of renewable energy as defined by the State Law No. 30 of 2007 on energy.
- WBBE is the energy derived from lignocellulose of wood plants or woody materials.

b. Policies of MoEMR and PLN on WBBE development reviewed

Energy Acts

- No. 30 of 2007 on energy
- No. 30 of 2009 on electricity

Government Regulations (PP)

- No. 79 of 2014 on national energy policy
- No. 23 of 2014 on revision of PP 14/2012 on business in electricity power generation
- No. 61 of 2012 on revision of PP 14/2012 on use of state forest land area



*FGD on review of existing policy on wood-based biomass energy development (Photos by PMU)*

Presidential Instruction

- No. 1 of 2006 on supply and use of biomass fuels and biofuels

Presidential Regulations

- No. 22 of 2017: National Energy Strategic Plan or Rencana Umum Energy Nasional (RUEN)
- No. 105 of 2016 on revision of PP No. 68 of 2015 on structural organization of the Ministry of Energy and Mineral Resources (MoEMR)
- No. 5 of 2006 on achieving an optimal national energy mix in 2025

MoEMR decrees/regulations

- No. 49 of 2017 on revision of MoEMR Regulation No. 10 of 2017 on essential elements of electricity power Purchasing-Selling Agreement
- No. 37 of 2008 on arrangements for Sumatera network of electricity grid

- No. 05 of 2014 on procedures for accrediting and certifying electricity installation, competence of manpower as well as contracting firms
- No. 50 of 2017: revision of MoEMR's regulation No. 12 of 2017 on the utilization of new renewable energy sources for electricity power supply
- No. 27 of 2014: purchasing of electricity power by PLN from Biomass Electricity Power Generation (PLTBg)

Ministry of Finance

- No. 21 of 2010: provisions of tax and duty facilities on utilization of renewable energy sources

Ministry of Environment

- No. 11 of 2006: types of business plans and activities requiring Environmental Impact Statements (EIS)

c. Constraints to developing WBBE

Major constraints to developing WBBE in North Sumatera identified include:

i. Land availability

Experience shows that, in many instances of energy forest development, needed lands claimed as available did not possess a clean and clear status thus could not be utilized as planned.

ii. Manpower

Development of WBBE industry requires employment of advanced technology at different value chains. Available manpower not necessarily have acquired needed skills; training on managerial as well as technical skills most likely is required before embarking in WBBE business.

iii. Capital

Any WBBE industry requires significant amount of capital especially when investment is needed for energy forest plantation development which in many occasions became a serious problem.

iv. Government policy

The review on existing policies on national energy indicated that no government policy has ever been specifically developed to regulate promotion of WBBE development; this was in contrast with biofuels energy whose development is regulated with Presidential Instruction No. 1 of 2006.

v. Market for WBBE

The fact that subsidized price of fuel oil is always cheaper than price of WBBE has served as a disincentive for investment in WBBE development.

vi. Socio-political factor

- Existing policies on land use does not encourage development of EFP to support WBBE industry.
- Reallocating the subsidy on fuel oil importation to support WBBE development is unpopular on social and political grounds.

d. Recommendations for accelerating WBBE development

Importation of fuel oils to meet the growing domestic demand has significantly raised amount of energy subsidy. Among the feasible measures to increasing supply capacity of WBBE and decreasing import of fuel oils thus energy subsidy recommended by the policy review included:

i. The concept of Energy Self-sufficient Villages (DME) needs redefining in view of improving competitiveness of WBBE as opposed to subsidized fuel oils and promoting application of diversified use of lands for energy and food production;

ii. The current role of the National Energy Board requires redefining from a facilitator only to become a decision maker on WBBE development;

- iii. Accelerating WBBE development requires adoption of a strong national policy like that policy on biofuels development, i.e. Government Regulation No. 5 of 2006;
- iv. The targeted share of WBBE in national energy mix in 2025 is 5%; if this target is ever to be realized, revitalizing programs on EFP development and roles of the forest industries are inevitable;
- v. The most powerful incentive for forest communities and industries to produce wood biomass is security of market; consequently, WBBE industry would only prosper if market for wood biomass is secured through investment in processing of wood energy;
- vi. Significant amount of funds is allocated by the government for subsidy on fuel oil importation; this subsidy should be gradually re-allocated for WBBE development;
- vii. Unproductive lands that are available for WBBE and biofuel in 2013 development are estimated at 4.8 M hectares but only 13,000 hectares were on “clean and clear” status. The government would have to strengthen its policy on land allocation in order to increase the size of “clean and clear” lands;
- viii. To reduce dependence on import of fuel oil, the government has to enhance the program on energy diversification by prioritizing use of CPO for biofuels; and
- ix. The MoEF should make EFP development as the top priority program; to be successful this program should receive internal and external support, especially from legislators and MoEMR.

### 3.6. Formation and Operation of a Stakeholder Forum

- a. Stakeholders of WBBE development and their respective roles.  
Twelve groups of stakeholders had been identified as having role in one form or another in WBB development processes; the respective role and function of the stakeholders are summarized in Table 2.

Table 2. Roles and functions of stakeholders in WBBE development

No.	Stakeholders group	Role	Function	Competence
1	Individual forest farmers	To grow energy trees on owned lands	Supplier of wood energy	To cooperate on personal behalf
2	Forest farmers group (KTH)	Village level farmers organization to organize EFP development on legally allocated lands	Representative of farmers	To collaborate with other parties to procure inputs needed by farmers
3	Heads of FMUs	To develop collaboration with KTHs to develop EFP	Link between KTHs and wood energy users	To select credible KTHs; to identify competent buyers
4	North Sumatera PLN Unit	To provide information on demand for electricity	Buyers of electricity produced by private sector	To monitor and evaluate moves of electricity producers
5	North Sumatera Provincial Forestry Agency	To organize FMUs in EFP development	Link between FMUs and energy wood users	To select competent FMUs in EFP development

6	North Sumatera Provincial MoEMR Agency	To provide information on electricity consumption and delegate licensing of PLTBm to ITSP	To provide information on energy market in North Sumatera	To disseminate information on technology for PLTBm development
7	Provincial one-door Licensing Authority	To efficiently license construction of PLTBm	Link between DG EBT with provincial government	To select investors for PLTBm
8	DG PHPL of MoEF	To gather information on lands for EFP development and energy wood mills	Link between investors in EFP with provincial government	To issue license for EFP and energy wood processing mills
9	DG EBT of MoEMR	To provide information on level of electrification in the province	Link between DG EBT with provincial MoEMR Agency	To provide information on electricity market in the province
10	MoCSME	To develop cooperatives and SM enterprises on WBBE development	Link between MoEF with donors for CSME empowerment in WBBE development	To cooperate with national and international organizations
11	Ministry of Trade (MoT)	To assist in marketing of WBBE products	Link between MoT and MoEF and WBBE suppliers	To license marketing of WBBE products
12	Ministry of Industry (Mol)	To assist in soliciting investor for wood pellet industries	Link between government with fund owners and borrowers	To license construction of energy wood processing mills

b. Mechanism for stakeholders coordination in WBBE development

- Formation of a stakeholders coordination in WBBE development (SCF) in North Sumatera could be accomplished through three options, namely:
  - ✓ Use of existing forum on rubber industry development, i.e. FOKKASU or
  - ✓ Formation of a new forum at District (Kabupaten) level or
  - ✓ Formation of a new forum at FMU level.

Based on technical, juridical and economical consideration, the key stakeholders favoured formation of SCF for WBBE development at FMU level; the reasons for this favour were: FMU has acquired technical competence in EFP development, scope WBBE development is juridical consistent with a FMU's defined role and function, and least costly to establish and operate.

- Formation of a SCF forum at FMU level can be accomplished in collaboration with other FMUs situated nearby the wood pellet industry; in this case, a Head of FMU will serve as Chairman or Chairlady of the SCF and as agent of wood energy producers in the working area of the FMUs. This model is believed consistent with the efforts of North Sumatera provincial government in promoting any FMU to become a self-sustained, profitable business entity.

c. Operational plan of the SCF

A mid-term operational plan for Pematangsiantar FMU as the model has been developed with the main programs and activities as depicted in Table 3.

Table 3. Mid-term operational plan for Pematangsiantar SCF

No.	Program	Activities	Year				
			1	2	3	4	5
1	SCF consolidation	• Holding periodic discussions between stakeholders	X	O	O	O	O
		• Soliciting investor(s)	X	O	O	O	O
		• Signing of MoUs and agreements with investor(s)	X	O	O	O	O
2	SCF socialization	• Developing and activating website	O	X	O	O	O
		• Training of extension officers and staff	O	X	O	O	O
3	Human resources capacity development	• To identify training need	O	X	O	O	O
		• To develop training curriculum	O	X	O	O	O
		• To recruit competent trainers	O	X	O	O	O
		• To monitor and evaluate training results	O	O	X	O	O
4	Harvesting and processing of wood energy	• To organize operations of energy wood harvesting	O	O	X	X	X
		• To monitor processing operations	O	O	X	O	O
		• To evaluate results of harvesting and processing operations	O	O	X	O	O
		• To improve existing SOPs based on experience	O	O	O	X	X
5	Marketing of wood energy products	• To identify industries in need of energy wood	O	O	X	X	X
		• To negotiate on terms of energy wood trading	O	O	X	X	X
		• To assist in shipment of energy wood	O	O	X	X	X
6	Raising level of efficiency and quality	• To collaborate in producing superior seeds	O	O	X		
		• To experiment in growing superior seeds	O	O	X	X	
		• To monitor and evaluate results of the experiments	O	O	X	X	X
		• To promote use of superior seeds	O	O	O	X	X



## 4. Discussions

### 4.1. Delivery of Output 3

Proponent(s) of project PD 737/14 Rev.2 (I) hypothesized that Output 3 “Investment in wood-based energy industry development promoted” will be delivered if all planned activities on the output have been fully implemented. The essential that must prevail in order to accept or refuse the hypothesis is to assess the level of execution of the activities pertaining to Output 2; the assessment is summarized below.

**Activity 3.1:** To disseminate information on technology and market for wood-based energy through website and other means

- The activity was self-executed by the PMU; one senior technical staff was assigned to continuously and carefully attend the execution process;
- The website had been uploaded with rich information on different aspects of wood biomass energy development and on project activities.

**Activity 3.2:** To organize one regional workshop on wood-based energy development

- The activity was implemented on 4 December 2017 at Horison Hotel in Pematangsiantar City; it was organized by the PMU and attended by some 54 people representing different groups of stakeholders
- Planned objectives of the workshop were achieved as evidenced by the developing discussions among the participants:
  - ✓ The participants clearly understood the objectives of the project and what it intends to accomplish
  - ✓ The participants conceived well that the project was to initiate development of wood-based energy industry through improved enabling conditions
  - ✓ The participants provided inputs and insight to ensuring an effective operation of the project
  - ✓ The participants actively involved in defining the conclusions and recommendations of the workshop.

- In conclusion, the activity had been fully implemented and achieved its planned objectives.

**Activity 3.3:** To examine calorific properties of the energy wood species planted  
The calorific value of gamal and kaliandra aging 30 and 36 months grown at two different sites are presented in Table 1. The statistical test conducted on the values obtained resulted in the following conclusions:

- Overall, caloric values of wood aging 30 months were not significantly different from the wood aging 36 months at 95% level of significance;
- Overall, caloric values of the wood grown at Simalungun FMU were significantly higher than the wood grown of Tapanuli Selatan FMU, at 95% level of significance;
- In general, caloric values of kaliandra were higher than the values of gamal at 95% significance level; and
- Caloric values of kaliandra grown at Simalungun FMU were highest among all at 95% confidence level.

Assuming that the objective of EFP development is to maximize caloric value, implications of above findings on EFP management are:

- It is more efficient to harvest EFP at the age of 30 months as extending harvest to age 36 months entails additional costs and risks; and
- It is best to grow kaliandra than gamal on sites having similar attributes to that one at Simalungun FMU.

Obviously, the activity had been fully implemented and generated the caloric values as planned thus contributed to delivery of Output 3.

**Activity 3.4:** To conduct a study on feasibility of investment in commercial manufacturing of wood-based energy including electricity and wood pellets

- The activity had been executed by a team of competent professionals in January – May 2019; the team also spared time to directly assess several suitable sites for wood pellet factories before selecting two most strategic sites at Sei Mangke and Gunung Tua.
- Using NPV, IRR, BCR and Payback period as the criteria, investment in wood pellet industry at both proposed sites was feasible with Sei Mangkei factory had a slightly better feasibility than Gunung Tua factory as illustrated in the previous section.
- The disappointing fact is that, twenty months after the public release of the feasibility study report by the PMU, no party has ever approached the project expressing interest in the investment. One obvious reason for this could be the pandemic situation.
- Another reason for the no entry situation could be the decreasing price of wood pellet in world markets since the rise of the covid-19 pandemic. The study assumed a constant at factory price of wood pellet at IDR 1,450.000 – 1,500.000 per ton, equivalent to USD 104-107, whilst the actual price was far below USD 100 until recently. The slumped market has discouraged any entity to invest in wood pellet industry.
- All in all, the activity has been fully implemented noting that its product, the feasibility study, has not been successful in persuading individuals or fund owners to invest in.

**Activity 3.5:** To review existing policy on wood-based biomass energy development in view of strengthening incentive for investment

- The activity had been executed with the assistance of a competent national consultant, Dr Subarudi of EFORDIA;
- No less than seventeen government regulations of different levels had been reviewed and results presented to a FGD for comments.
- Constraints to developing WBBE had been identified and their feasible solutions discussed by the FGD. Six major constraints including availability of lands, skilful



manpower, capital, government policy, WBBE markets and socio-political aspect, had been identified and discussed.

- The FGD recommended nine measures for removing the constraints to developing WBBE, namely: i) revisiting the DME concept, ii) redefining role of the NEB in WBBE development, iii) formulating and adopting a strong national policy on WBBE development, iv) revitalizing programs on EFP development, v) securing market for wood biomass, vi) re-allocating subsidy on fuel oil for WBBE development vii) increasing availability of “clean and clear” suitable lands for EFP developments as the top priority program of MoEF.
- The activity had obviously been fully implemented and produced its intended outcomes.

**Activity 3.6:** To form and operate a consultation forum on renewable energy for enhancing communication and coordination between stakeholders.

- The activity was implemented with the assistance of a qualified national consultant, Dr Subarudi of EFORDIA, by pursuing a logical operational strategy.
- The targeted outcomes, i.e. the stakeholders involved and their task and function identified, a stakeholder forum established and its mid-term operational plan developed.
- Twelve groups of stakeholder of WBBE were identified and their role, function and competence defined; representation of the groups covered only farmers and government sector while private sector was not identified as a stakeholder. Exclusion of the private sector may have serious implications as WBBE development inevitably requires processing facilities and investment.
- The process pursued in the establishment of a SHF was logical; it started with identification of the main stakeholders and analyses of their need, interest and potential role in WBBE development, identification of different formats of SHF, collaborative selection of the most feasible format and development of a mid-term operational plan for the SHF.
- The Consultant recommended to form a SHF at the FMU level on technical, juridical and economical grounds.
- Based on above highlight, it is justifiable to conclude at this juncture that the activity had been fully implemented and delivered its desired outcomes.

Above information of individual activities clearly indicates that all activities under Output 3, six in total, had been fully implemented. By hypothesis then, the output must have been delivered. This delivery of output can be verified by examining the indicators of achievement of Output 2 presented in the logical framework of the project, namely:

- i. Website of wood-based energy operational since Year 1
  - Under Activity 3.1, a website of the project had been developed and operational since Year 1;
  - Content of the website has been continuously updated and enriched till end of the project
  - Therefore, the indicator had been satisfied.
- ii. One national workshop on wood-based energy development was organized in Medan in Year 1.
  - One regional workshop on wood-based energy development was organized in Pematangsiantar City by the PMU in Year 1. Scope of the workshop had been changed from national to regional level due mainly to the tight allocated budget. The reason for moving the venue from Medan to Pematangsiantar was technical in nature, as the latter city was less costly to visit by most invitees.
  - Despite the changes to venue and scope, Activity 3.2 had been fully implemented as evidenced by the technical report on the workshop that has been printed and disseminated by the PMU.

- iii. Data on calorific properties of 3 planted tree species available in Year 4
  - Analysis of calorific content of gamal and kaliandra had been carried out in collaboration with EFORDIA's wood technology in Bogor; the analysis was accomplished by professional laborants using commonly acceptable procedures and techniques for trees aging 30 and 36 months;
  - The analysis was carried out for gamal and kaliandra species from two demo plots only, as lamtoro did not survive age 24 months and beyond while the demo plot at Humbang Hasundutan was considered as failing;
  - Despite the reduced number of wood species analysed, i.e. from 3 to 2 species, it was obvious that the indicator had been 67 percent satisfied. If the failing lamtoro at Humbang Hasundutan demo plot were considered as a force majeure phenomenon, the indicator could be declared as fully met.
- iv. A feasibility study on investment in wood-based energy industry completed in Year 4
  - With an approval of the PSC, the feasibility study had been implemented in Year 2 in order to provide ample time to widely disseminate findings of the study;
  - The study report was released in September 2019 in both Bahasa Indonesia and English versions. Therefore, the indicator had been satisfied.
- v. Existing policy on wood-based energy development reviewed and enhanced in Year 2
  - Existing policy had been reviewed by a competent consultant and review results discussed by a FGD noting that policy enhancement was expected to be accomplished by carrying out the recommendations made by the consultant;
  - The indicator can be regarded as fully met through execution of Activity 3.5.
- vi. A stakeholder consultation forum operational since Year 2
  - The indicator was to be realized through Activity 3.6 which had been executed with the assistance of a competent national consultant;
  - A stakeholder forum had been established at the FMU level and its mid-term operational plan developed;
  - A technical report on the implementation of Activity 3.6 has been published in July 2019 thus the indicator can be considered as fully satisfied.

Above discussions indicated that five defined indicators of achievement of Output 3 were satisfied while one indicator was only 67% met. Overall, it is reasonable to conclude that all indicators had been met thus Output 3 delivered. This conclusion confirmed the conclusion made on hypothetical delivery of Output 3 as previously declared.

#### **4.2. Quality of the Output Delivered**

Conceptually, the output to be delivered was defined as "investment in wood-based energy development promoted". To promote investment may take different meanings, including "to advance, to assist, to boost, to raise, to elevate, to upgrade, to advertise, etc.". Obviously, the output was loosely defined; indicators of the output delivered also could not be used to precisely measure level or stage of promotion of investment that has been realized.

It might be useful to closely examine how and to what extent individual activities under Output 3 have contributed to promotion of investment in wood-based energy development. It should be emphasized at this juncture that defined indicators of the output were the primary outcomes of the activities under the output.

- a. Activity 3.1: To disseminate information on technology and market for wood-based energy through website and other means
  - The primary outcome of Activity 3.1 was a website that operational since the first year. The web contained a variety of information on wood-based energy development obtained from the project and from other sources. Surely, such information would be useful for investment decision making if the web was visited by prospective investors.

- The web therefore, was a tool to disseminate information that could aid or assist in investment if, and only if, the web was visited by prospective investors. The worst case that could happen was that an investment decision was made without relying on the information contained in the project web. In this case, Activity 3.1 did not make any contribution to promotion of investment.
- b. Activity 3.2: To organize one regional workshop on wood-based energy development
- The primary objective of the workshop was to disseminate information on Project PD 737/14 Rev.2 (I) that stakeholders would be aware of the project including its objectives and what it intended to do. In addition, the workshop also briefed stakeholders on potential benefits of wood-based energy development accruable to society as well as potential role of stakeholders in the project operations that would initiate wood-based development by improving its enabling conditions.
  - Obviously, the workshop did not make any direct intervention to promote investment. What the workshop did was to gain support of stakeholders on the project and its primary objective which was to initiate wood-based energy development. By gaining such support, the workshop has in fact, contributed to creating favourable climate for investment in wood-based energy development.
- c. Activity 3.3: To examine calorific properties of the energy wood species planted
- The primary objective of this activity was to produce data on calorific properties of gamal, kaliandra and lamtoro woods, planned to be collaboratively produced by FMUs, farmers and private sector. Calorific properties of these wood species grown in other regions and localities were readily available with different sources. However, calorific properties of the wood species planted in North Sumatera were not available yet.
  - Proponent(s) of the project argued that calorific properties of the wood species produced in North Sumatera must be made available to convince prospective investors that gamal, kaliandra and lamtoro were promising species to grow as the source of wood energy with high calorific content, similar to other localities or regions.

In this sense, data on calorific properties generated under Activity 3.3 as presented in Table 1 could be considered as contributing to promotion of investment by convincing availability of quality energy wood.

- d. Activity 3.4: To conduct a study on feasibility of investment in commercial manufacturing of wood-based energy including electricity and wood pellets
- As shown in the logical framework matrix, the prime outcome of this activity was a study report on feasibility of investment in wood-based energy industry. Such a report was published in September 2019 and elaborated on feasibility of investment in wood pellet industry using NPV, IRR, BCR and Payback period as the criteria. Had the report promoted investment in wood pellet industry in North Sumatera?
  - As to date, no such investment has materialized. Does it mean that the study report produced under Activity 3.4 did not contribute to promoting investment? There are so many reasons for this unrealized investment despite the promising profitability reported by the study.
  - Certainly, the information on feasibility of investment in wood pellet industry should have encouraged investment if the information reached interested fund owner. In no doubt, outcome of Activity 3.4, i.e. the feasibility study report is encouraging investment in wood pellet industry.

- e. Activity 3.5: To review existing policy on wood-based biomass energy development in view of strengthening incentive for investment
- Existing policy on wood-based energy development had been reviewed, constraints identified and feasible measures for removing the constraints recommended.
  - The activity then was an attempt to create a favourable climate for investment in wood-based biomass energy development. Surely, a favourable climate to invest is created through implementation of the relevant and effective government policies on WBBE development and serves as a strong incentive for private sector to invest. If so, Activity 3.5 had certainly contributed to promoting investment in WBBE development.
- f. Activity 3.6: To form and operate a consultation forum on renewable energy for enhancing communication and coordination between stakeholders
- The primary purpose of this activity was to establish and operate a stakeholder forum for WBBE development. Proponent(s) of the project argued that stakeholders need to meet periodically to exchange information, experience and insight relating to WBBE development for which a stakeholder forum (SHF) is required.
  - If operational, a SHF could discuss on different investment opportunities including in wood pellet industry; it could encourage investment but discourage another one through sharing of information, experience and insight. In this sense, a SHF could contribute to promoting investment in WBBE development.

In conclusion, all activities under Output 3 had been implemented and conceptually contributed to promoting investment in WBBE development in one form or another; Activities 3.1, 3.3 and 3.4 provided useful information to aid investment decision making while Activities 3.2, 3.5 and 3.6 had basically helped create favourable environment to invest in WBBE industries. This perceived contribution, however, was nullified by the fact that no investment had entered the WBBE industry till end of the project. In other words, investment in WBBE industry had been conceptually promoted but was practically invalidated or nullified.



## 5. Conclusions and Recommendations

### 5.1. Conclusions

- i. All defined activities on Output 3, six in total, had been fully implemented, either by the PMU or with the assistance of other competent parties; conceptually, therefore, the output must have been delivered, i.e. investment in wood-based energy industry development promoted;
- ii. Close examination of defined indicators of Output 3 revealed that all indicators, six in total, had been met, confirming the conclusion on delivery of the output through full implementation of six pertaining activities;
- iii. In retrospect, Output 3 had been loosely defined as “investment in wood-based energy development promoted”, as the word “to promote” may have different meanings including: to advertise, to advance, to assist, to boost, to raise, to elevate, to upgrade, etc.
- iv. Defined indicators of achievement of Output 3 could not be used to accurately measure the level of investment promotion achieved as some activities had functioned only to generate data and information thought as useful to aid investment decision making (Activities 3.1; 3.3 and 3.4) while some other activities had worked to create favourable environment for investment (Activities 3.2; 3.5 and 3.6);
- v. Conceptually, Output 3 has been fully delivered, i.e. investment in wood-based energy development promoted but no investment has entered the industry in North Sumatera region till end of the project.

## 5.2. Recommendations

- i. There is a need to more specifically define any output in future ITTO projects by avoiding use of a word with unprecise meanings like word “promoted” in Output 3. The output could have been defined as “such million US Dollar investment or two units of wood pellet industry realized”;
- ii. Accordingly, indicators of achievement of output could have been defined in a SMART manner, i.e. specific, measurable, applicable, replicable and time bound;
- iii. To realize investment in wood pellet industry in North Sumatera, the MoEF may have to make a bold decision by assigning one of existing state-owned companies to make investment in the name of social and environmental benefits during the recently sinking price of wood pellet; economic benefits should accrue after recovery of the price slump.
- iv. Critical for the promotion of investment in wood-based energy development is to create favourable environment for investment which can be accomplished through adoption of relevant and effective government policies on EFP development, subsidy on fuel oil, etc.

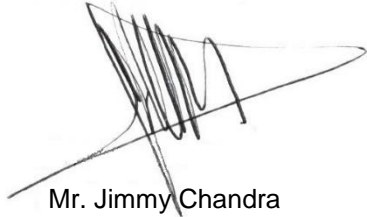


## 6. Implication for Practice

- The dialogues held between the project and local communities clearly and convincingly indicated that the communities were committed to supporting EFP development under the conditions that market for harvested energy wood is secured in the long-run and that harvesting of energy wood is authorized by the government. In the absence of investment in wood pellet industry more than two years after the dialogues, it would not be surprising to find scepticism of local communities on WBBE development program.
- Failing to realize investment in wood pellet industry would succeed degradation of forest resources and poverty among most local communities which implies a lack of political will on accelerating WBBE development.


## Responsible for the report

Project Coordinator

A handwritten signature in black ink, appearing to be 'Jimmy Chandra', written over a horizontal line.

Mr. Jimmy Chandra

Management Advisor

A handwritten signature in black ink, appearing to be 'Hiras Sidabutar', written in a cursive style.

Dr. Hiras Sidabutar

Date: November 2021



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