

# **THE FOURTH YEARLY PLAN OF OPERATION (YPO 4)**

## **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**

**October 2020 - September 2021**

**Submitted to ITTO: October 2020**

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<b>Project number</b>	<b>:</b>	<b>PD 737/14 Rev.2 (I)</b>
<b>Project title</b>	<b>:</b>	<b>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</b>
<b>Host Government</b>	<b>:</b>	<b>Government of Indonesia</b>
<b>Executing Agency</b>	<b>:</b>	<b>Directorate General of Sustainable Management of Production Forests (PHPL)</b>
<b>Collaborating Agency</b>	<b>:</b>	<b>Indonesian Sawmill &amp; Woodworking Association (ISWA)</b>
<b>Project Management Unit (PMU)</b>	<b>:</b>	<b>Established pursuant to the MoU signed by PHPL and ISWA on 18 September 2017</b>
<b>Starting date</b>	<b>:</b>	<b>1 October 2017</b>
<b>Project duration</b>	<b>:</b>	<b>48 months</b>
<b>Total project costs</b>		
• ITTO	<b>:</b>	<b>USD 589,863</b>
• GOI	<b>:</b>	<b>USD 197,150</b>
• Total	<b>:</b>	<b>USD 787,013</b>
<b>YPO 4 project costs</b>		
ITTO	<b>:</b>	<b>USD 132,770.58</b>
GOI	<b>:</b>	<b>USD 49,960</b>
Total	<b>:</b>	<b>USD 182,730.58</b>
<b>Submitted to ITTO</b>	<b>:</b>	<b>October 2020</b>

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## List of Abbreviation

CA	Collaborating Agency
CO	Company
CTA	Chief Technical Advisor
DG PHPL	Directorate General of Sustainable Management of Production Forest
EA	Executing Agency
EBT	New and Renewable Energy
FGD	Focussed Group Discussion
FMU	Forest Management Unit
FS	Field Supervisor
ISWA	Indonesian Sawmill & Woodworking Association
ITTO	International Tropical Timber Organization
LFM	Logical Frame Work
LG	Local Government
MOEF	Ministry of Environment Forestry of Indonesia
NC	National Consultant
NE	National Expert
NGO	Non-Governmental Organization
NSPFA	North Sumatra Provincial Forestry Agency
PC	Project Coordinator
PF	Project Finance
PFE	Permanent Forest Estate
PLN	The State Electricity Company
PMT/U	Project Management Unit
PS	Project Secretary
RDI	Research and Development Institute
RDPB	Regional Domestic Product Bruto
SCF	Stakeholder Consultation Forum
SFM	Sustainable Forest Management
UHP	Directorate of Production Forest Business Management
YPO	Yearly Plan of Operation

## 1. Project Progress Report

### 1.1. Description on the work implemented since the inception

This progress report covers the period of operation from 1 October 2017 to 30 September 2020; the activities implemented during this period are outlined below:

#### Output 1: Development of sustainable supply of energy wood initiated

Out of 5 activities defined under Output 4, activities that have been implemented under YPO 1, YPO 2 and YPO 3 are:

i. Activity 1.1 (completed)

To identify suitable lands for development of energy forests in South-eastern of North Sumatra province covering 13 districts (Kabupaten). This activity was implemented with the assistance of a competent national consultant, Dr Aswandi of Aek Nauli Forestry Research Institute, and had been successfully completed. A satisfactory technical report has been submitted by the Consultant to the PMU.

ii. Activity 1.2 (completed)

To identify suitable lands on 3 FMUs for energy forest development; the FMUs identified were KPH Unit XII Simalungun district, KPH Unit XVII Humbang – Hasundutan district and KPH Unit X Padang Sidempuan of Tapanuli Selatan district.

The same as Activity 1.1, this activity was implemented with the assistance of a competent national consultant, Dr Aswandi, and had been completed. A technical report of the activity had been submitted by the Consultant.

iii. Activity 1.3 (on-going)

To establish energy forest models for purpose of demonstration and training (3 sites, 3 species, 36 ha in total). Establishment of demo plots for energy forest at 3 sites using kaliandra, gamal, and lamtoro species had been completed as outlined below noting that growth monitoring is on-going:

a. At Simalungun FMU

- The total land area planted was 9 Ha, the land was earlier occupied by Panribuan village community
- Planting of Kaliandra, gamal and lamtoro, each 3 Ha in size, was completed by end of April 2018
- The growth monitoring conducted in early April 2020 indicated that kaliandra grew better than gamal and lamtoro. Data processing is underway and will be reported to the next PSC meeting under Progress Report #6.

b. At humbang Hasundutan FMU

- The total land area planted was 12 Ha; the land was previously occupied by Parlilitan village community
- Planting of kaliandra, gamal and lamtoro, each 4 Ha in extent, was completed by end of June 2018
- The growth monitoring carried out in early April 2020 indicated that kaliandra grew best compared to gamal and lamtoro. Monitoring data are under processing, to be reported to the next PSC meeting under Progress Report #6

c. At Padang Sidempuan FMU,

- The total land area planted was 12 Ha; the land was controlled by the FMU, not under occupation by local community
- Planting of kaliandra, gamal and lamtoro, each 4 Ha in size, was completed by end of May 2018
- The monitoring of growth carried out in mid-March 2020 indicated that kaliandra grew better than the other two species. The same as the other two demplots, monitoring data are still under processing.

In general, survival rate in all demplots was relatively low which might be due to:

- Low quality of planting materials
- Inappropriate planting of materials by laborers
- Lack of maintenance
  - ✓ Late of weeding
  - ✓ Late of replacement of died seedlings

In particular, the low survival rate could be attributable to:

- Unsuitable soil at Humhas FMU
- The lamtoro's site requirements do not match the site attributes in all sites.

iv. Activity 1.5:

To estimate potential wood supply of non-forest sources. The activity has been fully executed and its technical report is now ready with the PMU.

#### Output 2: Skilfull manpower for development of wood-based biomass energy available

Out of 5 activities defined under Output, 4 activities have been implemented under YPO1, YPO 2 and YPO 3; they are:

- i. Activity 2.1: To conduct dialogue with local communities on benefits of energy forest development (50 villages in 13 districts) in Years 1 and 2 (completed).
  - Dialogue with the communities at 49 villages in 13 Districts had been completed. The activity was implemented with the assistance of the University of Simalungun since June 2018 (YPO 1) till January 2019 (YPO 2)
  - A Technical report on the activity is now available with the project.
- ii. Activity 2.2: To train local communities on technical skills for energy forest development covering planting, tree nursing, planting and harvesting techniques (100 farmers leaders of 50 villages).

The activity has been fully implemented including the training on bee honey production, the 5<sup>th</sup> training module of the activity. Results of the activity are outlined below:

- The subjects covered in the training were:
  - a. Techniques for nursery development and for the production of planting materials (Module 1) for the three target species, namely: gamal, kaliandra and lamtoro
  - b. Techniques for land preparation and for planting of planting materials (Module 2)
  - c. Techniques for plantation maintenance covering replacement of died seedlings, weeding, and fertilizing (Module 3)

- d. Techniques for harvesting (Module 4) of trees of different ages and density of plantation.
- e. Techniques for producing bee honey (Module 5) covering bee raising, honey harvesting and marketing
- Participants of the training were 205 in total, originating from 12 districts surrounding the plantation demplots, noting that: participants of Module 1, 2, 3 and 4, each 34 people, are the same persons, while participants of Module 5 were 35 people. It is to be noted also, that the training on harvesting techniques was implemented only at two demplots as harvesting at Humbang Hasundutan demplot is not feasible due to the fact that all 3 species were failing to grow and develop.
- The time schedule for execution of the training modules (1,2 and 3) was:
  - ✓ 25-27 September 2019 at Simalungun demplot, 34 trainees
  - ✓ 02-04 October 2019 at Padang Sidempuan demplot with 34 trainees
  - ✓ 12-14 November 2019 at Humbang Hasundutan demplot, 34 trainees.
- The training on harvesting techniques (Module 4) was executed as follows:
  - ✓ 26-28 November 2019 at Simalungun demplot, 34 trainees
  - ✓ 04-06 December 2019 at Padang Sidempuan demplot, 34 trainees
- The training bee honey production (Module 5) was carried out on 06 – 09 July 2020 (excluding preparation) in Pematangsiantar with 35 participants originating from 11 different districts.

The number of trained farmers was 205 in total which met the indicator of achievement, i.e. 100 farmers, defined in the project document. A technical report on the implementation of the activity is now available with the PMU.

- iii. Activity 2.3: To train local people on village cooperative management  
The activity has been fully executed with 35 participants in total.
- iv. Activity 2.4: To conduct comparative studies on wood-based energy industry development for executives and manager.  
Under this activity, 3 studies have been conducted which are highlighted below:
  - a. The Vietnam study
    - Conducted on 13-19 May 2019 with 17 participants in total comprising reps. of MoEF, Regional Government (Tapanuli Utara District), forestry industry associations and PMU of the project
    - The study was considered successful; the participants gained first hand information on various aspects of forest industry development especially on forest management and forest industry development policies
    - The lesson learned from Vietnam were applicable to Indonesia's case
  - b. The Ganzhou, China study
    - The study was conducted on 24-30 May 2019 with Mr. Jimmy Chandra, the Project Coordinator, as the sole participant
    - The primary activity of the study was to attend the 4<sup>th</sup> Global Conference on Rubber-wood Industry Development. Among the useful lessons learned from the Conference are outlined below:

- ✓ China consumed some 6-7 MM<sup>3</sup> of KD sawn rubber wood mainly by the furniture industries; wastes are used for producing black pellet in combination with wastes of other wood industries
- ✓ China is pursuing a wood industry clustering strategy for wood industry development whereby wood wastes by different industries can be efficiently collected and utilized by needing industries
- ✓ Another critical element of the clustering strategy is construction of “grand kiln-drying facilities”, in this manner, individual-processors, particularly small-sized ones, do not have to invest in kiln-drying but can use the service of the “grand kiln-drying” on a rental basis
- ✓ In addition, wood terminal development is also an essential part of the clustering strategy. A wood terminal buys timber from different sources, both domestic and overseas, and sells to consuming processors at competitive prices due to economies of scale
- ✓ Efficient utilization of wood raw materials is also promoted through use of wood-ripping machines having high sawing precision thus minimize wastes.

c. The Shanghai study

- The study was a participation in the International Forum “Together towards Global Green Supply Chains: A forest products industry initiative” held in Shanghai, China, on 22-25 October 2019; the Project was represented by Mr. Istanto of the Executing Agency and Dr. Hiras Sidabutar of the PMU.
- Among the important lessons learned from the Forum are highlighted below:
  - ✓ The global communities have shown a positive change in their attitude towards forest industries: from initially identified as “trouble maker” to an essential element of forest resource restoration and climate change negotiation process
  - ✓ Vietnam’s export value of timber products had increased from USD 1,7M in 2013 to app. USD 11,4 M in 2019, using imported raw materials and log harvested from the 3 M hectares of plantation, due mainly to ability to formulate and implement the effective strategy and policies on timber industry development.

Output 3: Investment in wood-based energy industry development promoted

There are 6 activities under Output 3 and five of them have been implemented under YPO 1, YPO 2 and YPO 3 as summarized below:

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

- This activity has been continuously implemented since October 2017; and will go on till end of the project

Activity 3.2: To organize one national workshop on wood-based energy development in Medan (completed)



- This Activity had been implemented under YPO 1 in the form of a One-day Workshop on “Initiation of new renewable energy (EBT) development in North Sumatera Province, on 4 December 2017 in Pematang Siantar.
- The workshop was attended by 53 participants representing the primary stakeholders and had successfully achieved its planned objectives.
- A separate technical report on the workshop is now available with the Project.

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

- This activity has been completed with the assistance of 4 (four) competent national experts led by Dr. Dede Hermawan;
- Findings of the study had been presented to the workshop held on 2 September 2019 in Jakarta.
- The workshop was attended by some 40 people representing government institutions, practitioners, decision makers and would-be investors
- The feasibility study report is now available with the project

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

- The activity had been implemented and completed with the assistance of a national consultant, Dr Subarudi of Forestry R & D Agency;
- A FGD on results of the review work was held on 28 January 2019 and attended by some thirty professionals;
- A technical report on the implementation of the activity is now available for use by decision makers.

Activity 3.6: To form and operate a consultation forum on renewable energy for enhancing communication and coordination between stakeholders (completed)

- The activity had been implemented and completed with the assistance of a national consultant.
- A technical report on the activity is now available with the PMU

## **1.2 Execution of YPO 1, YPO 2 and YPO 3**



### **1..1. The workplan reviewed**

The workplan and progress in implementation of YPO 1, YPO 2 and YPO 3 is summarized in Table 1.

**Table 1. Review of workplan (YPO 1, YPO 2 and YPO 3) since Oct 2017**

Output/Activity	YPO 1 (Oct '17 – Sep '18)				YPO 2 (Oct '18 – Sep '19)				YPO 3 (Oct '19 – Sep '20)				YPO 4 (Oct '20 – Sep '21)				Executor	Achievement (%)
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
<b>Output 1: Development of sustainable supply of energy wood initiated</b>																		
Activity 1.1: To identify suitable lands (North Sumatera province)	■	■	■														PMU, AN-FRI Expert	100
Activity 1.2: To identify Su & Av lands (3 FMUs)		■	■	■													PMU, AN-FRI Expert	100
Activity 1.3: To establish demplots (3 sites) <sup>1)</sup>			■	■	■	■	■	■	■	■	■	■	■	■	■	■	PMU, Contractors	80
Activity 1.4: To estimate potential supply of planted energy forests													■	■	■	■	PMU, AN-FRI	Nil
Activity 1.5: To estimate potential supply of non-forest sources									■	■	■	■	■	■			PMU, AN-FRI	100
<b>Output 2: Skilful manpower for development of energy forests available</b>																		
Activity 2.1: To conduct dialogues (49 out of 50 villages)	■	■	■	■	■	■	■	■									PMU, University	100
Activity 2.2: To train local people on energy forest development <sup>2)</sup>									■	■	■	■	■	■	■	■	PMU, Contractors	85
Activity 2.3: To train local people on village cooperative management									■	■	■	■	■	■			PMU, Professionals	35
Activity 2.4: To conduct comparative studies					■	■	■	■									PMU, EA	100
Activity 2.5: To develop technical manuals													■	■	■	■	PMU, Expert	Nil

Output/Activity	YPO 1 (Oct '17 – Sep '18)				YPO 2 (Oct '18 – Sep '19)				YPO 3 (Oct '19 – Sep '20)				YPO 4 (Oct '20 – Sep '21)				Executor	Achievement (%)
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
<b>Output 3: Investment in wood-based energy industry promoted</b>																		
Activity 3.1: To disseminate information	Realized												Planned				PMU	75
Activity 3.2: To organize a regional workshop			Realized														PMU	100
Activity 3.3: To examine caloric properties													Planned				PMU, Bogor-FRI	Nil
Activity 3.4: To conduct a FS					Realized	Realized	Realized	Realized									PMU, Experts	100
Activity 3.5: To review existing policy					Realized	Realized	Realized	Realized									PMU, Bogor-FRI	100
Activity 3.6: To form a stakeholders forum					Realized	Realized	Realized	Realized									PMU, Consultant	100

 Realized  
 Planned

1) Demplots established, growth and yield monitoring and maintenance on-going since Oct 2018, planned for every 4 months

AN-FRI : Aek Nauli Forest Research Institute  
 Su & Av : Suitable and available lands

### 1.3 Progress in implementation

a. Progress in implementation of the activities under YPO 1, YPO 2 and YPO 3

Table 2. Progress in implementation of the activities

Output/activity	Percentage Executed	Completion date		Remarks
		Originally planned	Realized/ Expected	
<u>Output 1:</u> Activity 1.1: To identify suitable lands (North Sumatera province)	100%	Sep 2018	Mar 2018	Completed in time
Activity 2.2: To identify Su & Av lands (3 FMUs)	100%	Sep 2018	Jun 2018	Completed in time
Activity 1.3 To establish energy forest models in Year 1 for purpose of demonstration and training (3 sites, 3 species, 36 Ha in total)	85%	Sep 2021	Sep 2021	Growth & yield monitoring on-going every 4 months since Oct. 2018
Activity 1.5: To estimate potential supply of non-forest sources	100%	Jan 2019	Sep 2020	Late start due to pandemic Covid-19
<u>Output 2:</u> Activity 2.1 To conduct dialogues (49 out of 50 villages)	100%	Sep 2019	Mar 2019	Completed in time
Activity 2.2 To train local communities on technical skills for energy forest development covering planting, tree nursing and harvesting techniques (100 farmers leaders of 50 villages)	100%	Jun 2021	Sep 2020	Started earlier than schedule
Activity 2.3: To train local people on village cooperative management	100%	Sep 2020	Sep 2020	Late started due to pandemic Covid-19
Activity 2.4: To conduct comparative studies	100%	Sep 2021	Sep 2021	Completed in time

Output 3: Activity 3.1 To disseminate information on technology and market for wood-based energy through website and other means	75%	Sep 2021	Sep 2021	Routine, on-going
Activity 3.2: To organize a regional workshop	100%	Sep 2018	Sep 2018	Completed in time
Activity 3.4: To conduct a study on feasibility of investment in commercial manufacturing of wood-based energy including electricity and wood pellets	100%	Sep 2019	Sep 2019	Completed in time
Activity 3.5 To review existing policy on wood-based biomass energy development in view of strengthening incentive for investment	100%	Mar 2019	Mar 2019	Completed in time
Activity 3.6 To form and operate a consultation forum on renewable energy for enhancing communication and coordination between stakeholders	100%	Sep 2019	Sep 2019	Completed in time

b. Achievement of outputs

- In total, out of 16 planned activities, 11 activities have been completed in Years 1-3; 2 activities are on-going (Act. 1.3 and 3.1) and 3 activities have not started yet: Acts 1.4; 2.5 and 3.3.
- None of the planned outputs has been delivered as defined indicators of individual outputs have not been met as detailed below:

i. Output 1

There are 5 activities planned for execution and status of implementation is as follows:

- 3 activities completed (Acts 1.1; 1.2; 1.5)
- 1 activity ongoing (Acts 1.3)
- 1 activity has not started yet (Act 1.4)

Conclusion: Output 1 has not been delivered

ii. Output 2

Under this output, 5 activities are planned for execution with status in implementation as follows:

- Activities 2.1; 2.2; 2.3 and 2.4 completed
- Activity 2.5 has not commenced yet

Conclusion: Output 2 has not been delivered

iii. Output 3

Under this output, 6 activities have been planned for implementation; status of implementation of individual activities is summarized below:

- Activity 3.1 is on-going till end of project
- Activities 3.2, 3.4, 3.5 and 3.6 completed
- Activity 3.3 has not started yet

Conclusion: Output 3 has not been delivered

As none of the outputs has been delivered, the specific objective has not been achieved. However, the project is progressing on track to timely achieve its defined specific objective.

#### 1.4 Inputs applied

The financial and cash flow statements as of 30 September 2020 appear as Annexes 1 and 2. The amount of funds with the project at 30 September 2020 was USD 351,364.42 (Annex 1) while the remaining funds of the project on that very date was USD 132,770.58 (Annex2). To assist in the implementation of activities, the experts/ consultants/ contractors that have been employed are as listed below:

<u>Name</u>	<u>Activity</u>	<u>Status of work</u>
• Dr Aswandi	Act. 1.1, 1.2 and 1.5	Completed
• Dr Subarudi	Acts. 3.5, 3.6	Completed
• Dr Dede Hermawan	Act 3.4	Completed
• 4 small local firms	Acts. 1.3, 2.2	Establishment of demplots and training on energy forest development, completed
• Univ. Simalungun	Act. 2.1	Completed
• Professional practitioners	Act. 2.2 (Module 5)	Completed
• Professional practitioners	Act. 2.3	Completed

#### 1.5 Critical Analysis of Project Progress

Overall, project operations have been going on as planned and on track to achieve planned specific objectives in time. A few critical notes that deserve mentioning are:

- Weeding must be carried out on time; otherwise weeds may grow taller than the plants due mainly to the abundant sunshine, fertile soil and high rainfall;
- Performing growth and yield monitoring and reporting is a big challenge due to the size as well as dispersed location of demplots and the size of samples used;
- Results of the dialogue with local communities of 49 villages in 13 Districts indicate that local communities are most interested in producing energy wood provided that market for wood energy is available; hence, developing a wood pellet industry in near future appears is a big challenge to the project.

## **1.6 Conclusions**

- The project operation is going on smoothly and on track to achieve its planned objective without any perceptible operational problems.
- Progress in implementation of the activities is:  
11 Activities already completed, 2 activities on-going and 3 activities not started yet.
- The project would be completed on schedule within the sanctioned budget of time and funds regardless of the pandemic Covid-19.

## **2. Fourth Yearly Plan of Operation (YPO 4)**

YPO 4 is the final plan of operation for implementing the project; it covers the period from October 2020 to September 2021. In addition to this normal time coverage, this final YPO also covers the activities that have to be carried out and completed during October – December 2021 period which includes:

- i. Preparation of handing over of the demplots from the Executing Agency to the FMUs and local communities responsible for follow up actions, and
- ii. Final reporting of the project as regards technical and financial matters in accordance with applicable ITTO rules and procedures.

### **2.1 Logical Framework Matrix (LFM)**

#### **a. LFM for the entire duration**

The original and adjusted LFM is presented in Annex 3. It is to be noted in Annex 3 that, during the first PSC Meeting, adjustments had been made to particular indicators of the development objective, specific objective, and the outputs. The main reasons to make the adjustments were: i) to make the indicators more realistic to achieve considering the prevailing environment of the project, and ii) to avoid confusion of definition of some indicators.

#### **b. LFM for YPO 3**

Table 3 exhibits indicators of achievement under YPO 4 which also accommodates implementation of additional activities proposed by the PMU under Output 1 and Output 3 that have been endorsed by the Secretariat through its letter Ref. No. F. 20-0032 of 22 June 2020



**Table 3. Logical Framework for YPO 4**

Output/Activity	Measurable indicators	Means of verification	Key assumptions
Output 1: Development of sustainable supply of energy wood initiated	<ul style="list-style-type: none"> <li>• Growth of trees monitored 3 times starting Nov. 2020 every 4 months</li> <li>• Yield of trees monitored twice in Oct 2020 and Apr 2021</li> <li>• Maintenance of plantations on 3 demplots carried out in 2020 and 2021</li> <li>• Problems with growth and development of trees at 3 demplots, with a focus on HumHas demplot scientifically assessed</li> <li>• Potential supply of energy wood from planted forests estimated using scientifically method</li> </ul>	<p>Monitoring report</p> <p>Monitoring report</p> <p>Monitoring report</p> <p>Expert's report</p> <p>Expert's report</p>	<p>-</p> <p>-</p> <p>-</p> <p>Competent expert available</p> <p>Competent expert available</p>
Output 2: Skilful manpower for development of energy forests available	<ul style="list-style-type: none"> <li>• 3 technical manuals, each for gamal, kaliandra and lamtoro plantation development developed</li> </ul>	Manual documents	Competent expert available
Output 3: Investment in wood-based energy industry promoted	<ul style="list-style-type: none"> <li>• Caloric content of gamal, kaliandra and lamtoro aging 24 and 30 months examined</li> <li>• Two sets of short videos on project operations produced</li> </ul>	<p>Laboratory report</p> <p>Videos</p>	<p>Cooperative EFORDI Agency</p> <p>Professional available in time</p>

## 2.2 Outputs and Activities of YPO 4 (Oct 2020 – Sept 2021)

The are five activities to be implemented under YPO 4 as presented in Table 4. Note that Activities 1.3 and 3.1 have been implemented since YPO 1 while Activities 1.4; 2.5 and 3.3 are the new ones. In addition, sub-activities 1.3.4 and 3.1.1 are newly added activities that have been endorsed by the Secretariat. Sub-act 1.3.4 deals with assessment of growth of planted trees at 3 demplots while other activities are handing over of the demplots and final reporting.

**Table 4. Activities planned for execution under YPO 4**

Output/activity	Responsible party *)	Date to		Remarks
		Commence	Complete	
<b>Output 1:</b>				
<u>Activity 1.3</u> To establish energy forest models in Year 1 for purpose of demonstration and training (3 sites, 3 species, 36 Ha in total);	FS	Nov 2017	Sep 2021	Executed since YPO 1
<u>Sub-activities</u>				
1.3.1 To monitor growth of trees on 3 demplots	FS	Nov 2018	Sep 2021	
1.3.2 To monitor yield of trees on 3 demplots	FS	Oct 2020	Sep 2021	
1.3.3 To carry out maintenance of plantations on 3 demplots	FS	Oct 2018	Sep 2021	
1.3.4 To assess growth and development of demplots, focusing on HumHas demplot	PMU, Expert	Nov 2020	Apr 2021	New task
<u>Activity 1.4:</u> To estimate potential supply of non-forest sources	PMU, Expert	Mar 2021	Jun 2021	
<b>Output 2:</b>				
<u>Activity 2.5</u> To develop technical manual	PMU, Expert	Oct 2020	Feb 2021	
<b>Output 3:</b>				
<u>Activity 3.1</u> To disseminate information on technology and market for wood-based energy through website and other means	PMU	Oct 2017	Sep 2021	Executed since YPO 1
<u>Activity 3.3</u> To examine caloric properties	PMU, EFORDI Agency	Nov 2020	Jun 2021	
Final reporting	PMU			Oct – Dec 2021
Demplots handing over from EA to FMUs and communities	PMU, FMUs			Oct – Dec 2021

### 2.3 Fourth Year Activity Program

Table 5: Activities to be executed under YPO 4 (Oct 2020 – Sep 2021)

Output/Activity	YPO 1	YPO 2	YPO 3	YPO 4												Remarks	
				Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Activity 1.3: To establish demplots (3 sites)				[Planned]													
Sub-act 1.3.4 To assess growth and development of demplots, focusing on HumHas demplot					[Planned]												Sub-contract
Activity 1.4: To estimate potential supply of planted energy forests									[Planned]								Sub-contract
Activity 2.5: To develop technical manuals				[Planned]													Sub-contract
Activity 3.1: To disseminate information				[Planned]												Self-executed	
Activity 3.3: To examine caloric properties					[Planned]												Coop with FORDA
Final reporting																	Oct – Dec 2021
Demplots handing over from EA to FMUs and communities																	Oct – Dec 2021

||||| Realized

▨ Planned

## **2.4 YPO 4 indicators of achievement**

Indicators of achievement under YPO 4 are presented in Table 3 above.

## **2.5 Monitoring and reporting**

### **i. Monitoring**

- Monitoring of progress in implementation of activities is to be performed by the Field Supervisor continuously. Occasional monitoring also performed by the ITTO Rep., Project Coordinator and PHPL (Rep (s) subject to availability of funds.
- Monitoring of growth and development of the demo plots carried out quarterly starting Oct 2018 by the Field Supervisor. The parameters to be monitored include average height of trees and survival rate by species.
- Monitoring of yield is conducted at the ages of 24, 30 and 36 months by the Field Supervisor.

### **ii. Reporting**

- Progress in implementation of individual activities shall be reported monthly by the Field Supervisor to the Project Coordinator whom will report to the ITTO and PHPL every six months.
- Reports on the implementation of Activities 1.4; 2.5; and 3.3 will be submitted by appointed sub-contractors in accordance with the work contracts signed with the Project Coordinator.

## **3. Personnel, Coordination and Institutional Relations**

### **3.1 Project personnel, partners and supporting organizations**

- Key personnel of Project Management Unit comprise Project Coordinator, Project Secretary, Field Supervisor, Database Operator and Management Advisor.
- Partners will consist of national experts and FORDA.
- Supporting institutions are 3 FMUs and FORDA.

### **3.2 Involved organizations, stakeholders and communities**

- Implementation of Activity 1.3 is supported by 3 FMUs and local communities
- Activity 3.3 will be executed in cooperation with FORDA.

### **3.3 Consultant/contractor (s)**

- Sub activity 1.3.4 and Activities 1.4 and 2.5 will be implemented with the assistance of national experts

#### 4. Budget

Planned budget for YPO 4 is shown in the table below.

**Table 8.** Planned budget for YPO 4 by activity (USD)

Output/activity	Total	ITTO	GOI
<u>Output 1:</u>			
Activity 1.3 To establish energy forest models in Year 1 for purpose of demonstration and training (3 sites, 3 species, 36 Ha in total)			
Sub-activities			
1.3.1 To monitor growth of trees on 3 demplots	5,246.59	3,246.59	2,000.00
1.3.2 To monitor yield of trees on 3 demplots	4,960.00	2,960.00	2,000.00
1.3.3 To carry out maintenance of plantations on 3 demplots	31,121.09	21,121.09	10,000.00
1.3.4 To assess growth and development of demplots, focusing on HumHas demplot	4,400.00	2,400.00	2,000.00
Activity 1.4: To estimate potential supply of non-forest sources	6,000.00	4,000.00	2,000.00
<u>Output 2:</u>			
Activity 2.5 To develop technical manual	8,000.00	5,000.00	3,000.00
<u>Output 3:</u>			
Activity 3.1 To disseminate information on technology and market for wood-based energy through website and other means	20,371.25	13,871.25	6,500.00
Activity 3.3 To examine caloric properties	7,930.00	5,930.00	2,000.00
Subtotal activities	88,028.93	58,528.93	29,500.00
General expenses	94,701.65	74,241.65	20,460.00
Total	182,730.58	132,770.58	49,960.00

## Annex 1. Project Cash Flow Statement

### PROJECT CASH FLOW STATEMENT

Project No. ITTO PD 737/14 Rev. 2 (I)

Period ending on: 30 September 2020

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 Sumatera Province of Indonesia"

Component	Reference	Date	Amount	
			in US\$	Local Currency
<b>A. Funds received from ITTO:</b>				
1 First instalment	S061TR0650568817	27/10/2017	\$100,000.00	Rp 1,363,000,000.00
2 Second Instalment	S061TR0520926218	31/07/2018	\$100,000.00	Rp 1,441,300,000.00
3 Third instalment	S061TR0180011119	31/07/2019	\$100,000.00	Rp 1,402,600,000.00
4 Fourth instalment	S061TR0299775520	24/04/2020	\$100,000.00	Rp 1,481,500,000.00
Bank Interest USD			\$120.47	Rp 1,711,979.64
Bank Interest IDR			\$1,267.79	Rp 18,084,136.29
Total Funds Received:			\$401,388.26	Rp 5,708,196,115.93
<b>B. Expenditures by Executing Agency:</b>				
10. Project Personnel			\$123,085.01	
11. Project Coordinator			\$61,250.00	Rp 841,397,755.20
12. Project Secretary			\$22,750.00	Rp 312,740,350.00
13. Finacial Staff			\$0.00	Rp -
14. Technician			\$4,785.00	Rp 65,873,115.00
15. International Consultant			\$0.00	Rp -
16. National Consultant			\$17,650.00	Rp 249,222,167.67
17. Field Supervisor			\$14,000.00	Rp 192,455,600.00
18. National Expert			\$2,650.00	Rp 37,927,450.00
19. Component Total:			\$123,085.01	Rp 1,699,616,437.87
20. Sub-contracts			\$174,264.88	
21. Sub-contract 1 (Planting)				
- Planting			\$49,894.28	Rp 646,554,156.70
- Seed procurement			\$1,381.39	Rp 19,450,000.00
- Growth monitoring (a)			\$703.41	Rp 10,421,000.00
- Yield monitoring (b)			\$0.00	Rp -
- Maintenance ( c )			\$5,878.91	Rp 87,096,000.00
- Demplots assessment (d)			\$0.00	Rp -
22. Sub-contract 2 (Specialist)				
- Sub contract 2A			\$0.00	Rp -
- Sub contract 2B			\$3,820.75	Rp 56,604,350.00
- Sub contract 2C			\$0.00	Rp -
- Sub contract 2D			\$0.00	Rp -
23. Sub-contract 3 (Dialogue)			\$35,864.55	Rp 515,249,750.00
24. Sub-contract 4 (Training)				
- Planting			\$28,287.01	Rp 398,281,110.00
- Harvesting			\$21,143.57	Rp 298,144,000.00
- Honeybee training			\$12,000.00	Rp 177,780,000.00
25. Sub-contract 5 (Cooperative)			\$7,950.00	Rp 117,779,250.00
26. Sub-contract 6 (Workshop)			\$7,341.00	Rp 99,037,410.00
27. Sub-contract 7 (Wood properties)			\$0.00	Rp -
29. Component Total:			\$174,264.88	Rp 2,426,397,026.70
30. Travel			\$33,650.56	
31. Daily Subsistence Allowance				
31.1 DSA International Consultant(s)			\$9,495.20	Rp 135,777,748.00
31.2 DSA National Consultant(s)			\$1,260.00	Rp 16,998,660.00
31.3 DSA Monev			\$5,100.96	Rp 67,192,130.00
31.4 DSA National Expert			\$490.00	Rp 7,081,970.00
32. Air Ticket				
32.1 International Expert(s)/Consultant(s)			\$1,050.31	Rp 14,788,400.00
32.2 Air Ticket			\$8,951.62	Rp 120,178,123.60
33. Local Transport Costs			\$7,302.47	Rp 98,846,455.00
39. Component Total:			\$33,650.56	Rp 460,863,486.60

40. Capital Items			\$1,942.92		
41. IT Devices (PC, Printer, etc)			\$1,942.92	Rp	26,211,883.00
49. Component Total:			\$1,942.92	Rp	26,211,883.00
50. Consumable Items			\$4,890.35		
51. Consumables			\$4,890.35	Rp	65,539,600.00
52. Document, material			\$0.00	Rp	-
53. Sundries			\$0.00	Rp	-
54. Utilities			\$0.00	Rp	-
55. Office space and facilities			\$0.00	Rp	-
59. Component Total:			\$4,890.35	Rp	65,539,600.00
60. Miscellaneous			\$13,530.71		
61. Meeting			\$5,421.05	Rp	75,842,705.00
62. Rental Provider			\$623.35	Rp	9,000,000.00
63. Report Printing			\$1,483.73	Rp	20,890,867.00
64. PSC/PTC Meeting			\$3,002.59	Rp	42,274,419.00
65. Financial Audit			\$3,000.00	Rp	42,852,000.00
66. Demplot handling over					
a. Technical meetings			\$0.00	Rp	-
b. Field checking with concerned parties			\$0.00	Rp	-
c. Development of handing over documents and official signing			\$0.00	Rp	-
69. Component Total:			\$13,530.71	Rp	190,859,991.00
70. National Management Costs			\$0.00		
71. Executing Agency Management Costs					
72. Focal Point Monitoring					
79. Component Total:			\$0.00		
Total Expenditures To-date:			\$351,364.42	Rp	4,869,488,425.17
Bank Administration & Tax USD			\$93.07	Rp	796,002.91
Bank Administration & Tax IDR			\$258.27	Rp	3,941,963.00
Remaining Balance of Funds (A-B):			\$49,672.50		
Notes: (1) Amounts in U.S. dollars are converted using the average rate of exchange when funds were received by the Executing Agency					
(2) Total Expenditures To-date (in local currency) should be the same as amount shown in Sub-Total of column (C) of the Financial Statement.					

## Annex 2 Project Financial Statement

### PROJECT FINANCIAL STATEMENT

Project No. ITTO PD 737/14 Rev. 2 (I)

Period ending on: 30 September 2020

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 Sumatera Province of Indonesia"

Component	Approved Revised Amount (A)	Expenditures To-date			Available Funds (E) { A - D }
		Accrued (B) a/	Expended (C)	Total (D) { B + C }	
<b>I. Funds managed by Executing Agency</b>					
10. Project Personnel	\$170,525.00		\$123,085.01	\$126,050.01	\$44,474.99
11. Project Coordinator	\$89,250.00	\$1,750.00	\$61,250.00	\$63,000.00	\$26,250.00
12. Project Secretary	\$33,150.00	\$650.00	\$22,750.00	\$23,400.00	\$9,750.00
13. Finacial Staff			\$0.00	\$0.00	\$0.00
14. Technician	\$7,425.00	\$165.00	\$4,785.00	\$4,950.00	\$2,475.00
15. International Consultant			\$0.00		
16. National Consultant	\$17,650.00		\$17,650.00	\$17,650.00	(\$0.00)
17. Field Supervisor	\$20,400.00	\$400.00	\$14,000.00	\$14,400.00	\$6,000.00
18. National Expert	\$2,650.00		\$2,650.00	\$2,650.00	\$0.00
19. Component Total:	\$170,525.00	\$2,965.00	\$123,085.01	\$126,050.01	\$44,474.99
20. Sub-contracts	\$230,051.80		\$174,264.88	\$174,264.88	\$55,786.92
21. Sub-contract 1 (Planting)					
- Planting	\$49,894.28		\$49,894.28	\$49,894.28	(\$0.00)
- Seed procurement	\$1,381.39		\$1,381.39	\$1,381.39	(\$0.00)
- Growth monitoring (a)	\$3,950.00		\$703.41	\$703.41	\$3,246.59
- Yield monitoring (b)	\$2,960.00		\$0.00	\$0.00	\$2,960.00
- Maintenance (c)	\$27,000.00		\$5,878.91	\$5,878.91	\$21,121.09
- Demplots assessment (d)	\$2,400.00		\$0.00	\$0.00	\$2,400.00
22. Sub-contract 2 (Specialist)					
- Sub contract 2A	\$4,000.00		\$0.00	\$0.00	\$4,000.00
- Sub contract 2B	\$4,950.00		\$3,820.75	\$3,820.75	\$1,129.25
- Sub contract 2C	\$5,000.00		\$0.00	\$0.00	\$5,000.00
- Sub contract 2D	\$10,000.00		\$0.00	\$0.00	\$10,000.00
23. Sub-contract 3 (Dialogue)	\$35,864.55		\$35,864.55	\$35,864.55	(\$0.00)
24. Sub-contract 4 (Training)					
- Planting	\$28,287.01		\$28,287.01	\$28,287.01	(\$0.00)
- Harvesting	\$21,143.57		\$21,143.57	\$21,143.57	(\$0.00)
- Honeybee training	\$12,000.00		\$12,000.00	\$12,000.00	\$0.00
25. Sub-contract 5 (Cooperative)	\$7,950.00		\$7,950.00	\$7,950.00	\$0.00
26. Sub-contract 6 (Workshop)	\$7,341.00		\$7,341.00	\$7,341.00	\$0.00
27. Sub-contract 7 (Wood properties)	\$5,930.00		\$0.00	\$0.00	\$5,930.00
29. Component Total:	\$230,051.80		\$174,264.88	\$174,264.88	\$55,786.92
30. Duty Travel	\$45,735.62		\$33,650.56	\$33,650.56	\$12,085.06
31. Daily Subsistence Allowance					
31.1 DSA International Consultant(s)	\$9,495.20		\$9,495.20	\$9,495.20	\$0.00
31.2 DSA National Consultant(s)	\$1,260.00		\$1,260.00	\$1,260.00	\$0.00
31.3 DSA Monev	\$10,145.97		\$5,100.96	\$5,100.96	\$5,045.01
31.4 DSA National Expert	\$490.00		\$490.00	\$490.00	\$0.00
32. Air Ticket					
32.1 International Expert(s)/Consultant(s)	\$1,050.31		\$1,050.31	\$1,050.31	(\$0.00)
32.2 Air Ticket	\$14,018.17		\$8,951.62	\$8,951.62	\$5,066.55
33. Local Transport Costs	\$9,275.97		\$7,302.47	\$7,302.47	\$1,973.50
39. Component Total:	\$45,735.62		\$33,650.56	\$33,650.56	\$12,085.06



40. Capital Items	\$1,942.92		\$1,942.92	\$1,942.92	\$0.00
41. IT Devices (PC, Printer, etc)	\$1,942.92		\$1,942.92	\$1,942.92	\$0.00
49. Component Total:	\$1,942.92		\$1,942.92	\$1,942.92	\$0.00
50. Consumable Items	\$8,752.69		\$4,890.35	\$4,890.35	\$3,862.34
51. Consumables	\$6,779.10		\$4,890.35	\$4,890.35	\$1,888.75
52. Document, material			\$0.00	\$0.00	\$0.00
53. Sundries	\$1,973.59		\$0.00	\$0.00	\$1,973.59
54. Utilities			\$0.00	\$0.00	\$0.00
55. Office space and facilities			\$0.00	\$0.00	\$0.00
59. Component Total:	\$8,752.69		\$4,890.35	\$4,890.35	\$3,862.34
60. Miscellaneous	\$33,750.00		\$13,530.71	\$13,530.71	\$20,219.29
61. Meeting	\$5,421.05		\$5,421.05	\$5,421.05	\$0.00
62. Rental Provider	\$2,184.60		\$623.35	\$623.35	\$1,561.25
63. Report Printing	\$3,983.73		\$1,483.73	\$1,483.73	\$2,500.00
64. PSC/PTC Meeting	\$6,002.59		\$3,002.59	\$3,002.59	\$3,000.00
65. Financial Audit	\$7,000.00		\$3,000.00	\$3,000.00	\$4,000.00
66. Demplot handling over					
a. Technical meetings	\$1,800.00		\$0.00	\$0.00	\$1,800.00
b. Field checking with concerned parties	\$3,000.00		\$0.00	\$0.00	\$3,000.00
c. Development of handing over documents and official signing	\$700.00		\$0.00	\$0.00	\$700.00
69. Component Total:	\$30,091.97		\$13,530.71	\$13,530.71	\$16,561.26
70. National Management Costs			\$0.00	\$0.00	\$0.00
71. Executing Agency Management Costs			\$0.00	\$0.00	\$0.00
72. Focal Point Monitoring			\$0.00	\$0.00	\$0.00
79. Component Total:			\$0.00	\$0.00	\$0.00
Sub-Total:	\$487,100.00	\$2,965.00	\$351,364.42	\$354,329.42	\$132,770.58
80. Project Monitoring & Administration					b/
81. ITTO Monitoring and Review					b/
82. ITTO Mid-term and Ex-post Evaluation					b/
83. ITTO Programme Support Costs					b/
83. Donor Monitoring Costs					
89. Component Total:					b/
90. Refund of Pre-Project Costs (Pre-Project Budget)					b/
Sub-Total:		\$0.00	\$0.00	\$0.00	b/
100. GRAND TOTAL:	\$487,100.00	\$2,965.00	\$351,364.42	\$354,329.42	

Note: Budget Components are those detailed in the Project Document.

a/ Accrued expenditure: expenditures committed/accrued as at the end of the reporting date, but not yet settled.

b/ Funds retained and accounted for by ITTO - details not available with Executing Agency.

### ANNEX 3. Original and adjusted LFM for the entire duration

Project elements	Measurable indicators	
	Original	Adjusted
<p><b><u>Development Objective</u></b> To increase contribution of the forest sector to renewable energy supply and regional economic development through increased supply of wood-based biomass energy</p> <p><b><u>Specific Objective</u></b> To improve enabling conditions for building up capacity to supply wood-based biomass energy in North Sumatra region</p>	<p><u>3 years after project completion:</u></p> <ul style="list-style-type: none"> <li>a. At least 100 villages in 10 districts engaged in energy forest development activities</li> <li>b. 2-3 companies realized investment in wood-based biomass energy</li> </ul> <p><u>By end of project:</u></p> <ul style="list-style-type: none"> <li>a. Approximately 36 Ha of energy forest established and used for demonstration and training</li> <li>b. At least 100 farmers leaders trained on skills for energy forest development and 50 leaders on community cooperative management</li> <li>c. 2-3 companies indicated interest in making investment on wood-based energy industry</li> </ul>	<p><u>3 years after project completion:</u></p> <ul style="list-style-type: none"> <li>a. At least 25 villages in 5 districts engaged in energy forest development activities</li> <li>b. At least 1 company realized investment in wood-based biomass energy</li> </ul> <p><u>By end of project:</u></p> <ul style="list-style-type: none"> <li>a. Approximately 36 Ha of energy forest established in 3 KPHs and used for demonstration and training</li> <li>b. Sustained</li> <li>c. At least 1 company indicated interest in making investment on wood-based energy industry</li> </ul>
<p><b>Output 1:</b> Development of sustainable supply of energy wood initiated</p>	<ul style="list-style-type: none"> <li>a. Available suitable lands for energy forest development identified and mapped in year 1</li> <li>b. Lands for energy forests formally designated in year 1</li> <li>c. 36 Ha of energy forests trial planted using 3 species in years 1-2</li> </ul>	<ul style="list-style-type: none"> <li>a. Suitable lands for energy forest development in 13 districts identified and mapped in Year 1</li> <li>b. Suitable lands for energy forest development on 3 KPHs identified and mapped</li> <li>c. 36 Ha of demo energy forests trial planted using 3 species in Year 1 on 3 KPHs.</li> </ul>

	<ul style="list-style-type: none"> <li>d. Estimates of sustainable energy wood supply planted on degraded lands available in year 4</li> <li>e. Potential supply of energy wood from non-forest sources assessed in year 3</li> </ul>	<ul style="list-style-type: none"> <li>d. Sustained</li> <li>e. Sustained</li> </ul>
<p><b>Output 2:</b> Skillful manpower for development of wood-based biomass energy available</p>	<ul style="list-style-type: none"> <li>a. Dialogue with local communities of 50 villages in 25 districts conducted in year 1</li> <li>b. 100 farmer leaders trained on energy forest development techniques in years 2-4</li> <li>c. 50 farmer leaders trained on community cooperative management</li> <li>d. 2 comparative studies on wood-based energy development conducted in years 2-3</li> <li>e. 3 technical manuals on energy forest development using suitable species formulated in year 4</li> </ul>	<ul style="list-style-type: none"> <li>a. Dialogue with local communities of 50 villages in 13 districts in south-eastern region of North Sumatra province conducted in years 1 and 2</li> <li>b. 100 farmer leaders trained on techniques for production of planting materials, tree planting, nursing of plantation and harvesting in years 2-4</li> <li>c. Sustained</li> <li>d. Sustained</li> <li>e. Sustained</li> </ul>
<p><b>Output 3:</b> Investment in wood-based energy industry development promoted</p>	<ul style="list-style-type: none"> <li>a. Website of wood-based energy operational since year 1</li> <li>b. One national workshop on wood-based energy development organized in Medan in year 1</li> </ul>	<ul style="list-style-type: none"> <li>a. Sustained</li> <li>b. One regional workshop on wood-based energy development organized in Pematang Siantar town in year 1</li> </ul>

	<p>c. Data on caloric properties of 3 planted tree species available in year 4</p> <p>d. Feasibility studies on investment in wood-based energy industry completed in year 4</p> <p>e. Existing policy on wood-based energy development reviewed and enhanced in year 2</p> <p>f. A stakeholder consultation forum operational since year 2</p>	<p>c. Sustained</p> <p>d. Sustained</p> <p>e. Sustained</p> <p>f. Sustained</p>
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## **Annex 4. Terms of Reference**

4.1. Sub-activity 1.3.4: To assess growth and development of gamal, kaliandra and lamtoro at three demplots (a newly added task under Activity 1.3)

a. Background information

After more than two years of monitoring of growth and development of gamal, kaliandra and lamtoro, it was found that these species did not exhibit satisfactory performance at the three demplots; this was particularly true with growth at Humbang Hasundutan demplot. This observation was somewhat surprising and dissapointing at the same time. There is compelling need to know the reasons behind this unsatisfactory growth performance in order to avoid similar problem from happening in the future energy forest development using the species. The assessment will involve 3 demplots with a focus on HumHas demplot case.

b. Expected outcomes

- i. Growth performance of gamal, kaliandra and lamtoro at all demplots exhibit using the growth monitoring reports available with the project.
- ii. Ecological suitability of the sites for growing the tree species revealed.
- iii. Technical weaknesses in demplot development process identified.
- iv. Recommendations for future planting of gamal, kaliandra and lamtoro as regards ecological and technical aspects.
- v. A technical report on the task accomplishment written in national language with English executive summary.

c. Task to carry out

A competent expert, having at least ten years of experience in energy forest development related works, will be hired to assist in implementing the activity; the expert shall carry out the following tasks in close consultation with the Project Coordinator:

- i. To re-do species-site matching process for purpose of identifying suitability of planting gamal, kaliandra and lamtoro at the demplot sites.
- ii. To evaluate the planting process on establishing the demplots, i.e. planting materials used, planting methods applied, land treatment performed, etc, through interviews with the local people involved in the process.
- iii. To identify inhibiting growth factors at each of the demplot focusing on HumHas demplot.
- iv. To make recommendations on future energy forest development using gamal, kaliandra and lamtoro to ensure satisfactory growth and development of the species.
- v. To submit a technical report on implementation of the activity, written in national language, equipped with an English executive summary.

4.2. Activity 1.4: To provide estimates of sustainable supply potential of wood from planted energy forests

a. Expected outcomes

- i. Figure on potential yield of energy wood from planted gamal, kaliandra and lamtoro based on growth of the species at the three demplots and other sources.
- ii. Estimates on sustainable yield by species under the silviculture system adopted

b. Tasks to be undertaken

A competent expert will be hired by the project to assist in the execution of the activity. The expert, in close consultation with the Project Coordinator shall undertake the following tasks:

- i. To collect data on growth and yield of gamal, kaliandra and lamtoro at the demplots as reported periodically by the Field Supervisor
- ii. To collect data on growth and yield of the tree species from other sources to use as reference in analysing the data obtained under task i) above
- iii. To define a most appropriate silviculture system to apply, i.e. cutting age, harvesting method, etc.
- iv. To provide estimates on potential sustainable yield of gamal, kaliandra and lamtoro per hectare per year consistent with above defined silviculture system.
- v. To submit a technical report on the implementation of the activity, written in national language, equipped with executive summary in english

c. Inputs to be applied

- A competent expert having at least ten years experience in the management of even-aged stands including application of coppice silviculture technique.
- The assignment is to commence in March 2021, lasts for 4 months
- The expert is entitled for a total honorarium of USD 4,000 (USD four thousand only) which covers expertise fee and duty travel as needed.

4.3. Activity 2.5: To develop technical manuals on energy forest development for planting of gamal, kaliandra and lamtoro

a. Expected outcomes

- Information on site requirements for growing gamal, kaliandra and lamtoro available.
- 3 technical manuals on gamal, kaliandra and lamtoro plantation development.

b. Tasks to be undertaken

A competent expert on energy forest development having at least ten years of experience in the management of forest plantations and in growing gamal, kaliandra and lamtoro will be hired to assist the implementation of the activity; the expert shall undertake the following tasks in consultation with the project coordinator:

- i. To collect information on site requirements for growing the target species.

- ii. To collect information on best observed growth and development of the target species at different localities as reference of plantation performance aimed to develop using the manuals.
  - iii. To formulate manual for development of gamal, kaliandra and lamtoro plantations in North Sumatera region in an easy-to-read, simple wording manner.
  - iv. To present draft manuals to a technical meeting, to be organized by the project, for review.
  - v. To finalize the manuals by incorporating comments of the meeting, ready for printing and distribution by the PMU.
  - vi. To submit to the Project three final documents of technical manuals, each for gamal, kaliandra and lamtoro.
- c. Inputs
- A competent expert on energy forest development hired for five months in a part time basis starting October 2020
  - The expert appointed is entitled for a lumpsum honorarium of USD 5,000 (US dollar five thousand only) to expertise fee and duty travel as necessary.

4.4. Activity 3.3: To examine caloric properties of the energy wood species planted

a. Expected outcome

Caloric content of gamal, kaliandra and lamtoro planted at the demplots, at two different ages, 24 months and 30 months, analysed using scientific procedure and technique in cooperation with FORDA in Bogor

b. Task to be undertaken:

To analyse caloric content of planted tree species will be carried out under a close cooperation manner between the Project and FORDA in Bogor

The task to be undertaken and responsibility of the parties are presented below:

- i. To collect 24 specimens for analysis from 3 species at 2 demplots at 2 different ages, i.e. 24 and 30 months; noting that the specimens from HumHas demplot are exempted due to poor growth of the species. Each specimen is replicated twice using different trees
  - ii. Each specimen consists of dry chips weighing 50 grams, packed in sealed plastic bags with clear labelling. For examples, label G1S24 means the first specimen of gamal aging 24 months from Simallungun demplot; likewise, L2T30 means the second specimen of lamtoro aging 30 months from Tapsel demplot. Note that each specimen consists of 2 samples originating from 2 different trees.
  - iii. Above packed specimens shall be sent by the project to FORDA laboratory for treatment and analysis.
  - iv. To report on results of the analysis
- Task iii) and iv) are to be accomplished by FORDA lab professionals

c. Inputs

- Wood laboratory of FORDA in Bogor will assist in caloric content analysis by experienced professionals
- The analytical work will last for 8 months starting November 2020
- The total cost is estimated at USD 5,930 comprising YSD 2,400 for honoraria and USD 3,530 for field collection and shipping of samples.