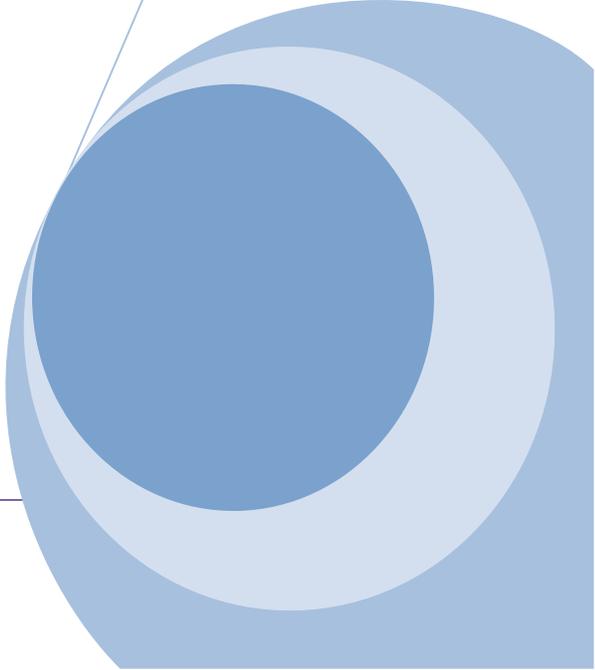


**ຂອບເຂດການຈ້າງວິເຄາະການເກັບກາກບອນໃນພື້ນທີ່ປູກປ່າປີ 2008
- 2019
(ແຂວງ ໄຊຍະບູລີ ແລະ ແຂວງ ຫຼວງພະບາງ) ແລະ ພື້ນທີ່ຜື້ນຜູ້ປ່ຽນປີ
2012 -2019**

**CARBON STORAGE STUDY IN REFORESTATION AREA
PLANTED Y2008 - 2019 (XAYABOULY, AND LUANG
PRABANG PROVINCES) AND REHABILITATION AREA
Y2012 – 2019.**

**CORPORATE SHEQ
HONGSA POWER COMPANY LIMITED
XAYABOULY PROVINCE, LAO PDR.**

01/09/2023



**CARBON STORAGE STUDY IN REFORESTATION AREA
PLANTED Y2008 - 2019
(XAYABOULY, AND LUANG PRABANG PROVINCES) AND
REHABILITATION AREA Y2012 - 2019**

Project Title: Carbon Storage Study in reforestation area planted Y2008 – 2019 (Xayabouly and Luang Prabang Provinces) and rehabilitation area Y2012 -2019 of Hongsa Mine Mouth Power Plant Project Year 2023

Contacts: Hongsa Power Company (“HPC”)
Hongsa Power Company (c/o Phu Fai Mining Company)

Brief Description: This Terms of Reference (“TOR”) is for review and collect data for carbon storage in biomass for reforestation and rehabilitation areas for Hongsa Mine Mouth Power Project, Xayabouly Province, Lao PDR.

Location: **Reforestation area in:**
1. Xayabouly Province (Hongsa, Ngeun, and Xing hon Districts)
2. Luang Prabang Province (Luang Prabang, Chomphet, Pak Ou and Xeing Ngeun Districts)

Rehabilitation area in:
Hongsa District, Xayabouly Province

Commencement: 1st October 2023

1. Introduction

The operation activities of thermal lignite mine power plant can emit the combustion emission from electrical production process such as carbon-dioxide (CO₂) and other emission gases. The CO₂ was also primarily emitted through the completely burning of fossil fuels i.e. oil, natural gas, and coal. The CO₂ was the one of greenhouse gases (GHGs) that cause to greenhouse effect, the solar radiation was absorbed in atmosphere, so temperature was increased due to the greenhouse effect.

In the principle, the CO₂ gas was collected into plants by photosynthesis process and then the CO₂ was transported and collected plant as the biomass. Therefore, HPC would like to conduct the carbon capture and storage study in planted areas such as reforestation and rehabilitation areas for evaluating that how much of CO₂ which can be captured by Project's reforestation and rehabilitation programs .

The Reforestation and Watershed Conservation Project is proposed to restore watershed forestry area total of 845 hectares in 25 years under Company compliance obligations while 2,242 ha will be rehabilitated throughout end of Project. Each year the reforestation area has been planted and restored approximately 30 – 40 hectares in 2 provinces i.e. Xayabouly and Luang Prabang Provinces which will be conducted in deforestation areas and provided by DAFO/PAFO. The study plot was 20 x 20 meters in each reforestation area of Xayabouly and Luang Prabang Provinces.

2. Overall Objectives

- 2.1 Consult and advice HPC and DAFO/ PAFO regard technical and process of forest biomass data collection in reforestation area Y2008 - 2019.
- 2.2 Perform biomass data collection survey in rehabilitation area Y2012 – 2019.
- 2.3 Review and verify collected data from DAFO and PAFO of reforestation area.
- 2.4 Calculate and summary the carbon storage in biomass of reforestation area and rehabilitation area.
- 2.5 Prepare report for the carbon storage in biomass of reforestation area and rehabilitation area.
- 2.6 Provide one (1) time for refresh training program for technical data collection to new team of DAFO/ PAFO

3. Project description

The Hongsa Mine Mouth Power Project is located in the 76.24 km² and 10.5 km² of Limestone Quarry in Concession Areas in Hongsa and Nguen District granted by the Government of Lao PDR (GOL) in Xayabouly Province, in the northwest region of Lao PDR, approximately 34 km northeast from the Thai-Lao border at the Houay Khon Checkpoint, Chaloe Prakiat District, Nan Province.

The Concession Period of this Project is 25 years for operational phase. The project area located in the Hongsa valley as shown in **Figure 1** below.

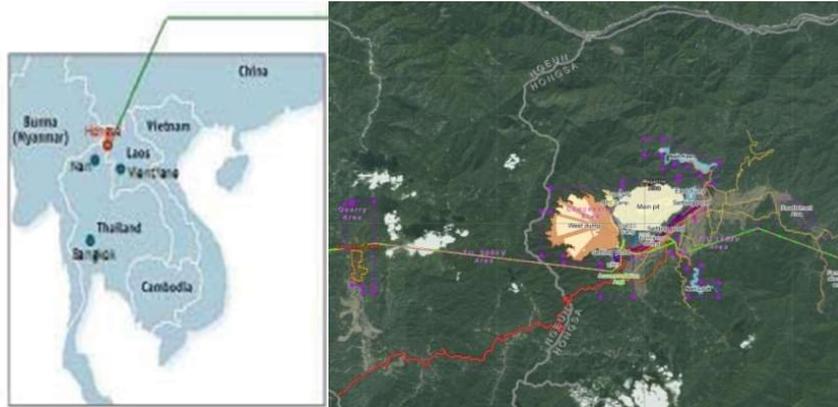


Figure1: Project Location

This valley is a relatively flat valley floor at about 500 m MSL, surrounded by rough hills rising to over 900 m in elevation. The valley floor area is triangular in shape, narrow in the east and wide in the west. Stream and small rivers flow into the valley, the largest of which is the Nam Louk with its tributaries the Nam Le, and the Nam Kene. The Nam Kene is joined by the Nam Louk at the northern edge of the valley, and flows through a narrow valley to the Mekong River.

The main project elements are power plant, coal mining, limestone quarry, water resource system and supporting infrastructure facilities.

3.1 The Power Project, which encompasses the development of a 1,878 MW coal-fired power project commonly referred to as the Hongsa Power Plant which consists of 3 x 626 MW Power Plant Units including all of the project facilities related thereto under the Power Concession Agreement. Lignite coal is used as primary fuel and diesel is used for start-up, flame stabilization, and low load operations. A total distance of 182 km transmission lines and substations have been constructed to supply electricity from the Power Plant to the Thai Grids (i.e. 500 kV) and the Lao Grids (i.e. 115 kV) under the EGAT and the EDL PPA, respectively.

3.2 The Coal Mining Project, which encompasses the survey, exploration, prospecting, evaluation, mining, processing, exploitation, and transportation as defined in the Mining Concession Agreement, the design, construction, completion, operation and maintenance of the Coal Mining Project, and all other ancillary activities related thereto to be carried out under the Mining Concession Agreement;

3.3 The Limestone Quarry Project, which limestone will be used by the Project to produce lime slurry for the Flue Gas Desulphurization (“FGD”) system equipped at the Power Plant. Limestone Quarry is located at Muang Ngeun to supply limestone at a rate of 1,650 tons/day for the Power Plant;

3.4 The water resource system of the Project, which comprises 2 dams located close to the Project area. The Nam Louk Dam is located southeast of the Power Plant and the Nam Kene Dam is located northeast of the Power Plant. The water supply for the operation of the Power

Plant will be sourced from Nam Louk and Nam Kene dams. The water from the Nam Louk Dam will be drawn by gravity, while a pumping station was constructed to pump the water from the Nam Kene Dam, to the Power Plant; and

3.5 The supporting infrastructures, which includes 35-km Main Roads (Muang Ngeun – Project Main Road), bypass road Muang Ngeun from Limestone Quarry to Main Road, access road to water reservoirs or dams, the water resource system (Nam Louk and Nam Kene Dams), Resettlement villages and facilities, Fuel Supply Station, Staff Accommodation and Ban Han bypass road.

3.6 Reforestation and watershed conservation project, the reforestation and watershed conservation project of HPC has been conducted since 2008 in Xayabouly and Luang Prabang Province to return the disturbed land by human activities such as farming, logging to be the forestland. After the Provincial of Agriculture and Forestry Office (PAFO) has submits propose area to HPC. HPC will provide seedling and plantation budget for reforestation in area. Reforestation areas have been maintained by HPC for 3 years before handover to government. The sizing for the permanent sampling plot of the carbon capture study is 20 x 20 meters.

- Total reforestation area in Xayabouly Province is 291.05 Hectares at Hongsa, Ngeun , and Xieng hon district (period 2008 -2019).
- Total reforestation area in Luang Prabang Province is 58.38 Hectares at Luang Prabang, Chomphet, and Xeing Ngeun district (period Y2013 - 2019).

Table 1: Reforestation area during 2008 – 2019 (Hongsa District)

District	Planted Year	Location	No. of plot sample	Area (Ha)
Hongsa ເມືອງ ຫົງສາ	2008	Na Poug Village ບ້ານ ນາປຸ່ງ	2	13.5
	2009	Nam Kene Village ບ້ານ ນ້ຳແກນ	2	21.5
	2010	Nam Kene Village ບ້ານ ນ້ຳແກນ	2	20
	2011	Kiw Ngiw Village ບ້ານ ກິ້ວມ່ວງ	1	10.35
		Nong LuangNong Village ບ້ານ ໜອງຫຼວງ	1	9.61
	2012	Kiw Ngiw Village ບ້ານ ກິ້ວມ່ວງ	1	7.42
		Nam Sib Village ບ້ານ ນ້ຳສິບ	2	14.02
	2013	Than Kham Village ບ້ານ ແທ່ນຄຳ	3	29.30
2014	Na Ken Kham Village ບ້ານ ນາແກ່ນຄຳ	1	10.04	

District	Planted Year	Location	No. of plot sample	Area (Ha)
	2015	HPC Farm Land ຟາມແລນ	1	5.15
	2016	Than Kham Village ບ້ານ ແທ່ນຄຳ	2	6.56
	2017	Na Poug Village (Huay Bang) ບ້ານ ນາປຸ່ງ	1	8.01
		Na Poug Village (Huay Pongng) ບ້ານ ນາປຸ່ງ	1	6.16
	2018	Na San (Huay Loun) ນາສ້ານ	1	3.22
		Nhong Luang ບ້ານ ຫອງຫຼວງ	1	5.5
		Na Poug ບ້ານ ນາປຸ່ງ	1	1.28
	2019	Na Poug ບ້ານ ນາປຸ່ງ	2	12.20
	Sum			25

Table 2: Reforestation area during 2013 – 2019 (Ngeun District)

District	Planted Year	Location	No. of plot sample	Area (Ha)
Muang Ngeun ເມືອງ ເງິນ	2013	Na Ngua Village ບ້ານ ນາງົວ	1	8.89
	2014	Thong Village ບ້ານ ທອງ	2	16.57
	2015	Thong Village ບ້ານ ທອງ	1	7.04
	2016	Thong Village ບ້ານ ທອງ	2	11.2
	2017	Na Yang Village ບ້ານ ນາຍາງ	2	11.16
	2018	Thong Village ບ້ານ ທອງ	2	10.49
	2019	Home Sai Village ບ້ານ ໂຮມໄຊ	2	10.26
Sum			12	75.61

Table 3: Reforestation area 2017- 2019 (Xieng hon District)

District	Planted Year	Location	No. of plot sample	Area (Ha)
Xieng hon ເມືອງ ຊຽງຮ່ອນ	2017	Huay Hak ບ້ານ ຫ້ວຍຮາກ	3	11.10
	2018	Huay Hak ບ້ານ ຫ້ວຍຮາກ	2	11.37
Sum			5	22.47

Table 4: Reforestation area during 2013 – 2018 (Luang Prabang Province)

District	Planted Year	Location	No. of plot sample	Area (Ha)
Luang Prabang ເມືອງ ຫຼວງພະ ບາງ	2015	Yang Village ບ້ານ ຢ່າງ	1	10.0
	2016	Phou Lek ຜູ້ເຫຼັກ	1	3.0
	2017	Yang Village ບ້ານ ຢ່າງ	2	10
	2018	Phou Lek ຜູ້ເຫຼັກ	1	4
	2019	Lak Sip Village ບ້ານ ຫຼັກສິບ	1	4
Xiang Ngeun ເມືອງ ຊຽງເງິນ	2013	Huay Tao Village ບ້ານ ຫ້ວຍເທາ	1	10.38
	2015	Kiw Mak Now Village ບ້ານ ກິ້ວໝາກນາວ	1	5.0
Chomphet ເມືອງ ຈອມເພັດ	2014	Tad Roy Kua ຕາດຮ້ອຍຄົວ	2	12.0
Sum			10	58.38

3.7 Rehabilitation, the rehabilitation program that has been conducted since 2012 at earth bund and other rehabilitated areas, where are covered with plants and grasses. These areas have been prepared with appropriate soil improvement and re-vegetating using pioneer fast-growth species with intensive maintenance and planting of indigenous species. Results of rehabilitation activities will turn disturbed mine land to forests of fast-growing tree mixed with native trees. For natural ecological recovery this area will serve as source of stock and seed of trees for surrounding areas. An Earth Bund area has been rehabilitated since 2012 - 2017 and East bund was later start rehabilitated in 2015. Additional rehabilitated areas start in early 2017 are North diversion area and Base of earth bund area while rehabilitation areas in year 2019 are part of ash dump and main dump.

Total rehabilitation area in Hongsa District is 166 Hectares (period Y2012 - 2019).

Table 5: Rehabilitation areas (Y2012 – 2019)

No.	Year	Area	Amount (Ha)	No. of plot sample
1	2012	Earth bund	9.01	4
2	2013	Earth bund	45.25	6
3	2014	Earth bund	27.65	4
4	2015	Earth bund	29.61	3
5	2016	Earth bund	3.31	2
6	2017	Earth bund	15.8	1
7	2015	East bund	16.63	3
8	2017	Base of Earth bund	9.44	1
9	2017	North diversion	3.52	2
10	2019	Main dump	5.77	2
Sum			166	28

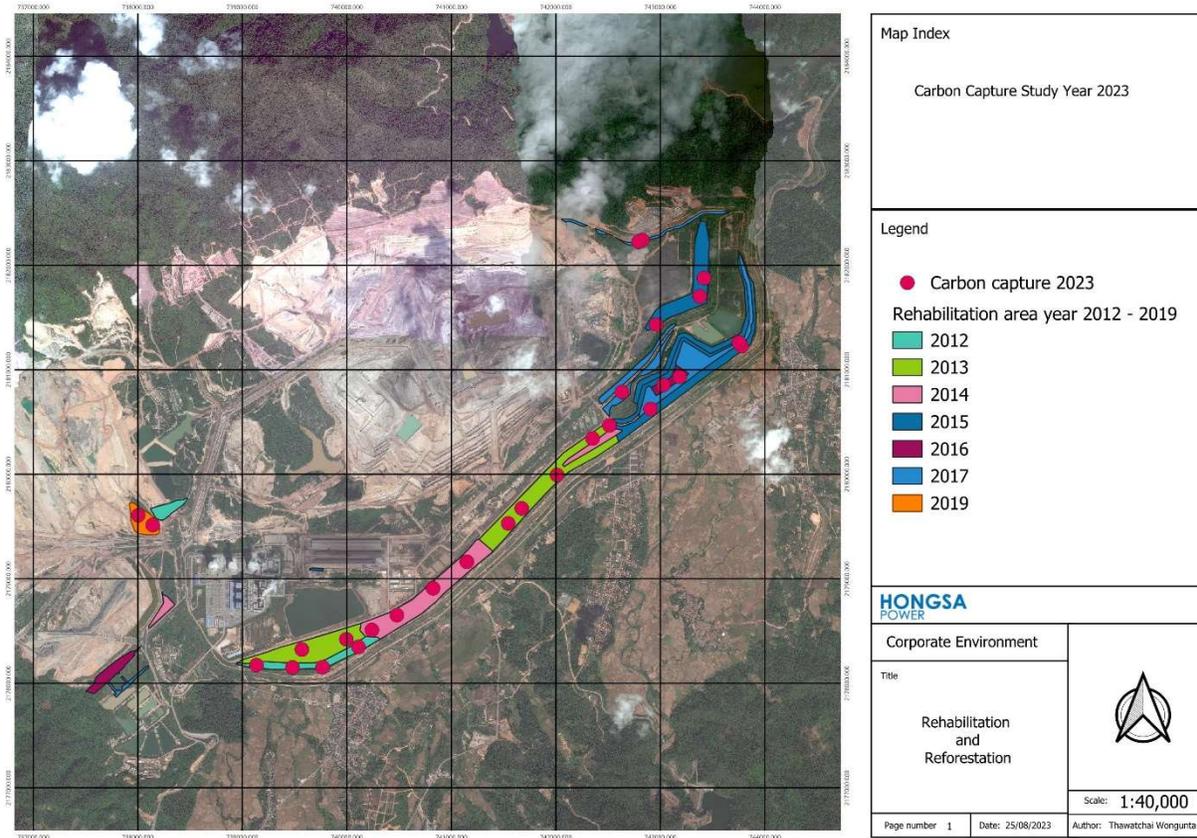


Figure 2: Rehabilitation area Y2012 - 2019

4. Duration of the contract

This TOR covers the period of 90 days during 1 October 2023 – 31 December 2023

5. Scope of works

The scope of the study is to be undertaken by the potential consultant who has full knowledge and understanding of its duties and obligations. The consultant shall perform the services promptly as following tasks:

1. Reforestation and watershed conservation program:

- 1) Consult and advise DAFO/ PAFO regard technical and process of forest biomass data collection for data collection in reforestation area (Hongsa, Ngeun, Xieng hon, and Luang Prabang).
- 2) Review the collected raw data of the reforestation areas of Xayabouly and Luang Prabang Provinces, in total 52 plots sample.
- 3) Summary and calculation of the carbon storage in reforestation areas of Xayabouly and Luang Prabang Provinces which study in year 2023 and compare the study result with previous year such as 2022.

2. Rehabilitation area:

- 1) Perform biomass data collection survey in rehabilitation area Y2012 – 2019 at Hongsa district, in total 28 plots sample in the permanent plot sizing 20 x 20 meter.
- 2) Summary and calculation of the carbon storage in rehabilitation which study in year 2023 and compare the study result with previous year such as 2022.

3. Submission of the carbon storage in the reforestation area and rehabilitation area report to HPC in both hard copy and soft file (included the collected raw data). The report shall be separated into 2 reports are reforestation area report and rehabilitation area report. The report shall be included the forest biomass, carbon storage, forest type, importance value index (IVI), compared the result of this year with previous year study, etc.

6. Schedule and timeline

The consultant shall submit schedule, work plan, and its timeline as following:

No.	Detail of work	Time period	Remark
1	<ul style="list-style-type: none"> • Plan and Perform biomass survey in rehabilitation areas, for data collection. 	1 - 31 Oct. 2023	Summit travelling plan to HPC at least 7 days before performing biomass survey in rehabilitation area.

No.	Detail of work	Time period	Remark
2	<ul style="list-style-type: none"> Review the collected raw data of the reforestation areas of Xayabouly and Luang Prabang Provinces. Review the collected raw data of the rehabilitation areas 	1 - 30 Nov. 2023	
3	<ul style="list-style-type: none"> Summary and calculation of the carbon storage in reforestation areas of Xayabouly and Luang Prabang Provinces. Summary and calculation of the carbon storage in rehabilitation area. Submit the draft report (soft file) 	1 - 20 Dec. 2023	
4	<ul style="list-style-type: none"> Submit the final report of carbon storage study in the reforestation area planted year 2008 – 2019 (Xayabouly and Luang Prabang Province) to HPC. Submit the final report of carbon storage study in the rehabilitation area planted year 2012 – 2019 to HPC. 	Within 25 Dec. 2023	Hard copy and soft file are required to submit. In case of any comments by HPC, the reviewed version as a final version.

7. Information and Services provided by HONGSA POWER CO., LTD

- 7.1 The reforestation area of HPC in Xayabouly (2008 –2019) and Luang Prabang Province (2013 - 2019).
- 7.2 Collected plant data (Plant name, GBH., height) in forestation by PAFO and DAFO.
- 7.3 The rehabilitation area of HPC (2012 –2019) and map of rehabilitation area.
- 7.4 The report of carbon storage study year 2022 in reforestation area planted during 2008 – 2018.
- 7.5 The report of carbon storage study year 2022 in rehabilitation area planted during 2012 – 2017.
- 7.6 Other related information to support the study.

8. Term of Payment

The term of payment will be divided upon the milestones as following:

No.	Detail of work progress	Percentage of Payment
1	After perform biomass survey in rehabilitation area and submit site survey report to HPC.	50%
2	<ul style="list-style-type: none"> • Submit the final report of the carbon storage study in reforestation area planted year 2008 – 2019 (Xayabouly and Luang Prabang provinces) and approval by HPC. • Submit the final report of the carbon storage study in rehabilitation area planted year 2012 – 2019 and approval by HPC. 	50%

9. Authorized Contact Persons of Hongsa Power Company

The authorized contact person:

Ms.Phannipa Kiatbumrung (Division Manager - Procurement)

Address1: Hongsa Power Company Limited
 NNN Building 4th Floor/Room No. D5, Boulichan Road,
 Phonsinouan Village, Sisattanak District, Vientiane Capital, Lao PDR.

Address2: Hongsa Power Company Limited
 Phonchan Office, Hongsa Sub-district, Xayabouly District, Lao PDR.

Address3: Hongsa Power Company Limited (Nan Office)
 3/37-38 Worawichai Rd., Naiwiang Sub-district, Muang Nan District, Nan Province 55000

Telephone Number: +856-20-52441809

Tel: +856(0)74266121-4 EXT. 1131

E-mail address: Phannipa_K@hongsapower.com

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