Monitoring Report

A.T. Biopower Rice Husk Power Project
In Pichit Thailand
CDM Registration Number : 1026

July 14, 2008 Version 1

Monitoring Period
July 1, 2007 : December 31, 2007

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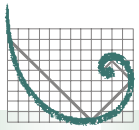

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1 GENERAL DESCRIPTION OF PROJECT ACTIVITIES

1.1 TITLE OF THE PROJECT ACTIVITY

A.T Biopower Rice Husk Power Project in Pichit, Thailand (the Project)

1.2 SUMMARY TABLE

The objective of this monitoring report is to identify the exact greenhouse gas emission reduction during morintoring period *of 1 July 2007 to 31 December 2007.*

Table 1.1 Summary table of A.T Biopower Project activity

CDM activity	A.T. Biopower project in Pichit, Thailand
CDM registration reference number	1026
Starting date of the project activity	21 December 2005
Starting date of the first credit period	21 December 2005
Length of the first crediting period	7 years
Period cover by the first monitoring report	21 December 2005 – 30 June 2007
Period cover by the current monitoring report	1 July 2007 – 31 December 2007
Net emission reduction estimated in the PDD	70,772 tCO_2eq/year
Total emission reduction claimed in the first monitoring report	100,678 tCO_2eq
Total emission reduction claimed in the second monitoring report	**34,411.25 tCO_2eq**

The greenhouse gas emission reduction during second monitoring period (1 July 2007 – 31 December 2007) is 34,411.25 tCO_2eq.

1.3 PROJECT DESCRIPTION

The project is designed to generate electricity using rice husk as a fuel that would otherwise be burned in the open air or left to natural decay.

It involves the construction and operation of a new rice husk power plant in Pichit province; with approximately 22 MW gross generating capacity, 20 MW net. Electricity will be sold through a 25-year power purchase agreement (PPA) with the Electricity Generating Authority of Thailand (EGAT).

According to the Power Development Plan (PDP) by the Electricity Generating Authority of Thailand (EGAT) (1) , the demand for electricity of Thailand will double from 126,811 GWh in 2004 to 265,788 GWh in 2015. Against this backdrop, securing steady supply sources of electricity is a matter of vital importance for the Thai economy.

(1) EGAT Power Development Plan (PDP) 2004, Appendix 7

Biomass fuels, especially rice husk and bagasse, represent particularly rich energy resources for Thailand. These renewable energy sources currently fuel less than 1% of Thailand's electricity generation, which is dominated by natural gas, lignite and imported fuel oil.

Recognizing the potential contribution of renewable energy to the Thai energy mix, the government has placed great importance on supporting environmentally friendly, indigenous, and renewable sources of energy. It is noteworthy that Thailand's National CDM Strategy [2] released by the Office of National Resources and Environmental Policy and Planning, places biomass renewable energy at the top of the list of promising CDM project areas for Thailand. In addition to providing renewable energy, the Project will have an added contribution to Thailand's sustainable development in that it will improve the disposal of a major source of agricultural waste.

1.4 PROJECT LOCATION

The project site is located at 96 Moo 2 Horkai Sub-District of Ampur Bang-Moon-Nak. The region, in the Lower North of Thailand, is the rice hub of Thailand and is some 320 kilometers from Bangkok. The project area has abundant rice husk, provides convenient access to transportation arteries and is close to the 115 kV transmission line of the Provincial Electricity Authority.

The plant is located on a 34 hectare site. Half of total area is used for plant buildings, equipment, and storage facilities. The rest is used as buffer zones and green space. The front of the plant is adjacent to Highway No. 1313 and the Nan River while there is a small pool at the back side of the plant called "Lah Rod Fai" which adjoins the northern route railway. At the left and right sides are surrounded by vast area of rice fields.

1.5 DOCUMENTATION

The project was validated by DNV and registered on 18 June 2007. All related document such as the Project Design Document, Validation Report for registration, Letter of Approval, the First Monitoring Report are available on website of the UNFCCC.
http://cdm.unfccc.int/Projects/DB/DNV-CUK1174909241.2/view.html

1.6 IMPLEMENTATION AND CURRENT STATUS OF THE PROJECT

The 22 MW rice husk fired Power Project at Pichit, Thailand has been commissioned. First synchronization of the project with 115 kV Substation at Bang Moon Nak was performed on September 20, 2005 and after initial operation, commercial operation (COD) was declared on December 21, 2005.

The project has been completed with major equipment supplied as follows:

Table 1.2 The major equipments of project activity

No	Equipment	Supplier
1	Boiler	Electrowatt-Ekono (Thailand) Ltd.
2	Turbine & Generator	Electrowatt-Ekono (Thailand) Ltd.
3	Balance of Plant	Electrowatt-Ekono (Thailand) Ltd.
4	Fuel Handling System	Electrowatt-Ekono (Thailand) Ltd.

The entire equity of A.T. Biopwer has been provided by the following parties.

- Chubu Electric Power Co., Inc. (Japan)
- Al Tayyar Energy Limited (United Arab Emirates)
- Private Energy Market Fund L.P. (Finland)
- Finnish Fund for Industrial Cooperation Ltd. (Finland)
- Flagship Asia Corporation (Malaysia)
- Rolls-Royce Power Ventures Limited (United Kingdom)

The project has been completed as planned and described in the Project Design Document (PDD), aiming to establish it as Clean Development Mechanism (CDM) project. The plant has been in operation continuously (with outages – forced & planned) since December 21, 2005. The plant has used rice husk as biomass fuel, and diesel oil has been used only for boiler start up and auxiliary combustion.

1.7 SUSTAINABILITY – ECONOMIC AND SOCIAL

Thailand is considered as one of the major rice producers of the world and thus each year the country leaves a huge quantity of rice husk to be dumped or to be burned in the open air. The use of rice husk at the A.T Biopower Project reduces carbon dioxide emission by replacing fossil fuel-based electricity and by preventing rice husk from being left to decay or burnt in the open air.

The project promotes sustainable development by

- Reducing consumption of fossil fuel.
- Eliminating local pollution, because rice husk burned in a controlled environment does not generate nitrogen oxides and sulphur dioxide which causes smog.
- Adding value to domestic agriculture product and helping to save the country's currency in importing oil and coal.
- Pollution is decreased because the machinery used in the project is specially designed for rice husk combustion and is of stat-of-art technology, thus combustion can be made cleaner than conventional method or when rice husk are burnt in the open air.

- More income and more jobs are created for local people as rice husk are purchased from rice mills and local people are hired to operate various types of jobs in the power plant while continuous business can develop such as rice husk transportation, housing and catering need.
- To contribute to the local community social development by establishing the Community Development Fund that is run by a committee of local leaders. This Fund is managed focusing on education for the youth, cultural life, and the environmental improvement.

1.8 MONITORING PERIOD

This monitoring period is from July 1, 2007 to December 30, 2007.

1.9 QUALITY CONTROL (QC) AND QUALITY ASSURANCE (QA)

1.9.1 Quality Management System

The A.T Biopower Power Plant is operated by Chubu Electric Power (Thailand) Co., Ltd. (CEPT), by operation and maintenance contract, CEPT is assigned the responsibility of the project management and also for monitoring, reporting and measurement to A.T Biopwer head office.

The power plant has been certified ISO 9001 : 2001 since December 19,2007. All staffs are trained according to ISO 9001 standard

1.9.2 Quality Control and Quality Assurance procedures for monitoring data

Parameter	Quality Control and Quality Assurance procedures for monitoring
BF	Measured by a weighing meter. Trucks carrying rice husk is weighed twice, upon entry and exit. Meters at the weighing station underwent maintenance according to International Organization of Legal Metrology (OIML) standard. Results are checked against purchase receipts and inventory data.
NCV	The net calorific value of rice husk is measured at least every six months, taking at least three samples for each measurement. The net calorific value of diesel and residual oil is reviewed annually to ensure accurate and reliable use of local or national data. The result has been kept electronically as per the PDD.
EF_{CH4}	This parameter is reviewed yearly, and data kept electronically.
AVD	This parameter is measured continuously (each time trucks arrive) by a meter. Data has been kept electronically.
N	This parameter is recorded continuously (each time trucks arrive). Data has been kept electronically. The consistency of the number of truck trips with the quantity of biomass combusted is checked and compared by the relation with previous year.
$EF_{km,CO}2$	This parameter is reviewed yearly. Data has been kept electronically.

Parameter	Quality Control and Quality Assurance procedures for monitoring
F_{trans}	This parameter is measured continuously. Data has been kept electronically. The amount of fuel consumption is monitored by fuel pump meters, which underwent regular calibration and maintenance. The consistency of the data is checked against fuel purchase invoices.
$COEF_{CO2}$	This parameter is reviewed yearly. Data has been kept electronically.
$FF_{project\ plant}$	The amount of fuel consumption is monitored by fuel pump meters, which underwent regular calibration and maintenance. The consistency of the data is checked against fuel purchase invoices.
EF_{grid}	This involves the use of official data released by EGAT and EPPO. Quality control of this data beyond the control of the project operators.
$COEF_{CO2}$	This parameter is reviewed yearly. Data has been kept electronically.

1.10 MEASURES TO ENSURE THE RESULT / UNCERTAINTY ANALYSIS

As the majority of emission reduction resulted from the displacement of grid electricity, the electricity meter is considered the significant source of uncertainty. To minimize the uncertainty, the energy exported to the National Grid is recorded from two independent meters – main meter and backup meter. Reading of main meter is used for billing. In the event of main meter malfunction, the reading of the backup meter is to be used for billing. The main meter is maintained by EGAT, who issued receipts. From the project side, the accuracy of the main meter is verified by comparing the values with the back-up meter.

Other measures are also in place to ensure accuracy of the less significant parameters. Truck scale equipment underwent maintenance subject International Organization of Legal Metrology (OIML) standard. The meter reading is checked against purchase receipts and inventory data.

Diesel oil consumption meter reading is compared against fuel purchase invoices.

1.11 ROLES AND RESPONSIBILITIES

ATB Plant Manger is responsible for implementing the monitoring plan at project site, and ATB head office staff is responsible for the data collection and review other than those monitored at site. Finally, ATB Chief Executive Officer is the sole agency responsible for the all the monitoring result and greenhouse gas emission reduction calculation result.

2 MONITORING RESULT

2.1 BASELINE METHODOLOGY

A.T Biopower Rice Husk Power project uses the approved consolidated baseline and monitoring methodology ACM0006 (Version 04) – "Consolidated baseline methodology for grid-connected electricity generation from biomass residues" is applied to the project activity.

The approved consolidated baseline methodology ACM0006 is based on several individually approved methodologies, including AM0004, which was prepared specifically in connection with the project. The Project meets all of the applicability conditions list in ACM0006, as summarized below.

- The Project must involve grid-connected biomass residue electricity generation.

The project uses rice husk to fuel power plant and the power is exported to EGAT's grid.

- No other biomass types other than biomass residue, define as a by-product, residue or waste stream from agriculture, forestry and related industries, are used in the project plant and these biomass residue are the predominant fuel used in the project plant (some fossil fuel may be co-fired)

The project is not involved the use of biomass that is not a biomass residue. Some small amount of fossil fuel is used objectively for start-up; however the major fuel is remain biomass residue.

- For projects that use biomass residue from a production process, the implementation of the project shall not result in an increase of the processing capacity of raw input or in other substantial changes in this process.

The rice husk will be supplied from various rice mills. The rice husk procurement plan is based on current production level and availability at these rice mills and not depend on an increase in processing capacity. Therefore, these shall be not increase of process on the capacity of raw input or other subtaintial changes in the rice milling process on the account of the project.

- The biomass residue used by thr project facility should not be store for more than one year.

Rice husk has not been stocked for more than one year. The indoor storehouse of the project can only store up rice husk for a month. Otherwise rice husk that is stockpiled than one year is worth to use as fuel.

- No significant energy quantities, except from transportation of the biomass, are required to prepare biomass residues for fuel combustion.

No significant energy quantities are required to prepare biomass. Unlike some other biomass fuel with higher moisture content, rice husk is a relatively dry fuel required no pre-treatment process such as dewatering.

2.2 *MONITORED PARAMETER*

ID No		Data variable	Unit	Monitor by	Monitoring frequency
D-1	BF	Quantity of rice husk used as fuel in the project plant	tonne/yr (dry basis)	Project site	Every time ATB receives rice husk and aggregate annually (per verification period)
D-2	-	Rice husk inventory in the project site	tonne	Project site	At initial stage and final stage per each verification period
D-3	-	Moisture content of rice husk	%	Laboratory data	Weekly and visual check of feed carried out daily
D-4	NCV_{rice}	Net calorific value of rice husk	TJ/ton (dry basis)	Laboratory data	At least every six months, taking at least three samples for each measurement.
D-5	$EF_{burning, CH4, rice}$	CH_4 emission factor for uncontrolled burning of the rice husk	t-CH_4/tonne	Latest IPCC	Annually (per verification period)
D-6	CF-1	Conservativeness factor for uncontrolled burning of the rice husk	-	ACM0006	Annually (per verification period)
D-7	$EG_{project\ plant}$	Quantity of electricity exported to the power grid	MWh/yr	Project site	Daily and aggregate it annually (per verification period)
D-8	EF_{grid}	CO_2 emission factor for electricity displaced	t-CO_2/MWh	EGAT	At renewal of crediting period
D-9	N	Number of truck trips for rice husk transportation per rice miller	Number/yr	Project site	Every time ATB receives rice husk and aggregate annually (per verification period)
D-10	AVD	Average return trips distance between rice miller and project site	km	Project site	Every time ATB receives rice husk and aggregate annually (per verification period)
D-11	-	Annual truck trips for rice husk transportation per year	km/yr	Project site	Every time ATB receives rice husk and aggregate annually (per verification period)
D-12	$EF_{CO2,km}$	Average emission factor for the trucks	t-CO_2/TJ	Latest IPCC	Annually (per verification period)
D-13	F_{trans}	Fossil fuel consumption for on-site transportation	tonne/yr	Project site	Daily and aggregate annually (per verification period)
D-14	$FF_{project}$	Quantity of fossil fuel combusted for boiler start-up/auxiliary	Tonne/yr	Project site	Daily and aggregate annually (per verification period)
D-15	$COEF_{CO2}$	CO_2 emission factor of diesel oil	t-CO_2/TJ	Latest IPCC	Annually (per verification period)
D-16	NCV_{diesel}	Net calorific value of diesel oil	TJ/tonne	Laboratory data	Review the appropriateness of the use accurate and reliable local or national data annually.
D-17	$EF_{CH4,project}$	CH_4 emission factor for boiler combustion of rice husk	t-CO_2/TJ	Latest IPCC	Annually (per verification period)

ID No		Data variable	Unit	Monitor by	Monitoring frequency
D-18	CF-2	Conservativeness factor for boiler combustion of the rice husk	-	ACM0006	Annually (per verification period)
D-19	$COEF_{CO2,leakage}$	CO_2 emission factor of the most carbon intensive fuel (i.e coal)	t-CO_2/TJ	Latest IPCC	Annually (per verification period). Only necessary where leakage occurs.
D-20	-	Amount of rice husk consumed in all grid-connected power plants in the region (within region defined in 3.2.9)	tonne/yr	EGAT or EPPO, extrapolated	Annually (per verification period)
D-21	-	Amount of rice husk that is available in surplus in the region (within region defined in 3.2.9)	tonne/yr	Survey, extrapolated	Annually (per verification period)

2.3 *OBTAINED PARAMETER*

For the project, following parameters have been monitored on continuous basis:

1. Energy (Electricity)

The electricity exported to the grid (MWh/yr) is monitored and verified continuously by both plant site and electricity off-taker (EGAT) side by electronic measurement. According to the Power Purchase Agreement, the recording data of off-taker side is given precedence over that of the project site in the event of an anomaly between the two. Principally operator monitors amount of electricity exported to power grid by using off-taker data. The recording data of electronic meter installed at control room is treated as backup monitoring.

2. Fuel (Rice husk) on dry basis:

The rice husk fuel is weighed at the Electronic Weigh-Bridge upon arrived at the plant site. The moisture content of the received rice husk is also measured at the same time. The amount of rice husk combusted is equal to the amount of rice husk delivered to the site, adjusted with the change in rice husk stock over the monitoring period. The recording data of rice husk fuel on receipt was archived with relevant data including the date of delivery, weight of delivered rice husk and identification of rice miller from which the husk was sourced. Once rice husk is delivered to the site, it is piled at the storage yard neighboring to the plant in the regular manner with constant height and width, so that the rice husk inventory at the storage yard can be estimated easily by operators.

3. Fuel (Diesel oil)

The diesel oil has been consumed for off-site and on-site rice husk transportation and boiler start-up/auxiliary use.

Concerning off-site transportation use, it is estimated based on the record of rice husk receipt measured on truck scale system at the plant gate. Namely the number of truck transportation, the identification of rice miller as rice husk supplier and the distance between rice husk miller and the plant site enables the calculation of fossil fuel used for rice husk transportation.

Concerning on-site use, it is estimated based on the record of fossil fuel receipt.

Table 2.1 Electricity Exported & Fuel (Biomass & Fossil Fuel) Consumption per month

No.		Net Electricity Exported (kWh)	Rice husk fuel consumed (tonne dry basis)	Off-site transportation distance (km)	On-site diesel oil consumed for biomass (tonne)	On-site diesel oil consumed for boiler combustion (tonne)
1	2007/07	12,875,020	14,307	91,998.00	7.5	15.1
2	2007/08	11,298,040	13,095	78,133.00	8.1	18.1
3	2007/09	8,981,310	10,643	54,386.00	6.5	12.0
4	2007/10	6,206,890	6,961	54,566.00	4.5	15.0
5	2007/11	12,956,830	12,964	62,133.00	6.0	20.7
6	2007/12	12,752,420	12,798	62,380.00	5.6	14.8
Total		**65,070,500**	**70,768**	**403,596**	**38**	**96**

2.4 EMISSION REDUCTION

2.4.1 Calculation Formulas

$$ER_y = BE_{biomass,y} + BE_{electricity,y} - PE_{off-site,y} - PE_{on-site,y} - PE_{start-up,y} - PE_{combustion,y}$$

Where:

ER_y = Emission reduction of t he project activity during the year, (tCO_2/yr)

$BE_{biomass,y}$ = Baseline emission due to uncontrolled disposal of rice husk (tCO_2/yr)

$PE_{off-site,y}$ = Project emission due to off-site transportation (tCO_2/yr)

$PE_{on-site,y}$ = Project emission due to on-site transportation (tCO_2/yr)

$PE_{start-up,y}$ = Project emission due to start-up/auxiliary use (tCO_2/yr)

$PE_{combustion,y}$ = Project emission due to combustion of rice husk (tCO_2/yr)

Table 2.2 Emission Reduction during the second monitoring

	Item	tonne CO_2-e
Baseline Emission	CH_4 emission from uncontrolled burning of rice husk	2,929.14
	CO_2 emission from fossil fuel fired plants connected to the power grid	33,185.96
	Total	**36,115.10**
Project Emission	CO_2 emission from off-site transportation	442.74
	CO_2 emission from on-site transportation	129.15
	CO_2 emission from fossil fuels for start-up /auxiliary use	323.06
	CH_4 emission from boiler combustion of rice husk	808.90
	Total	**1,703.85**
Emission Reduction	Baseline Emission - Project Emission	**34,411.25**

2.5 *LEAKAGE ANALYSIS FOR 2007 (JULY 2007 – DECEMBER 2007)*

As identified in the PDD, a leakage assessment was carried out as part of monitoring the supply situation for the rice husk. To demonstrate that the use of rice husk by the project does not result in increased fossil fuel consumption elsewhere, a leakage assessment is carried out. Of the three options provided in the baseline methodology, leakage assessment L_2 is used:

"Demonstrate that three is an abundant surplus of the biomass residue in the region of the project activity which is not utilized. For this purpose, demonstrate that the quantity of available biomass residue of type *k* in the region is at least 25% larger than the quantity of biomass residue of type *k* that is utilized (e.g. for energy generation or as feedstock), including the project plant."

The baseline methodology stipulates that in defining that geographical boundary of the region for the leakage assessment, the usual distances for biomass transport should be taken into account, and the region may cover a radius around the project activity of at least 20 km but no more than 200 km. Due to the large number of rice millers in the region, it is not possible to isolate public data according to distance. Instead, based on the project's planned procurement area, the geographical boundary was defined in line with the registered PDD as Pichit and the surrounding provinces of Chainart, Nakhon Sawan, Uthai Thani, Kamphaeng Phet, Phitsanulok and Petchabun. These provinces cover an area of roundly 100 km in radius.

The percent of rice husk in surplus will be calculated by the formulas presented below:

$$\text{Percent of rice husk in surplus } [RH_s] \ (\%) = \left(\text{Amount of available rice husk in the region (tonne/yr)} - \text{Amount of rice husk that is utilized (tonne/yr)} \right) \times 100\%$$

2.5.1 *Leakage 2007 (July 2007 – December 2007)*

Table 2.3 Rice Production and Rice Husk Production

Province	Rice Production (Tonnes)			Production of Rice Husk (tonne)	(July - December 2007) (tonne)
	Major Rice	Second Rice	Total		
Uthai Thani	257,700.00	129,678.00	387,378.00	89,096.94	44,548.47
Kamphaeng Phet	573,409.00	301,299.00	874,708.00	201,182.84	100,591.42
Pichit	715,211.00	460,911.00	1,176,122.00	270,508.06	135,254.03
Chai Nat	503,887.00	467,225.00	1,051,112.00	241,755.76	120,877.88
Nakhon Sawan	1,181,489.00	495,112.00	1,676,601.00	385,618.23	192,809.12
Phetchabun	595,729.00	7,660.00	603,389.00	138,779.47	69,389.74
Phisanulok	575,978.00	446,542.00	1,022,520.00	235,179.60	117,589.80
Total	**4,483,403.00**	**2,308,427.00**	**6,791,830.00**	**1,562,120.90**	**781,060.45**

Source: Agricultural Statistic of Thailand, Office of Agricultural Economics. Latest data available for 2007 http://www.oae.go.th/pdffile/yearbook_1.pdf, accessed on 28 May 2008

Based on information from the Office of Agricultural Economics, rice production in the 7 provinces totalled 6,791,830.00 tonnes , translating to a total rice husk of some 1.56 million tonnes for whole year or around 0.78 million tonnes for July to December 2007.

Rice Husk Use

The major traditional uses of rice husk were identified as the use in chicken farm, brick plants and cement plants, in additional to rice millers' own consumption for rice milling and parboiling. This demand has been relatively stable as mentioned in the PDD. Another source of rice husk is the use for grid connected power plants. The amount of rice husk used for each proposed was estimated base on official data together with survey result obtained by ATB. This information is summarized below.

A. Rice Milling and Parboiling

The quantity of rice husk consumed by rice millers for rice milling and parboiling is calculated as 133,639 tonnes or 17.11% (1) of total rice husk. This information is based on interview with the Rise Engineering Supply Company, and Ruam Charn Rice Miller.

B. Chicken farms

According to the Department of Livestock Development, the chicken populations in the 7 provinces total approximately 19 million.

Table 2.4 Chicken population in procurement area

Province	Broiler Chicken	Native Chicken	Total	Rice Husk Demand (tonne)
Uthai Thani	650,806	306,628	957,434	787.48
Kamphaeng Phet	488,507	518,740	1,007,247	591.09
Pichit	1,279,481	503,997	1,783,478	1,548.17
Chai Nat	1,546,121	297,175	1,843,296	1,870.81
Nakhon Sawan	7,006,300	1,068,034	8,074,334	8,477.62
Phetchabun	2,725,567	1,223,077	3,948,644	3,297.94
Phisanulok	298,572	718,797	1,017,369	361.27
Total	**13,995,354**	**4,636,448**	**18,631,802**	**16,934.38**

Source: Department of Livestock Development, Latest available data for 2007, http://www.dld.go.th, , accessed on 28 May 2008

Of these, only broiler farms which use evaporator-controlled system need to use rice husk to lay the floor. For conservative estimation, it is assumed that all broiler farms use the evaporator-controlled system. Therefore, the chicken population requiring rice husk is deemed as 16,934.38 tonne or 8,467.19 tonne for half year.

In order to ascertain the amount of rice husk used per chicken, ATB conducted an interview as part of an EIA in 2004. Two farmers, one with a small farm of 10,000 chickens and another with a medium farm of 140,000 chickens, gave figures of 1.21 kg and 0.54 kg rice husk requirement per chicken, respectively. Based on the assumption that the difference reflected small farms tending to use a larger amount of rice husk per chicken, the figure of 1.2 kg per chicken per year was determined to be the appropriate and conservative value to use for the estimation of rice husk used in chicken farms. Thus,

Rice husk used in chicken farms in the Project's procurement area = Total chicken population in the Project's procurement area X Rice husk demand per chicken (t rice husk/chicken/yr)

C. Brick plants

Data on the number of brick plants in the project's procurement area of 7 provinces and their production capacities were obtained from the Department of Industrial Works. The number of brick plant is the same as for year 2005, as provided in PDD, because the Department of Industrial Works has not registered any new brick plants since 2005. In an interview with one major brick supplier, it transpired that the demand for brick in this region has decreased by 5-10%, which accounts for no new brick plants being set up.

Table 2.5 Brick plants in procurement area

Province	Number of brick plants	Total Capacity (piece/year)
Uthai Thani	14	58,680,000.00
Kampaeng Phet	17	26,590,000.00
Pichit	4	1,650,000.00
Chainart	13	14,990,000.00
Nakhon Sawan	17	19,585,000.00
Phetchabun	14	45,315,000.00
Phitsanulok	24	30,550,000.00
Total	**103**	**197,360,000.00**

Source: Department of Industrial Work. Latest data available for 2006; accessed on 28 May 2008.

ATB conducted an interview with 4 brick makers in 2004. The brick makers gave rice husk consumption figures of between 0.18 kg and 0.25 kg for production of one piece of brick, with the smaller brick makers requiring more rice husk per piece of brick. For the purpose of a conservative, the 0.25 kg figure was used for the estimation of rice husk used in brick plants. Also for conservatism, it is assumed that all brick plants use rice husk for their energy requirement.

Rice husk used in brick plants in the Project's procurement area	=	Total bricks produced in the Project's procurement area (bricks/year)	x	Rice husk demand per piece of brick produced (t rice husk/brick)

According to the formula above the rice husk use in brick plants in the project procurement area is around 49,340 tonnes annually or 24,670 tonnes per half year.

D. Cement plants

There is one known cement manufacturer in the procurement area that uses rice husk as part of its fuel mix. ATB conducted an interview with the manufacturer in order to obtain the consumption volume of rice husk. Based on the interview, the rice husk use for cement plants was determined to be 10,600 tonne of 5,300 tonnes for half year.

E. Grid-connected power plant

There are currently four power plants by the Thai Power Supply Company totaling approximately 61 MW_{gross} located approximately 350 km from the project site. Although the power plants fall outside of the leakage assessment area, for conservatism, it is assumed that 25% of their rice husk needs is sourced from within this boundary. This assumption is very conservative in that not only are the plants located outside of what would normally be considered an economic transport distance, but also as, apart from the smallest

3 MW plant, all plants are associated with rice and saw milling company, which acts as the major supplier.

Based on ATB's interview with the power company, the total rice husk use for the four plants is approximately 325,000 tonnes per year. Therefore, for the purpose of this assessment, it is assumed that 81,250 tonnes, or 40,625 tonnes for half year, are procured from within the project's leakage assessment area.

Rice husk surplus

The following table summarizes that supply and demand situation of rice husk in the 7 provinces – Pichit, Uthai Thani, Kampaeng Phet, Chainart, Nakhon Sawan, Phetchabun and Phitsanulok – that comprise the project's procurement area.

Table 2.6 Supply and demand of rice husk in procurement area

	Tonnes
Supply	
Rice husk production (July - December 2007)	781,060
[A] Total Supply	**781,060**
Demand	
Rice milling and parboiling	133,639
Chicken farms	8,467
Brick plants	24,670
Cement plants	5,300
Grid-connected power plants	40,625
ATB Project's fuel requirement	70,768
[B] Total Demand	**283,469**
Surplus [A] - [B]	**497,592**
Surplus as defined by ACM0006 ([A]-[B])/[B]	**176%**

It can be seen from the table that the quantity of available rice husk in the region is approximately 176% larger than the quantity of rice husk that is used, for all purposes including the ATB plant. This is significantly higher than the 25% threshold given in the baseline methodology. Therefore, the project does not bead to any leakage.

Annex I

Emission Reduction Calculation Sheets

Baseline Emission Calculation Sheet

Project Title: **A.T Biopower Rice Husk Power Project**
Project Site: **Pichit (Thailand)**
Methodology: **ACM0006 (Version 04)**

Sheet Title: **Baseline Emission**
Developed by: **ERM-Siam**
Date completed: **June 09 2008**

Total Baseline Emission = **36,115.10** **$t\text{-}CO_2/year$**

(i) CH_4 Emission from uncontrolled burning of rice husk; BE-1

Monitoring Parameter	Symbol	Unit	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total
Quantity of rice husk used as fuel in the project plant	-	tonne (wet-basis)/year	16,832.04	15,405.59	12,520.86	8,189.07	15,252.27	15,056.24	
Moisture content of rice husk (<15%)	-	%	15.00	15.00	15.00	15.00	15.00	15.00	
Quantity of rice husk used as fuel in the project plant	BF	tonne (dry-basis)/year	14,307.23	13,094.75	10,642.73	6,960.71	12,964.43	12,797.80	
CH_4 emission factor for uncontrolled burning of the rice husk.	$EF_{burning, CH4, rice, y}$	$t\text{-}CH_4$/tonne	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	
Conservativeness factor for uncontrolled burning of the rice husk	CF-1	-	0.73	0.73	0.73	0.73	0.73	0.73	
Global warming potential of CH_4	GWP_{CH4}	$t\text{-}CO_2/t\text{-}CH_4$	21.00	21.00	21.00	21.00	21.00	21.00	
CH4 emisison from uncontrolled burning of rice husk	**BE-1**	**$t\text{-}CO_2/year$**	**592.19**	**542.00**	**440.51**	**288.11**	**536.61**	**529.71**	**2,929.14**

(ii) CO_2 emission from fossil fuel fired plants connected to the power grid

Monitoring Parameter	Symbol	Unit	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total
Quantity of electricity exported to the power grid.	$EG_{project, plant}$	MWh	12,875.02	11,298.04	8,981.31	6,206.88	12,956.83	12,752.42	
CO_2 emission factor for electricity displaced	EF_{grid}	$t\text{-}CO_2/MWh$	0.51	0.51	0.51	0.51	0.51	0.51	
CO2 emisison from fossil fuel plants connected to the power grid	**BE-2**	**$t\text{-}CO_2$**	**6,566.26**	**5,762.00**	**4,580.47**	**3,165.51**	**6,607.98**	**6,503.73**	**33,185.96**

Project Emission Calculation Sheet

Project Title: **A.T Biopower Rice Husk Power Project**
Project Site: **Pichit (Thailand)**
Methodology: **ACM0006 (Version 04)**

Sheet Title: **Project Emission**
Developed by: **ERM-Siam**
Date completed: **June 09 2008**

Total Baseline Emission = **1,703.85** **$t\text{-}CO_2/year$**

(i) CO_2 emission from off-site transportation; PE-1

Monitoring Parameter	Symbol	Unit	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total
Annual truck trips for rice husk transportation per year	-	km	91,998	78,133.00	54,386.00	54,566.00	62,133.00	62,380.00	
Average emission factor for the trucks	$EF_{CO2, km}$	$t\text{-}CO_2/km$	0.001097	0.001097	0.001097	0.001097	0.001097	0.001097	
CO_2 emission from off-site transportation	**PE-1**	**$t\text{-}CO_2/year$**	**100.92**	**85.71**	**59.66**	**59.86**	**68.16**	**68.43**	**442.74**

(ii) CO_2 emission from on-site transportation; PE-2

Monitoring Parameter	Symbol	Unit	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total
Fossil fuel consumption for on-site transportation	F_{trans}	tonne/year	7.52	8.12	6.52	4.49	6.01	5.58	
Net calorific value of Diesel oil	NCV_{diesel}	TJ/tonne	0.0457	0.0457	0.0455	0.0455	0.0455	0.0455	
CO_2 emission factor for Diesel oil	$COEF_{CO2}$	t-CO/TJ	74.1	74.1	74.1	74.1	74.1	74.1	
CO_2 emission from on-site transportation	**PE-2**	**$t\text{-}CO_2/year$**	**25.46**	**27.46**	**22.00**	**15.14**	**20.26**	**18.83**	**129.15**

(iii) CO_2 emission from fossil fuels for start-up/auxiliary use; PE-3

Monitoring Parameter	Symbol	Unit	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total
Quantity of fossil fuel combusted for boiler start-up/auxiliary	$FF_{project}$	tonne/year	15.14	18.09	11.98	14.95	20.68	14.81	
Net calorific value of Diesel oil	NCV_{diesel}	TJ/tonne	0.0457	0.0457	0.0455	0.0455	0.0455	0.0455	
CO_2 emission factor for Diesel oil	$COEF_{CO2}$	t-CO/TJ	74.1	74.1	74.1	74.1	74.1	74.1	
CO_2 emission from fossil fuels for start-up /auxiliary use	**PE-3**	**$t\text{-}CO_2/year$**	**51.26**	**61.20**	**40.43**	**50.44**	**69.75**	**49.98**	**323.06**

(iv) CH_4 emission from boiler combustion of rice husk; PE-4

Monitoring Parameter	Symbol	Unit	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total
Quantity of rice husk used as fuel in the project plant	-	tonne/year	16,832	15,406	12,521	8,189	15,252	15,056	
Moisture content of rice husk	-	%	15	15	15	15	15	15	
Quantity of rice husk used as fuel in the project plant	BF	tonne (dry-basis)/year	14,307.23	13,094.75	10,642.73	6,960.71	12,964.43	12,797.80	
Net calorific value of rice husk	NCV_{rice}	TJ/tonne (dry-basis)	0.0132433	0.0132433	0.0132433	0.0132433	0.0132433	0.0132433	
Conservativeness factor for boiler combustion	CF-2	-	1.37	1.37	1.37	1.37	1.37	1.37	
CH4 emission factor for boiler combustion of rice husk	EF_{CH4}	t-CH4/TJ	0.03	0.03	0.03	0.03	0.03	0.03	
Global warming potential of CH_4	GWP_{CH4}	$t\text{-}CO_2/t\text{-}CH_4$	21	21	21	21	21	21	
CO2 emission from boiler combustion of rice husk.	**PE-4**	**$t\text{-}CO_2/year$**	**163.54**	**149.68**	**121.65**	**79.56**	**148.19**	**146.28**	**808.90**

Emission Reduction

Project Title:	**A.T Biopower Rice Husk Power Project**
Project Site:	**Pichit (Thailand)**
Methodology:	**ACM0006 (Version 04)**
Sheet Title:	**Total Emission Reduction**
Developed by:	**ERM-Siam**
Date completed:	**June 09 2008**

Total Emission Reduction from July 2007 - December 2007

EMISSION REDUCTION

	Item	tonne CO_2 e
Baseline Emission	CH_4 emission from uncontrolled burning of rice husk.	2,929.14
	CO_2 emission from fossil fuel fired plants connected to the power grid	33,185.96
	Total	**36,115.10**
Project Emission	CO_2 emission from off-site transportation	442.74
	CO_2 emission from on-site transportation	129.15
	CO_2 emission from fossil fuels for start-up /auxiliary use	323.06
	CH_4 emission from boiler combustion of rice husk	808.90
	Total	**1,703.85**
Emission Reduction	Baseline Emission - Project Emission	**34,411.25**