MONITORING REPORT

BIOGAS TANKS IN GUIZHOU PROVINCE, CHINA

GS 614

Caohai natural reserve, Weining

Third Crediting Year, 1st April 2010 to 31st March 2011

Version History of the Monitoring Report

Version number	Date	Change
1	19th Jul, 2012	First draft
2		
3		

Abstract

This is the third crediting year monitoring report for the project GS 614 "Biogas Tanks in Guizhou Province in China". The project area comprises two different climatic zones (Weining and Danzhai) and two monitoring surveys are conducted per year (one during summer and one during winter).

The baseline and the project situation had been surveyed to monitor the Green House Gases emission of the targeted households but also their expenses in fuel purchase, the share of biogas in the total energy requirement of the households and indicators of hygiene improvement.

The third crediting year

A total of 2754.5 metric tons of CO2 equivalent had been saved thanks to the project activity during the third crediting year. In Weining, farmers had saved an average 868.2 RMB on their yearly fuel expense and biogas contribute to 44% of their energy needs, the global hygiene rank has increased by 5.4 and they use the biogas lamp for about 22 minutes per day.

In Danzhai villagers had saved 32.8 RMB in average and biogas contributes to 40% of the energy needs, the global hygiene rank has been increased by 1.5 and they use the biogas lamp 10 minutes per day.

These results prove the impact of the project on Green House Gases Emission reductions but also its contribution to local and sustainable development and poverty alleviation.

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I. CALCULATION METHODOLOGY

The emission reductions (ER) calculations are based on the Gold Standard biodigester methodology which has been also described in the PDD. There are two different climatic zones in the project, so the ERs are calculated separately for the each one of them. There are also two energy consumption pattern in the years. During the warmest months of the year, villagers don't heat their house (we consider this period summer even if it is longer than the actual three months of summer). During the coldest months of the year, they heat their house (we consider this period winter even if it is longer than the actual three month of winter). Therefore there are two monitoring surveys conducted per year, one for each energy consumption pattern, thus the period covered by each survey is not a full year but a season.

The ERs are then calculated for each season, and ERs for the year are the sum of the ERs for the summer and for the winter.

II. CLIMATIC ZONE

Two different climatic zones have been identified in the project area: the districts of Weining and Danzhai. Each zone has specificities regarding fuel use, as described in the following paragraphs.

i. Weining

This zone is located at the north west of the Guizhou province. The average altitude is above 2000m and the average temperature is around 11° C. In this area the villagers start to heat their house at the beginning of October and do so until mid February. In this zone we can distinguish three areas with different fuel consumption pattern: Caohai where people are using mostly coal, Dajie where people are using mostly firewood and Niupeng where people are using both coal and firewood. Thus having a good representativeness between these three areas is important to have a right estimation of the Emission Reductions.

ii. Danzhai

This zone is located at the south east of the Guizhou province. The average altitude is around 1000m and the average temperature around 14° C. In this area the villagers start to heat their house at the beginning of November and do so until end of February. The fuel consumption pattern is pretty homogenous in the area, villagers are mostly using firewood.

III. NUMBER OF BIODIGESTERS AND SURVEY DONE

The following tables summarize the number of tanks built in each climatic zone before the beginning of winter and summer. Only the tanks that are completely finished and that are producing gas at the beginning of the season are taken into account. It also displays the survey done to estimate the baseline situation and the project situation.

i. Danzhai the third Crediting Year (1st April 2010 to 31st March 2011)

Name in Chinese			Name in Pinyin			Summer 2010					Winter 2010				
							Baseline		Monitoring			Baseline		Monitoring	
District	Township	Village	District	Township	Village	Number of biodigester	Number of baseline survey	Ratio Baseline	Number of monitoring survey	Ratio Monitoring	Number of biodigester	Number of baseline survey	Ratio Baseline	Number of monitoring survey	Ratio Monitoring
丹寨	兴仁	甲脚	Danzhai	Xingren	Jiajiao	57	14	25%	7	12%	57	14	25%	7	12%
丹寨	兴仁	者拉	Danzhai	Xingren	Zhela	64	16	25%	8	13%	64	16	25%	8	13%
丹寨	扬武	排倒	Danzhai	Yangwu	Paidao	24	6	25%	3	13%	24	6	25%	3	13%
丹寨	扬武	排莫	Danzhai	Yangwu	Paimo	90	23	26%	12	13%	90	23	26%	12	13%
丹寨	扬武	羊望	Danzhai	Yangwu	Yangwang	11	3	27%	2	18%	11	3	27%	1	9%
丹寨	排调	宰宿	Danzhai	Paidiao	Zaisu	26	6	23%	3	12%	26	6	23%	3	12%
丹寨	龙泉	五里	Danzhai	Longquan	Wuli	50	13	26%	6	12%	50	13	26%	6	12%
丹寨	龙泉	得禄	Danzhai	Longquan	Delu	103	25	24%	13	13%	103	25	24%	12	12%
丹寨	龙泉	杉木	Danzhai	Longquan	Shanmu	11	3	27%	2	18%	11	3	27%	1	9%
丹寨	龙泉	交圭	Danzhai	Longquan	Jiaogui	100	25	25%	13	13%	100	25	25%	0	0%
丹寨	龙泉	金山	Danzhai	Longquan	Jinshan	15	4	27%	2	13%	15	4	27%	2	13%
丹寨	龙泉	龙洞	Danzhai	Longquan	Longdong	8	2	25%	1	13%	8	2	25%	1	13%
丹寨	龙泉	高排	Danzhai	Longquan	Gaopai	28	7	25%	4	14%	28	7	25%	4	14%
丹寨	龙泉	金瓜洞	Danzhai	Longquan	Jinguadong	31	8	26%	4	13%	31	8	26%	4	13%
丹寨	兴仁	点力	Danzhai	Xingren	Dianli	75	19	25%	10	13%	75	19	25%	10	13%
丹寨	兴仁	白头	Danzhai	Xingren	Baitou	42	11	26%	6	14%	42	11	26%	6	14%
丹寨	兴仁	排佐	Danzhai	Xingren	Paizuo	25	6	24%	3	12%	25	6	24%	3	12%
TOTAL						**760**	**191**		**99**		**760**	**191**		**83**	

ii. Weining the third Crediting Year (1st April 2010 to 31st March 2011)

Name in Chinese			Name in Pinyin			Summer 2010					Winter 2010				
							Baseline		Monitoring			Baseline		Monitoring	
District	Township	Village	District	Township	Village	Number of biodigesters	Number of baseline survey	Ratio Baseline	Number of monitoring survey	Ratio Monitoring	Number of biodigesters	Number of baseline survey	Ratio Baseline	Number of monitoring survey	Ratio Monitoring
威宁	牛棚	范家田	Weining	Niupeng	Fanjiatian	38	10	26%	6	16%	38	10	26%	6	16%
威宁	牛棚	营山	Weining	Niupeng	Yingshan	9	2	22%	2	22%	9	3	33%	2	22%
威宁	牛棚	邓家营	Weining	Niupeng	Dengjiaying	43	11	26%	7	16%	43	12	28%	7	16%
威宁	牛棚	鱼塘	Weining	Niupeng	Yutang	30	8	27%	5	17%	30	8	27%	5	17%
威宁	牛棚	新山	Weining	Niupeng	Xinshan	30	8	27%	5	17%	30	8	27%	2	7%
威宁	草海	东山	Weining	Caohai	Dongshan	64	17	27%	10	16%	64	16	25%	10	16%
威宁	草海	郑家营	Weining	Caohai	Zhengjiaying	62	16	26%	8	13%	62	16	26%	10	16%
威宁	草海	吕家河	Weining	Caohai	Lujiahe	11	3	27%	0	0%	11	4	36%	2	18%
威宁	草海	响塘	Weining	Caohai	Xiangtang	3	0	0%	1	33%	3	0	0%	0	0%
威宁	草海	石龙	Weining	Caohai	Shilong	10	3	30%	2	20%	10	3	30%	2	20%
威宁	大街	高华	Weining	Dajie	Gaohua	45	12	27%	7	16%	45	14	31%	7	16%
威宁	大街	大街	Weining	Dajie	Dajie	3	1	33%	1	33%	3	0	0%	0	0%
威宁	牛棚	新营	Weining	Niupeng	Xinying	158	41	26%	24	15%	158	41	26%	26	16%
威宁	牛棚	中寨	Weining	Niupeng	Zhongzhai	42	11	26%	6	14%	42	11	26%	7	17%
TOTAL						**548**	**143**		**84**		**548**	**146**		**86**	

iii. Summary of the Baseline and Monitoring survey led for this report

ID	Date of the survey	Purpose of the survey	Defects or improvement in a survey or the method, if any
BL 4	March 2008	Assess the baseline situation in **Weining** in the village that got their tank built in 2007.	This survey did not take into account pig food fuel consumption. It was abandoned and replaced by survey BL 14 (see MT report Year 1).
BL 10	July, August 2009	Assess the Baseline situation in **Weining** for the household that got their tank built in 2008	
BL 14	August 2010	Assess the baseline situation in **Weining** in the village that got their tank built in 2007.	This survey was done with non-beneficiaries (in order to get the fuel consumption without biogas tank) in the village that got a tank in 2007. That's why the questionnaires don't have Tank ID number.
BL 12	September to December 2009	Assess the baseline situation in **Weining** in the village that got their tank built in 2009.	
MT 15	June, July, August 2010	Assess the project summer situation in **Weining** (tank built in 2007, 2008 and 2009)	All selected household were surveyed even if their tank is not working.
MT 19	January, February, March 2011	Assess the project winter situation in **Weining** (tank built in 2007, 2008 and 2009)	All selected household were surveyed even if their tank is not working.
BL 5	March 2008	Assess the baseline situation in **Danzhai** for the tank built in 2007	The survey assessed the average daily fuel consumption all over the year rather than considering specific consumption for Summer and for Winter.
BL 6	May 2009	Assess the baseline situation in **Danzhai** for the tank built in 2008	
BL 11	October November 2009	Assess the baseline situation in **Danzhai** for the tank built in 2009	

ID	Date of the survey	Purpose of the survey	Defects or improvement in a survey or the method, if any
MT 16	July August 2010	Assess the project summer situation in **Danzhai** for the tank built in 2007, 2008 and 2009	All selected household were surveyed even if their tank is not working.
MT 18	December 2010 and January 2011	Assess the project winter situation in **Danzhai** for the tank built in 2007 2008 and 2009	All selected household were surveyed even if their tank is not working.

IV. EMISSION REDUCTIONS CALCULATION

From the baseline and project emissions, we obtain the following Emission Reductions. More details are given in the Excel spreadsheet.

In order to have conservative values, CO2 emissions calculations have only been taken into account for active biodigesters. The failure rate has then been integrated in the final seasonal calculation, as described above.

i. Danzhai the third Crediting Year (1st April 2010 to 31st March 2011)

DANZHAI	GHG Emission (tCO2 eq/hh)	Emission Reduction (tCO2eq/hh)	Number of biodigester	Failure Rate	VER (tCO2eq)
Summer Baseline emission corrected	4.48	1.03	760	31%	538.9
Summer Monitoring emission corrected	3.45				
Winter Baseline emission corrected	5.70	0.98	760	31%	514.0
Winter Monitoring emission corrected	4.72				
Total		**2.02**			**1052.9**

ii. Weining the third Crediting Year (1st April 2010 to 31st March 2011)

WEINING	GHG Emission (tCO2eq/hh)	Emission Reduction (tCO2eq/hh)	Number of biodigesters	failure rate	VER (tCO2eq)
Summer Baseline emission corrected	6.45	1.90	548	25%	781.8
Summer Monitoring emission corrected	4.55				
Winter Baseline emission corrected	7.27	2.19	548	23%	919.8
Winter Monitoring emission corrected	5.08				
Total		**4.09**			**1701.6**

V. SUSTAINABLE DEVELOPMENT INDICATORS

Four sustainable development indicators have been monitored: the cost of energy, the percentage of traditional fuel in total energy requirement, the improvement of hygiene and the use of the biogas lamp.

To evaluate the hygiene a mark between 0 and 12.5 is given to each household according to the following criteria:

Is there a trashcan used in the latrine? Yes = 2 No = 0
What material is the latrine floor made of: Cement = 2 Paved = 2 Ground = 0 Wood = 1
Is there rubbish in the floor? Yes = 0 No = 1.5
Is there an animal pen? No = 0 Yes = 1
Is there a cemented floor in the animal pen? Yes = 1 No = 0
Is there a canal for excrement evacuation to the biodigester? Yes = 2 No = 0
Is there a pen? Yes = 1 No = 0
Is there a roof? Yes = 0.5 No = 0
Do you need to go nearby the animal pen to go to your room? Yes = 0 No = 1.5

Then the average of all household is made in the baseline situation and in the project situation.

To calculate the use of the lamp, we take the average time of use of all household

i. Danzhai the third Crediting Year (1st April 2010 to 31st March 2011)

DANZHAI	Hygiene Score	Indoor air pollution					Daily cooking time (hr/day)	Daily firewood collection time (hr/day)	Energy Used (GJ/season)	Price of Energy (RMB/season)	Use of Biogas Lamp (min/day)
		Smoke in the Kitchen	Cough	headache	eyes infection	respiratory problem					
Summer Baseline	7.8	2.7	2.0	1.7	1.3	1.5	2.6	1.1	84.5	43.2	-
Winter Baseline									95.7	461.0	
Summer Project	9.3	1.6	1.2	1.1	1.1	1.1	1.6	1.3	49.4	47.2	10
Winter Project									57.9	425.3	
Comparison	**1.5**	**1.1**	**0.8**	**0.6**	**0.2**	**0.4**	**1.0**	**-0.1**	**40%**	**31.8**	

ii. Weining the third Crediting Year (1st April 2010 to 31st March 2011)

WEINING	Hygiene Score	Indoor air pollution					Daily cooking time (hr/day)	Daily firewood collection time (hr/day)	Energy Used (GJ/season)	Price of Energy (RMB/season)	Use of Biogas Lamp (min/day)
		Smoke in the Kitchen	Cough	headache	eyes infection	respiratory problem					
Summer Baseline	4.1	3.4	2.0	2.0	1.9	1.2	4.2	1.3	78.1	1123.1	-
Winter Baseline									88.2	1254.5	
Summer Project	9.4	1.6	1.1	1.1	1.1	1.0	2.1	0.3	42.2	714.9	22
Winter Project									50.5	794.5	
Comparison	**5.4**	**1.8**	**0.9**	**0.8**	**0.9**	**0.2**	**2.2**	**1.1**	**44%**	**868.2**	

The hygiene in Danzhai has not been improved very much by the project because it was already pretty good in the baseline situation. We can see that biogas can contribute to 40% of the energy need of the household.

In Weining hygiene has increased a lot in the third crediting year thanks to the project because the baseline situation was worse than in Danzhai. Biogas contributes to 44% of the energy requirement of the household and allows them to save 743 to 917 RMB on their fuel purchase.

ANNEX 1: DATA TO BE MONITORED (PDD SECTION D.2.1.1)

ID number	Name	Data variable	Source of data	Data unit	Measured, calculated, estimated	Recording frequency	Proportion of data to be monitored	How will the data be archived?	Comment
PE.1	$N_{sample,p}$	*Number of households in the monitoring sample*	*ID*	*Households*	-	*Twice a year*	-	*Electronic*	*A monitoring survey is conducted during each period p.*
PE.2	$N_{hh,p}$	*Number of beneficiaries in the climatic areas*	*ID*	*Households*	-	*Twice a year*	-	*Electronic*	*Number of household in the climatic area that use their biogas tank at the beginning of the period p.*
PE.3	$F_{i,p,h}$	*Daily consumption of fuel i of households of the monitoring sample*	*Survey*	*Kg*	*estimated*	*Twice a year*	*Sample (at least 60 households)*	*Electronic and paper*	*The daily consumption concerns different activities according to the type of period and climatic area. Cooking is always one of these activities.*
PE.4	MS_p	*Average fraction of livestock's manure fed into the biodigester*	*Survey*	*%*	*estimated*	*Twice a year*	*Sample (at least 60 households)*	*Electronic and paper*	*The fraction is estimated for all the animals whose manure is put into the biodigester. No differentiation is made by type of animal.*
PE.5	$LC_{T,p,h}$	*Number of heads of livestock category T*	*Survey*	*Animals*	*estimated*	*Twice a year*	*Sample (at least 60 households)*	*Electronic and paper*	*The animals are the ones whose share of manure is put into the biodigester.*
PE.6	D_p	*Average duration of the considered period p*	*ID*	*Date*	*estimated*	*Twice a year*	-	*Electronic*	*This date is estimated by monitoring the period of heating of households in the climatic areas.*

PE.7	GWP_{CH4}	*Global Warming Potential of methane*	*IPCC Guidelines*	-	-	*According to IPCC's publications*	-	*Electronic*	-
PE.8	$\mu_{nr,h}$	*Non-Renewabilty Rate of the biomass consumed*	*Study*	*%*	*estimated*	*In case other project activities will impact on the NRB fraction*	-	*Electronic and paper*	*Original NRB studies have already been conducted. It may be updated whether indeed other project activities are initiated that would possibly have a significant impact on the NRB fraction. The methodology is given in a specific document.*

ANNEX 2: SUMMARY OF MONITORING RESULT

Name	Description	Unit	Value
$N_{ben,WN,sum}$	Number of beneficiary in Weining climatic zone during summer	household	548
$N_{ben,WN,win}$	Number of beneficiary in Weining climatic zone during winter	household	548
$N_{ben,DZ,sum}$	Number of beneficiary in Danzhai climatic zone during summer	household	760
$N_{ben,DZ,wint}$	Number of beneficiary in Danzhai climatic zone during winter	household	760
$N_{BL,DZ,sum}$	Number of baseline survey in Danzhai climatic zone during summer	household surveyed	191
$N_{BL,DZ,wint}$	Number of baseline survey in Danzhai climatic zone during winter	household surveyed	191
$N_{BL,WN,wint}$	Number of baseline survey in Weining climatic zone during winter	household surveyed	146
$N_{BL,WN,sum}$	Number of baseline survey in Weining climatic zone during summer	household surveyed	143
$N_{MT,DZ,sum}$	Number of monitoring survey in Danzhai climatic zone during summer	household surveyed	99
$N_{MT,DZ,wint}$	Number of monitoring survey in Danzhai climatic zone during winter	household surveyed	83
$N_{MT,WN,sum}$	Number of monitoring survey in Weining climatic zone during summer	household surveyed	84
$N_{MT,WN,wint}$	Number of monitoring survey in Weining climatic zone during winter	household surveyed	86
$BE_{WN,sum}$	Baseline Emission in Weining climatic zone during summer	metric ton of CO_2e/household	6.45
$BE_{WN,wint}$	Baseline Emission in Weining climatic zone during winter	metric ton of CO_2e/household	7.27
$BE_{DZ,sum}$	Baseline Emission in Danzhai climatic zone during summer	metric ton of CO_2e/household	4.48
$BE_{DZ,wint}$	Baseline Emission in Danzhai climatic zone during winter	metric ton of CO_2e/household	5.70
$PE_{WN,sum}$	Project Emission in Weining climatic zone during summer	metric ton of CO_2e/household	4.55
$PE_{WN,wint}$	Project Emission in Weining climatic zone during winter	metric ton of CO_2e/household	5.08
$PE_{DZ,sum}$	Project Emission in Danzhai climatic zone during summer	metric ton of CO_2e/household	3.45
$PE_{DZ,wint}$	Project Emission in Danzhai climatic zone during winter	metric ton of CO_2e/household	4.72
$ER_{WN,sum}$	Emission Reduction in Weining climatic area during summer	metric ton of CO_2e/household	1.90
$ER_{WN,wint}$	Emission Reduction in Weining climatic area during winter	metric ton of CO_2e/household	2.19
$ER_{DZ,sum}$	Emission Reduction in Danzhai climatic area during summer	metric ton of CO_2e/household	1.03
$ER_{DZ,wint}$	Emission Reduction in Danzhai climatic area during winter	metric ton of CO_2e/household	0.98
$ER_{WN,year3}$	Emission Reduction in Weining climatic area during the third crediting year	metric ton of CO_2e	1701.6
$ER_{DZ,year3}$	Emission Reduction in Danzhai climatic area during the third crediting year	metric ton of CO_2e	1052.9
ER_{year3}	Emission Reduction for the full project during the third crediting year	metric ton of CO_2e	2754.5
$\%TF_{trad,BL,WN}$	% of traditional fuel in total energy consumption in Weining before the project	dimensionless	100%

$\%TF_{trad,BL,DZ}$	% of traditional fuel in total energy consumption in Danzhai before the project	dimensionless	100%
$\%TF_{trad,MT,DZ}$	% of traditional fuel in total energy consumption in Danzhai after the project	dimensionless	40%
$\%TF_{trad,MT,WN}$	% of traditional fuel in total energy consumption in Weining after the project	dimensionless	44%
$\%Biogas_{WN}$	% of biogas in total energy requirement in Weining climatic zone	dimensionless	56%
$\%Biogas_{DZ}$	% of biogas in total energy requirement in Danzhai climatic zone	dimensionless	60%
$NRJ_{cost,BL,WN}$	Average amount of money spent per family before the project for fuel purchase in Weining	Chinese Yuan (RMB)	2377.6
$NRJ_{cost,BL,DZ}$	Average amount of money spent per family before the project for fuel purchase in Danzhai	Chinese Yuan (RMB)	504.2
$NRJ_{cost,MT,WN}$	Average amount of money spent per family after the project for fuel purchase in Weining	Chinese Yuan (RMB)	1509.4
$NRJ_{cost,MT,DZ}$	Average amount of money spent per family after the project for fuel purchase in Danzhai	Chinese Yuan (RMB)	472.4
$NRJ_{cost,SAVING,WN}$	Average amount of money saved per family thanks to the project for fuel purchase in Weining	Chinese Yuan (RMB)	868
$NRJ_{cost,SAVING,DZ}$	Average amount of money saved per family thanks to the project for fuel purchase in Danzhai	Chinese Yuan (RMB)	32
$F_{coal,WN,sum,BL}$	Average daily coal consumption in Weining in Summer in baseline situation	kg/day	10.56
$F_{coal,WN,wint,BL}$	Average daily coal consumption in Weining in Winter in baseline situation	kg/day	16.51
$F_{wood,WN,sum,BL}$	Average daily wood consumption in Weining in Summer in baseline situation	kg/day	5.47
$F_{wood,WN,wint,BL}$	Average daily wood consumption in Weining in Winter in baseline situation	kg/day	8.95
$F_{charcoal,WN,sum,BL}$	Average daily charcoal consumption in Weining in Summer in baseline situation	kg/day	0
$F_{charcoal,WN,wint,BL}$	Average daily charcoal consumption in Weining in Winter in baseline situation	kg/day	0
$F_{coal,DZ,sum,BL}$	Average daily coal consumption in Danzhai in Summer in baseline situation	kg/day	0.25
$F_{coal,DZ,wint,BL}$	Average daily coal consumption in Danzhai in Winter in baseline situation	kg/day	4.63
$F_{wood,DZ,sum,BL}$	Average daily wood consumption in Danzhai in Summer in baseline situation	kg/day	23.18
$F_{wood,DZ,wint,BL}$	Average daily wood consumption in Danzhai in Winter in baseline situation	kg/day	34.69
$F_{charcoal,DZ,sum,BL}$	Average daily charcoal consumption in Danzhai in Summer in baseline situation	kg/day	0.08
$F_{charcoal,DZ,wint,BL}$	Average daily charcoal consumption in Danzhai in Winter in baseline situation	kg/day	1.19
$F_{coal,WN,sum,MT}$	Average daily coal consumption in Weining in Summer in project situation	kg/day	6.72
$F_{coal,WN,wint,MT}$	Average daily coal consumption in Weining in Winter in project situation	kg/day	10.45
$F_{wood,WN,sum,MT}$	Average daily wood consumption in Weining in Summer in project situation	kg/day	1.53
$F_{wood,WN,wint,MT}$	Average daily wood consumption in Weining in Winter in project situation	kg/day	3.39
$F_{charcoal,WN,sum,MT}$	Average daily charcoal consumption in Weining in Summer in project situation	kg/day	0
$F_{charcoal,WN,wint,MT}$	Average daily charcoal consumption in Weining in Winter in project situation	kg/day	0
$F_{coal,DZ,sum,MT}$	Average daily coal consumption in Danzhai in Summer in project situation	kg/day	0.33
$F_{coal,DZ,wint,MT}$	Average daily coal consumption in Danzhai in Winter in project situation	kg/day	4.04
$F_{wood,DZ,sum,MT}$	Average daily wood consumption in Danzhai in Summer in project situation	kg/day	13.32
$F_{wood,DZ,wint,MT}$	Average daily wood consumption in Danzhai in Winter in project situation	kg/day	17.53

$F_{charcoal,DZ,sum,MT}$	Average daily charcoal consumption in Danzhai in Summer in project situation	kg/day	0.01
$F_{charcoal,DZ,wint,MT}$	Average daily charcoal consumption in Danzhai in Winter in project situation	kg/day	1.43
MS_{WN}	Average share of the manure put into the biodigester in Weining climatic area	dimensionless	34.96%
MS_{DZ}	Average share of the manure put into the biodigester in Danzhai climatic area	dimensionless	35.58%
$LC_{pig,WN,BL,sum}$	Average number of pig per household in the pre-project situation in summer in Weining	animal/household	4.42
$LC_{cow,WN,BL,sum}$	Average number of cow per household in the pre-project situation in summer in Weining	animal/household	0.67
$LC_{buffalo,WN,BL,sum}$	Average number of buffalo per household in the pre-project situation in summer in Weining	animal/household	0.34
$LC_{horse,WN,BL,sum}$	Average number of horse per household in the pre-project situation in summer in Weining	animal/household	0.03
$LC_{sheep,WN,BL,sum}$	Average number of sheep per household in the pre-project situation in summer in Weining	animal/household	0.04
$LC_{goat,WN,BL,sum}$	Average number of goat per household in the pre-project situation in summer in Weining	animal/household	0.35
$LC_{pig,WN,BL,wint}$	Average number of pig per household in the pre-project situation in winter in Weining	animal/household	4.31
$LC_{cow,WN,BL,wint}$	Average number of cow per household in the pre-project situation in winter in Weining	animal/household	0.66
$LC_{buffalo,WN,BL,wint}$	Average number of buffalo per household in the pre-project situation in winter in Weining	animal/household	0.34
$LC_{horse,WN,BL,wint}$	Average number of horse per household in the pre-project situation in winter in Weining	animal/household	0.03
$LC_{sheep,WN,BL,wint}$	Average number of sheep per household in the pre-project situation in winter in Weining	animal/household	0.04
$LC_{goat,WN,BL,wint}$	Average number of goat per household in the pre-project situation in winter in Weining	animal/household	0.34
$LC_{pig,DZ,BL,sum}$	Average number of pig per household in the pre-project situation in summer in Danzhai	animal/household	3.79
$LC_{cow,DZ,BLsum}$	Average number of cow per household in the pre-project situation in summer in Danzhai	animal/household	0.67
$LC_{b0uffalo,DZ,BL,sum}$	Average number of buffalo per household in the pre-project situation in summer in Danzhai	animal/household	0.34
$LC_{horse,DZ,BL,sum}$	Average number of horse per household in the pre-project situation in summer in Danzhai	animal/household	0.29
$LC_{sheep,DZ,BL,sum}$	Average number of sheep per household in the pre-project situation in summer in Danzhai	animal/household	0.01
$LC_{g0oat,DZ,BL,sum}$	Average number of goat per household in the pre-project situation in summer in Danzhai	animal/household	0
$LC_{pig,DZ,BL,wint}$	Average number of pig per household in the pre-project situation in winter in Danzhai	animal/household	3.81
$LC_{cow,DZ,BL,wint}$	Average number of cow per household in the pre-project situation in winter in Danzhai	animal/household	0.68
$LC_{buffalo,DZ,BL,wint}$	Average number of buffalo per household in the pre-project situation in winter in Danzhai	animal/household	0.34
$LC_{horse,DZ,BL,wint}$	Average number of horse per household in the pre-project situation in winter in Weining	animal/household	0.29
$LC_{sheep,DZ,BL,wint}$	Average number of sheep per household in the pre-project situation in summer in Danzhai	animal/household	0.01
$LC_{goat,DZ,BL,wint}$	Average number of goat per household in the pre-project situation in winter in Danzhai	animal/household	0
$LC_{pig,WN,MT,sum}$	Average number of pig per household in the project situation in summer in Weining	animal/household	4.57
$LC_{cow,WN,MT,sum}$	Average number of cow per household in the project situation in summer in Weining	animal/household	1.02
$LC_{buffalo,WN,MT,sum}$	Average number of buffalo per household in the -project situation in summer in Weining	animal/household	0.07
$LC_{horse,WN,MT,sum}$	Average number of horse per household in the -project situation in summer in Weining	animal/household	0.01
$LC_{sheep,WN,MT,sum}$	Average number of sheep per household in the project situation in summer in Weining	animal/household	0

$LC_{goat,WN,MT,sum}$	Average number of goat per household in the pre-project situation in summer in Weining	animal/household	0.89
$LC_{pig,WN,MT,wint}$	Average number of pig per household in the project situation in winter in Weining	animal/household	3.73
$LC_{cow,WN,MT,wint}$	Average number of cow per household in the project situation in winter in Weining	animal/household	0.93
$LC_{buffalo,WN,MT,wint}$	Average number of buffalo per household in the project situation in winter in Weining	animal/household	0.22
$LC_{horse,WN,MT,wint}$	Average number of horse per household in the project situation in winter in Weining	animal/household	0.09
$LC_{sheep,WN,MT,wint}$	Average number of sheep per household in the project situation in winter in Weining	animal/household	0
$LC_{goat,WN,MT,wint}$	Average number of goat per household in the project situation in winter in Weining	animal/household	1.09
$LC_{pig,DZ,MT,sum}$	Average number of pig per household in the project situation in summer in Danzhai	animal/household	4.06
$LC_{cow,DZ,MT,sum}$	Average number of cow per household in the project situation in summer in Danzhai	animal/household	0.44
$LC_{buffalo,DZ,MT,sum}$	Average number of buffalo per household in the pre-project situation in summer in Danzhai	animal/household	0.38
$LC_{horse,DZ,MT,sum}$	Average number of horse per household in the project situation in summer in Danzhai	animal/household	0.41
$LC_{sheep,\ DZ,MT,sum}$	Average number of sheep per household in the project situation in summer in Danzhai	animal/household	0
$LC_{goat,\ DZ,MT,sum}$	Average number of goat per household in the project situation in summer in Danzhai	animal/household	0
$LC_{pig,\ DZ,MT,wint}$	Average number of pig per household in the project situation in winter in Danzhai	animal/household	3.25
$LC_{cow,\ DZ,MT,wint}$	Average number of cow per household in the project situation in winter in Weining	animal/household	0.28
$LC_{buffalo,\ DZ,MT,wint}$	Average number of buffalo per household in the project situation in winter in Danzhai	animal/household	0.48
$LC_{horse,\ DZ,MT,wint}$	Average number of horse per household in the project situation in winter in Danzhai	animal/household	0.4
$LC_{sheep,\ DZ,MT,wint}$	Average number of sheep per household in the project situation in winter in Danzhai	animal/household	0
$LC_{goat,DZ,MT,wint}$	Average number of goat per household in the project situation in winter in Danzhai	animal/household	0
$D_{DZ,sum}$	Average duration of the summer in Danzhai	month	7.5
$D_{DZ,wint}$	Average duration of the winter in Danzhai	month	4.5
$D_{WN,sum}$	Average duration of the summer in Weining	month	7
$D_{WN,wint}$	Average duration of the winter in Weining	month	5
GWP_{CH4}	Global Warming potential of methane according to the IPCC	dimensionless	21
μ_{WN}	NRB rate of the forest in Weining	dimensionless	63.19
μ_{DZ}	NRB rate of the forest in Danzhai	dimensionless	61.09