Verification Report for

Project : Andhyodaya Bundled Small Scale Rural Biogas Projects (Phase 1), Kerala.

UCR Project ID : 281

Name of Verifier	SQAC Certification Pvt. Ltd.
Date of Issue	27/04/2023
Project Proponent	The Andhyodaya, Ernakulam, Kerala, India.
UCR Project Aggregator	The Andhyodaya, Ernakulam, Kerala, India.
Work carried by	Mr. Santosh Nair
Work reviewed by	Mr. Praful Shinganapurkar

Summary:

SQAC Certification Pvt. Ltd. has performed verification of the "Andhyodaya Bundled Small Scale Rural Biogas Projects (Phase 1), Kerala" for replacement of Non-Renewable Biomass with biogas for cooking and heating water which replaces inefficient traditional cooking stoves with cleaner biogas stoves. The overall objectives of the project activity are reduction of greenhouse gases, conservation of forests and woodlands as well as improved health conditions of end users due to improved indoor air quality.

The project activity meets the following 7 major UN sustainable development goals (SDG's):

Verification for the period **1st January 2013 till 31st December 2022**.

In our opinion, the total GHG emission reductions over the crediting / verification period stated in the Project Concept Note (PCN) / Monitoring Report (MR), submitted to SQAC are fairly stated.

The GHG emission reductions were calculated on the basis of UCR Biogas Protocol Standard Baseline which draws reference from AMS.I.E. Switch from non-renewable biomass for thermal

applications by the user. The verification was done onsite by way of interviews, onsite verification and submission of documents for verification through emails.

SQAC is able to certify that the emission reductions from the "Andhyodaya Bundled Small Scale Rural Biogas Projects (Phase 1), Kerala" for the period 1st January 2013 till 31st December 2022 amount to 4,67,170 CoUs.

Detailed Verification Report:

Purpose:

The project activity - Andhyodaya Bundled Small Scale Rural Biogas Projects (Phase 1), Kerala is located across many villages in the districts of Alappuzha, Ernakulam, Idukki, Kannur, Kasaragod, Kollam, Kottayam, Kozhikode, Malappuram, Palakkad, Pathanamthitta, Thiruvananthapuram, Thrissur and Wayanad in the state of Kerala, India and setup by the Non-Governmental Organisation (NGO) – The Andhyodaya (Project Proponent-PP). The project activity aims at avoidance of fuel wood (firewood) consumption by traditional stove users by switching to bio-digester (biogas) technology using cow dung as a renewable energy fuel. The implemented biogas units for cooking needs helps reduce the amount of fuel wood used for cooking and water heating and replaces inefficient traditional cooking stoves with cleaner biogas stoves. This technology also reduces methane (CH_4) emissions from cattle manure and contributes strongly to the sustainable development of the rural households involved in the project activity. The overall objectives of the project activity are reduction of greenhouse gases, conservation of forests and woodlands as well as improved health conditions of end users due to improved indoor air quality.

The objectives of this verification are, by way of suitable evidence, to establish that:

1. The project has been commissioned as per the documented evidence.
2. The details provided in the PCN / MR are correct.
3. The emission reductions from the project claimed are correct and in accordance with the requirements of the UCR Standard.

Location of project activity:

Country : India.
District : Alappuzha, Ernakulam, Idukki, Kannur, Kasaragod, Kollam, Kottayam, Kozhikode, Malappuram, Palakkad, Pathanamthitta, Thiruvananthapuram, Thrissur and Wayanad
State : Kerala
Latitude : 11° 15' 30.1788'' N

Longitude : 75° 54' 36.1224'' E

The digesters have been operational for a minimum of 330 days in a year with 4 hours of daily use per household.

UCR Project ID : 281

Start Date of Crediting Period : 01/01/2013

Project Commissioned from : 01/01/2002 onwards

Total Biogas Units in working condition within the Monitoring Period : 11,429

Size of Digestor (m^3)	Number installed
1	4066
3	5895
4	978
6	490
Total	**11429**

Scope:

The scope covers verification of emission reductions from the project Andhyodaya Bundled Small Scale Rural Biogas Projects (Phase 1), Kerala.

Criteria:

Verification criteria is as per the requirements of UCR Protocol Standard Baseline and AMS.I.E. Switch from non-renewable biomass for thermal applications by the user.

Description of project:

The project activity involves the installation of 11429 independent biogas plants (digesters) of capacities between $1m^3$, $3m^3$, $4m^3$ and $6m^3$, each serving individual households comprising of an average of 4-7 members, using cattle dung (renewable energy fuel) collected from buffaloes, cows and calves currently being housed at rural households in the villages.

The project activity is implemented in a phase wise manner since 01/01/2002. The majority of the digesters are of the fixed dome Deenabhandhu model, however, a few are of the floating drum and portable models. The slurry is fed from a mixing tank through an inlet pipe connected to the digester. After fermentation, the biogas collects in the space under the dome. It is taken out for use through a pipe connected to the top of the dome, while the sludge, which is a by-product, comes

out through an opening in the side of the digester.

The animal stalls are in the front yard/backyard/porch of the household in most of the cases. The animals are allowed to graze in the free pastures of the village or in some cases fed in the stall itself. One cow produces around 10-12 kg cow dung per day. Before the establishment of the biogas plant, this cow dung used to be dried and processed into dung cakes which were then used to fuel gobar chullas or sold annually to external contractors.

FRP Floating Drum Model

FRP Portable Model

Deenabhandhu Model

Biogas is a mixture of methane and carbon dioxide. It also has traces of hydrogen sulphide (3%), ammonia, oxygen, hydrogen, water vapour etc., depending upon feed materials and other conditions. Biogas is generated by fermentation of cellulose rich organic matter under anaerobic conditions. In anaerobic conditions, the methane-producing bacteria become more active. Thus, the gas produced becomes rich in methane. The optimum utilization depends upon the successful physical installations, which in turn depend upon plant design and its selection. The basic conversion principle is that when a non-ligneous biomass is kept in a closed chamber for a few days, it ferments and produces an inflammable gas.

This is the first monitoring report for the first crediting period for the period 01/01/2013 to 31/12/2022. The operational domestic biogas units are in continuous operation after installation, with minor and major repairs as and when are reported by the PP. Since the UCR protocol for biogas systems is based on a conservative 330 days (default) a year operation, the project activity was never non-operational for a period of 35 days or more during any year of the monitoring period.

The technical specifications of the project activity are as follows:

Specification	Value
Total installed capacity	28603 m^3
Mixing Proportion	(Water: Dung) 1:1
Number of units (digesters)	11429
Feed Material	Cattle Dung
Biogas Flow rate (2 burners each 4")	0.47 m^3/hr per burner (0.9 m3/hr) Nijajuna, B. T. (2002) pg.157)
Number of Stoves (typical 2 burner)	1 per household
Unit Conversion rate MJ -> kWh	0.28
Efficiency of Burners	60.00%
Calorific Value Biogas	22.1 MJ/m^3 Source: Nijajuna, B. T. (2002): Biogas Technology. New Age International Publishers. New Delhi.
Rated Capacity (thermal) $MW_{thermal}$	31.78 MW_{th}

The individual plant consists of a mixing chamber where wastewater and cow dung are mixed, an inlet pipe to feed the slurry into the reactor, the main biogas reactor/digester where methane formation/recovery takes place, a slurry outlet pipe, an outlet chamber, and a slurry platform. The outlet pipe and tank are provided to remove the digested/treated sludge or fermentation residue and the slurry platform is provided to maintain the treated slurry in clean condition. A pipe leading from the top of the dome to the stove is provided to supply biogas to a 1-2 ring stove inside the house.

The total GHG emission reductions achieved in this monitoring period is as follows:

Summary of the Project Activity and ERs generated for the entire Monitoring Period	
Start date of this Monitoring Period	01/01/2013
Carbon credits claimed up to	31/12/2022
Total ERs generated over the Monitoring period (tCO_{2eq})	467170 tCO_{2eq}
Leakage	2458 tCO_{2eq}

The baseline scenario is thermal energy from more GHG intensive means based on the use of non-renewable biomass for domestic cooking and water heating. Thus, this project activity was a voluntary investment which replaced equivalent amount of thermal energy from renewable source, the biogas. The baseline emission boundary is site of the anaerobic digester in the case of project

activity that recovers and utilizes biogas for producing thermal energy and applies this methodology on a standalone basis, i.e., without using a Type III component of a SSC methodology.

The project proponents are not bound to incur this investment as it was not mandatory by national and sectoral policies. Thus, the continued operation of the project activity would continue to replace thermal energy from fuel wood.

The CoUs or emission reductions for small-scale biogas units are based on approved fossil fuel emission displacement rates established by the UCR Standard. These rates have taken into account the size of the biogas unit, fossil fuel displaced and size of a household.

tCO_2/yr As per UCR Biogas Protocol	**No. of Digestor**	**Capacity m^3**
3.5	4066	1
4.5	5895	3
5.3	978	4
5.5	0	5
6.6	490	6
7.7	0	7
8.8	0	8
9.9	0	9

Level of Assurance:
The verification report is based on the information collected through onsite interviews, supporting documents provided during the verification, Project Concept Note (PCN) / Monitoring Report (MR), submitted to SQAC. The verification opinion is assured provided the credibility of all above.

Verification Methodology:

Review of the following documentation was done by SQAC Verifier, Mr. Santosh Nair, who is experienced in such projects.

- Project Concept Note (PCN)
- Monitoring Report (MR)
- Commissioning details of Bio Digestors
- Data provided upon request of all the documents of the related projects

Sampling Method:

The objective of the sampling effort is to determine the mean yearly value of the following parameters with 90/10 confidence/precision during the crediting period:

- Confirmation that non-renewable biomass has been substituted.

Sample Size: The sample size was determined by using the following equation

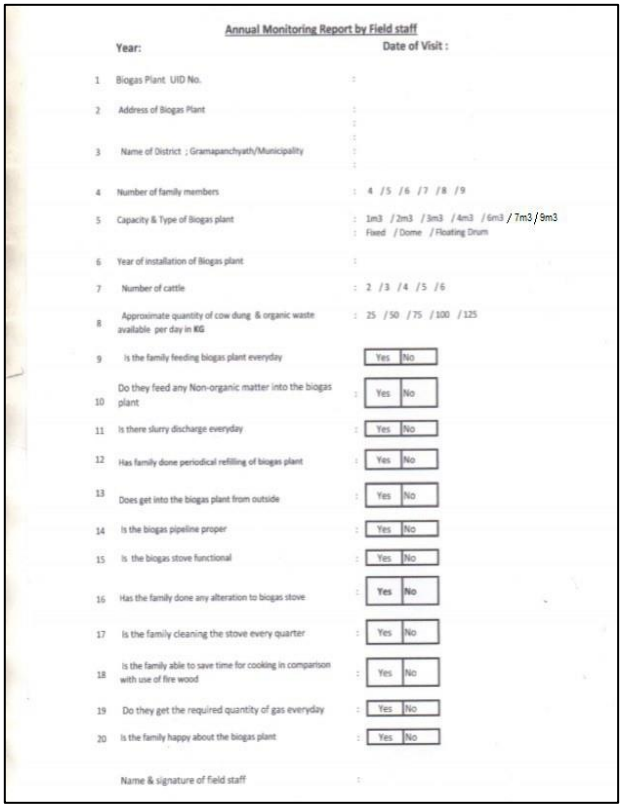
$$n \geq \frac{1.645^2 N \times p(1-p)}{(N-1)\times 0.1^2 \times p^2 + 1.645^2 p(1-P)}$$

Where:

n : Sample size
N : Total number of households (11429)
p : Expected proportion (0.75)
1.645 : Represents the 90% confidence required
0.1 : Represents the 10% relative precision

Therefore, the required sample size is at least 89.50 (approx. 90) households. This is assuming that 75% of the biogas units would be operating during the verification process. This assumption is conservative as the biogas systems within the monitoring report are all currently operational since the Project Proponent ensures that all the digesters are immediately repaired and operational. Since, the parameter of interest, i.e., confirmation that non-renewable has been replaced, will be in terms of percentage of households, there is no need to specify a variance to estimate.

SQAC conducted detailed audit of 94 Bio Digestors as samples, the list is attached below and as per the details mentioned in the format alongside.



Annual Monitoring Report by Field staff

Year: Date of Visit :

1	Biogas Plant UID No.	:
2	Address of Biogas Plant	:
3	Name of District ; Gramapanchyath/Municipality	:
4	Number of family members	: 4 /5 /6 /7 /8 /9
5	Capacity & Type of Biogas plant	: 1m3 /2m3 /3m3 /4m3 /6m3 / 7m3 / 9m3 : Fixed /Dome /Floating Drum
6	Year of installation of Biogas plant	:
7	Number of cattle	: 2 /3 /4 /5 /6
8	Approximate quantity of cow dung & organic waste available per day in KG	: 25 /50 /75 /100 /125
9	Is the family feeding biogas plant everyday	Yes / No
10	Do they feed any Non-organic matter into the biogas plant	: Yes / No
11	Is there slurry discharge everyday	: Yes / No
12	Has family done periodical refilling of biogas plant	: Yes / No
13	Does get into the biogas plant from outside	: Yes / No
14	Is the biogas pipeline proper	: Yes / No
15	Is the biogas stove functional	: Yes / No
16	Has the family done any alteration to biogas stove	: Yes / No
17	Is the family cleaning the stove every quarter	: Yes / No
18	Is the family able to save time for cooking in comparison with use of fire wood	: Yes / No
19	Do they get the required quantity of gas everyday	: Yes / No
20	Is the family happy about the biogas plant	: Yes / No

Name & signature of Field staff :

Andhyodaya Bundled Small Scale Rural Biogas Projects (Phase 1), Kerala List of Biogas Plants Audited						
SL. NO	**BIOGAS PLANT UID NUMBER**	**NAME**	**DISTRICT**	**CAPACITY**	**TYPE**	**GRAMA PANCHYATH**
1	AYA/EKM/2005/2581	Poulo Urumees	Ernakulam	$1M^3$	Drum	Ayyampuzha
2	AYA/EKM/2002/0042	Davis P V	Ernakulam	$1M^3$	Deenabandhu	Ayyampuzha
3	AYA/EKM/2002/0041	Jhony K V	Ernakulam	$1M^3$	Drum	Ayyampuzha
4	AYA/EKM/2007/3575	Francis C T	Ernakulam	$3M^3$	Deenabandhu	Karukutty
5	AYA/EKM/2002/0442	Iyobe	Ernakulam	$4M^3$	Deenabandhu	Karukutty
6	AYA/EKM/2003/0755	P K Jose	Ernakulam	$3M^3$	Deenabandhu	Karukutty
7	AYA/EKM/2006/2946	Santhosh T S,	Ernakulam	$4M^3$	Deenabandhu	Karukutty
8	AYA/EKM/2006/2884	P D Paulose	Ernakulam	$3M^3$	Deenabandhu	Karukutty
9	AYA/EKM/2002/0063	K P Govidan	Ernakulam	$4M^3$	Deenabandhu	Karukutty
10	AYA/EKM/2002/0075	Jose k s	Ernakulam	$1M^3$	Deenabandhu	Manjapra
11	AYA/EKM/2002/0168	C P Paulose	Ernakulam	$1M^3$	Drum	Manjapra
12	AYA/EKM/2006/3016	Johnson	Ernakulam	$3M^3$	Deenabandhu	Manjapra
13	AYA/EKM/2002/0045	Joji John	Ernakulam	$1M^3$	FRP Portable	Manjapra
14	AYA/EKM/2007/3663	Mother Superior	Ernakulam	$3M^3$	Deenabandhu	Manjapra
15	AYA/EKM/2004/1046	Rani Babu	Ernakulam	$1M^3$	Drum	Manjapra
16	AYA/EKM/2002/0008	Simi Devis	Ernakulam	$1M^3$	FRP Portable	Manjapra
17	AYA/EKM/2003/0490	K.V.Anthony	Ernakulam	$1M^3$	Drum	Manjapra
18	AYA/EKM/2004/0988	A.V.Eldo	Ernakulam	$1M^3$	Drum	Manjapra
19	AYA/EKM/2004/1516	Rafi M J	Ernakulam	$1M^3$	Drum	Manjapra
20	AYA/EKM/2005/1877	Babu K V	Ernakulam	$1M^3$	Drum	Ayyampuzha
21	AYA/EKM/2005/2407	Joy	Ernakulam	$3M^3$	Deenabandhu	Ayyampuzha

22	AYA/EKM/2002/0159	Joisy pappachan	Ernakulam	$1M^3$	Deenabandhu	Manjapra
23	AYA/EKM/2005/2607	Pradeep	Ernakulam	$4M^3$	Deenabandhu	Manjapra
24	AYA/EKM/2003/0682	Saju C T	Ernakulam	$3M^3$	Deenabandhu	Karukutty
25	AYA/TSR/2007/0752	Joy A. V	Thrissur	$3M^3$	Deenabandhu	Aloor
26	AYA/TSR/2004/0421	Jhonson P L	Thrissur	$3M^3$	Deenabandhu	Aloor
27	AYA/TSR/2005/0473	M.D.Thomas	Thrissur	$1M^3$	Drum	Aloor
28	AYA/TSR/2006/0556	M A Sreedaran	Thrissur	$3M^3$	Deenabandhu	Aloor
29	AYA/TSR/2007/0751	K T Antony	Thrissur	$3M^3$	Deenabandhu	Annamanada
30	AYA/TSR/2007/0639	Davis P T	Thrissur	$3M^3$	Deenabandhu	Annamanada
31	AYA/TSR/2007/0710	Mother Superior	Thrissur	$4M^3$	Deenabandhu	Chalakudy
32	AYA/TSR/2006/0602	T.K Joseph	Thrissur	$3M^3$	Deenabandhu	Chalakudy
33	AYA/TSR/2002/0025	George K. T	Thrissur	$3M^3$	Deenabandhu	Kodakara
34	AYA/TSR/2006/0535	Latheef C A,	Thrissur	$6M^3$	Deenabandhu	Kodakara
35	AYA/TSR/2007/0692	Paulose M.C	Thrissur	$1M^3$	Drum	Koratty
36	AYA/TSR/2007/0740	Gracy Robin	Thrissur	$1M^3$	Drum	Koratty
37	AYA/TSR/2007/0674	V.T George	Thrissur	$1M^3$	Drum	Koratty
38	AYA/TSR/2006/0562	Shaija.Vilson	Thrissur	$1M^3$	Drum	Koratty
39	AYA/TSR/2004/0364	Joy Varghese	Thrissur	$3M^3$	Deenabandhu	Koratty
40	AYA/TSR/2005/0458	K.K.Asokan	Thrissur	$1M^3$	Drum	Koratty
41	AYA/TSR/2007/0709	K.T Gopinadhan	Thrissur	$3M^3$	Deenabandhu	Mala
42	AYA/TSR/2004/0322	Jinto George	Thrissur	$3M^3$	Deenabandhu	Mala

43	AYA/TSR/2004/0347	Prasad M S	Thrissur	$3M^3$	Deenabandhu	Meloor
44	AYA/EKM/2004/1119	Usha.K.Nair	Ernakulam	$1M^3$	Drum	Koovapady
45	AYA/EKM/2004/1809	A.G.Vijayan	Ernakulam	$1M^3$	Drum	Koovapady
46	AYA/EKM/2005/2377	Omana.Gopalan	Ernakulam	$1M^3$	Drum	Koovapady
47	AYA/EKM/2005/2378	Lalitha.Mohanan	Ernakulam	$1M^3$	Drum	Koovapady
48	AYA/EKM/2005/2661	Sibi Baby	Ernakulam	$1M^3$	Drum	Koovapady
49	AYA/EKM/2005/2662	Eldo Varghese	Ernakulam	$1M^3$	Drum	Koovapady
50	AYA/EKM/2006/2871	N Somasekaran Nair	Ernakulam	$1M^3$	Drum	Koovapady
51	AYA/EKM/2006/2872	Krishnapillai N	Ernakulam	$1M^3$	Drum	Koovapady
52	AYA/EKM/2004/1426	Benny.C.J	Ernakulam	$1M^3$	Drum	Koovapady
53	AYA/EKM/2003/0613	M Gopalakrishnan Nair	Ernakulam	$3M^3$	Deenabandhu	Koovapady
54	AYA/EKM/2005/2563	M.K.Eldose	Ernakulam	$1M^3$	Drum	Koovapady
55	AYA/IDK/2002/1207	Jinu Joseph	Idukki	$6M^3$	Deenabandhu	Kanjikuzhi
56	AYA/IDK/2002/2134	Bijumon Joseph	Idukki	$6M^3$	Deenabandhu	Kanjikuzhi
57	AYA/IDK/2004/4607	Saji Mathew	Idukki	$3M^3$	Deenabandhu	Mariyapuram
58	AYA/IDK/2005/5652	Fr.James Thomas	Idukki	$6M^3$	Deenabandhu	Mariyapuram
59	AYA/IDK/2005/6566	Sr. Elcy Mother Superior	Idukki	$4M^3$	Deenabandhu	Mariyapuram

60	AYA/IDK/2006/6738	Fr. Tomy Philip	Idukki	$6M^3$	Deenabandhu	Mariyapuram
61	AYA/IDK/2005/6327	George Vargese	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
62	AYA/IDK/2005/6326	Varghese.Varghese	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
63	AYA/IDK/2007/7380	Tomy.Joseph	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
64	AYA/IDK/2004/4746	Valsa Thankachan	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
65	AYA/IDK/2004/5294	Subash P S	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
66	AYA/IDK/2004/4843	Shiny Thankachan	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
67	AYA/IDK/2004/5192	Shibu k s	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
68	AYA/IDK/2005/5609	Babu P K	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
69	AYA/IDK/2002/0955	Sherly Saji	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
70	AYA/IDK/2002/0484	Shibu Sebastian	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
71	AYA/IDK/2002/0608	Sherly Sibi	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
72	AYA/IDK/2006/6754	Cibil E P	Idukki	$4M^3$	Deenabandhu	Vathikkuddy
73	AYA/IDK/2003/2377	Mathew C T	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
74	AYA/IDK/2003/2422	Benny Jose	Idukki	$4M^3$	Deenabandhu	Vathikkuddy
75	AYA/IDK/2003/2734	Mother Superior	Idukki	$3M^3$	Deenabandhu	Erattayar
76	AYA/IDK/2002/0232	Salu.Scaria	Idukki	$3M^3$	Deenabandhu	Erattayar
77	AYA/IDK/2006/6718	Santhosh T.C	Idukki	$3M^3$	Deenabandhu	Erattayar
78	AYA/IDK/2002/0594	Philipose	Idukki	$3M^3$	Deenabandhu	Erattayar

79	AYA/IDK/2002/1149	Joseph	Idukki	$3M^3$	Deenabandhu	Erattayar
80	AYA/IDK/2007/7831	Johny Thomas	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
81	AYA/IDK/2007/7837	Moncy Mol V. J	Idukki	$6M^3$	Deenabandhu	Vathikkuddy
82	AYA/IDK/2003/3508	Mathew K V	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
83	AYA/IDK/2007/7836	Soly Tomy	Idukki	$4M^3$	Deenabandhu	Vathikkuddy
84	AYA/IDK/2007/7518	Rector Mar Epream Minor Seminary	Idukki	$4M^3$	Deenabandhu	Vazhathopp
85	AYA/IDK/2003/2300	Mar Epream Minor Seminary Farm	Idukki	$3M^3$	Deenabandhu	Vazhathopp
86	AYA/IDK/2007/7499	Joli Siby	Idukki	$6M^3$	Deenabandhu	Vazhathopp
87	AYA/IDK/2007/7377	Reji Philipp	Idukki	$4M^3$	Deenabandhu	Vazhathopp
88	AYA/IDK/2002/0479	Thomas Chacko	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
89	AYA/IDK/2003/2442	Sobichan Thomas	Idukki	$3M^3$	Deenabandhu	Vathikkuddy
90	AYA/IDK/2006/6626	Mathew Kurian	Idukki	3M3	Deenabandhu	Kamakshi
91	AYA/IDK/2002/1886	Sunoj Joseph	Idukki	$3M^3$	Deenabandhu	Erattayar
92	AYA/EKM/2005/1832	Chanchu Vipin	Ernakulam	$1M^3$	FRP Portable	Angamaly
93	AYA/EKM/2002/0283	Jose T M	Ernakulam	$3M^3$	Deenabandhu	Koovapady
94	AYA/EKM/2002/0185	Purushothaman M. S	Ernakulam	$3M^3$	Deenabandhu	Koovapady

Applied methodologies and standardized baselines:

SECTORAL SCOPE - 01 Energy industries (Renewable/Non-renewable sources)

TYPE I - Renewable Energy Projects

CATEGORY - AMS. I.E. Switch from Non-Renewable Biomass for Thermal Applications by the User (Ver.12.0)

This methodology comprises of activities to displace the use of non-renewable biomass by introducing renewable energy technologies to households, communities, and/or institutions such as schools, prisons or hospitals (hereinafter referred as end users). Examples of these technologies include but are not limited to: Biogas stoves.

Total Biogas Units in the 1st monitoring period: 11,429 individual units.

Capacity (m^3)	1	3	4	6
E (MJ/day)	13.26	39.78	53.04	79.56
E(kwh/d)	3.7128	11.1384	14.8512	22.2768
Thermal capacity kw @0.9/m^3 flow rate	1.111111	3.333333	4.444444	6.666667
Installed (kw) thermal capacity	4517.778	19650	4346.667	3266.667

Applicability of methodologies and standardized baselines

- The project activity is biogas cook stove for households and provides thermal energy from cattle dung that is renewable. It replaced the baseline technology mud/clay, three-stone traditional cook stove that used non-renewable biomass at the household level. The biogas produced is also used for captive power generation. All biogas units distinct from each other.

- Biogas produced by the digesters are used. The project involves the installation of bio digester and biogas stoves that replace the use of traditional stoves fuelled by non-renewable biomass. Hence the project fulfils the applicability criteria of AMS I.E.

- The annual average temperature of the biogas site is located is higher than 5°C
- The storage time of the manure after removal from the animal barns, including transportation, does not exceed 45 days before being fed into the digesters.
- The storage time of the manure after removal from the animal barns, including transportation, does not exceed 45 days before being fed into the digesters.
- The residual waste from the animal manure management system is handled aerobically.
- The communities across India are using non-renewable biomass since 31st December 1989. This is based on using published literature, official reports and statistics.
- The project activity does not use renewable biomass. The renewable source is cattle dung.
- The project activity is biogas cook stove and is not electric cook stoves.
- There is a technology switch from traditional stove to biogas stove.
- This is a small-scale project with total thermal capacity of 31.78 MWth which is not greater than the small scale thresholds defined by the applied methodology I.E. the limit of 45 MWth is the installed/rated capacity of the thermal application equipment or device/s (e.g. biogas stoves)".

Applicability of double counting emission reductions

Each of the biogas unit is constructed by the project participant close to the household. The details of the end user are provided in the emission report in the below sample format. The UID Number is unique for all the digesters in the project activity. The project participants have not applied for carbon credits under any other GHG program.

Sl. No.	UID Number	Date of installation	Head of the Family	Address	District	Family Members	Capacity	Type	No. of owned Cattle	Grama Panchayat
1	AYA/MLP/2002/0010	02-02-2002	Cheriyan	Padavil(H),Edivanna P.O 679329	Malappuram	6	6m3	Drum	10	Chaliyar
2	AYA/MLP/2002/0016	21-02-2002	Panghajaskhi	Cheriyamackal(h)Kuttamballekodu(po) 679354	Malappuram	5	1m3	Deenabandhu	2	Pothukall
3	AYA/MLP/2002/0018	23-02-2002	George Thomas	Chengalath (H),Uppada P.O 679354	Malappuram	6	6m3	Dheenabhandhu	5	Pothukallu
4	AYA/MLP/2002/0020	28-02-2002	Mammukutty M	Mancheriyil(H)Pookottumpadam P.O 679332	Malappuram	4	3m3	Dheenabhandhu	6	Amarambalam
5	AYA/MLP/2002/0021	03-03-2002	K V Thomas	Kazhuthuveettil(H),Edivanna P.O 679329	Malappuram	4	6m3	Drum	3	Chaliyar
6	AYA/MLP/2002/0025	10-03-2002	K.V.Thomas	Kodavanal(h)Munderi(po) 679354	Malappuram	5	1m3	Deenabandhu	3	Pothukall
7	AYA/MLP/2002/0026	10-03-2002	P M Chacko	Pedikattukunnel,Kakkadampoyyil P O 673604	Malappuram	3	1m3	Drum	2	Urangattari
8	AYA/MLP/2002/0032	03-04-2002	Joy George	Thattambil(h)Edivannam(po) 679329	Malappuram	6	1m3	Deenabandhu	2	Chaliyar


UID No.
MWEKM/2002/00675


UID No.


UIDNo.
AYA/TSR/2006/0562

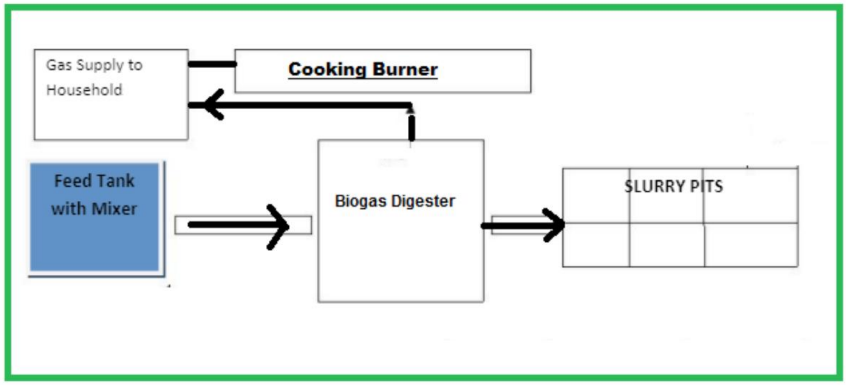

UIDNo.
AYA/TSR/2007/0639

Project boundary, sources and greenhouse gases (GHGs)

The project boundary includes the physical, geographical site(s) of:

- Biogas digesters.
- Households using biogas for heating and cooking

Project Boundary



	Source	GHG	Included?	Justification/Explanation
Baseline	Emissions from burning non-renewable wood	CO_2	**Included**	Major source of emission
		CH_4	Excluded	Excluded for simplification. This is conservative
	Emissions from animal manure stored on site	N_2O	Excluded	Excluded for simplification. This is conservative
Project Activity	Emissions from residue from anaerobic digester	CO_2	Excluded	Heat is generated from collected biogas, hence these emissions are not accounted for. CO_2 emissions from the decomposition of organic waste are not accounted
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative

Leakage Emissions is not applicable as the project cook stove is not switching to charcoal or processed renewable biomass.

Leakage related to the non-renewable woody biomass saved by the project activity: The following potential source of leakage shall be considered:

(a) The use/diversion of non-renewable woody biomass saved under the project activity by non project households/users that previously used renewable energy sources. If this leakage assessment quantifies an increase in the use of non-renewable woody biomass used by the non-project households/users, that is attributable to the project activity, then BEy is adjusted to account for the quantified leakage.

(b) Alternatively, BEy is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.

There is no transfer of equipment, being currently utilized transferred, from outside the project boundary to the project boundary. All the biogas units are constructed at the site. Thus leakage from equipment transfer need not be monitored.

Option (b) is selected wherein, "BEy is multiplied by a net to gross adjustment factor of 0.95 to account for leakages", and hence in this case, surveys of non-renewable woody biomass used by the non-project households/users will not be required.

Establishment and description of baseline scenario (UCR Protocol)

The baseline scenario is thermal energy from more GHG intensive means based on the use of non-renewable biomass for domestic cooking and water heating. Thus, this project activity was a voluntary investment which replaced equivalent amount of thermal energy from renewable source, the biogas. The baseline emission boundary is site of the anaerobic digester in the case of project activity that recovers and utilizes biogas for producing thermal energy and applies this methodology on a standalone basis, i.e., without using a Type III component of a SSC methodology.

According to the UCR project standard for such project activities, CoUs or carbon credits for small scale biogas units are based on approved fossil fuel emission displacement rates established worldwide. These rates have taken into account the size of the biogas unit, fossil fuel displaced and size of a household.

1-2 cubic meter	3 cubic meter	4 cubic meter	5 cubic meter	>5 cubic meter
3.5 CoUs/year	4.5 CoUs/year	5.3 CoUs/year	5.5 CoUs/year	Biogas units that have a capacity above 5 cubic meters that follow this UCR Protocol will be credited at the 5 cubic meters rate

BEy is determined by taking the following option: (a) Calculated as the product of the number of appliances multiplied by the estimate of average annual consumption of woody biomass per appliance (tonnes/year). Baseline emissions are derived as follows:

Calculated Annual Baseline Emission Reductions: $BE_y = HG_{ythermal} \times EF_{FF, CO2}$

BEy = Emission reductions from the use of non-renewable biomass as per the UCR protocol in a year y.

where:

$HG_{y, thermal}$ = Total thermal capacity of the number of digesters in year y

$EF_{FF, CO2}$ = 5.5 CoUs/year -CO2 emission factor of the fossil fuel displaced in the baseline as determined by the UCR Standard for $5m^3$. CO_2 emission factors for $3m^3$ and $4m^3$ are used at 4.5 CoUs/year and 5.3 CoUs/year respectively as indicated in the UCR Standard. CO2 emission factors for $6m^3$, $7m^3$, $8m^3$ and $9m^3$ are as follows:

Baseline Emissions tCO_2/yr As per UCR Biogas Protocol	**Capacity m^3**
3.5	1
4.5	3
5.3	4
5.5	5
6.6	6
7.7	7
8.8	8
9.9	9

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Baseline Emissions (tCO2eq)	49175.9	49175.9	49175.9	49175.9	49175.9	49175.9	49175.9	49175.9	49175.9	49175.9
Leakage (tCO2eq)	2458.8	2458.8	2458.8	2458.8	2458.8	2458.8	2458.8	2458.8	2458.8	2458.8
Emission Reductions (tCO2eq)	46717	46717	46717	46717	46717	46717	46717	46717	46717	46717
								Total ER_y		**467170**

NCV_{CH4} = NCV of methane (MJ/Nm^3) (default value: 35.9 MJ/Nm^3)
$NCV_{biomass}$ = Net calorific value of the non-renewable biomass as per UCR Standard (0.015 TJ/tonne)

There is no transfer of equipment being currently utilized transferred from outside the project boundary to the project boundary. All the biogas units are constructed at site. Thus leakage from equipment transfer is not monitored.

Total emission reductions (ER_y) = 4,67,170 CoUs (4,67,170 tCO_{2eq})

Monitoring period number and duration

First Issuance Period: 10 years, 0 months – 01/01/2013 to 31/12/2022

Conclusions:

Based on the audit conducted on the basis of UCR Biogas Protocol Standard Baseline which draws reference from AMS.I.E. Switch from non-renewable biomass for thermal applications by the user, the onsite audit and documents submitted during the verification including the data, Project Concept Note (PCN) / Monitoring Report (MR), SQAC is able to certify that the emission reductions from the project - Andhyodaya Bundled Small Scale Rural Biogas Projects (Phase 1), Kerala, UCR ID-281, for the period 1st January 2013 till 31st December 2022 amounts to 4,67,170 **CoUs (**4,67,170 **tCO_{2eq})**

S.QAC Certification Pvt. Ltd. Mapusa-Goa

Santosh Nair
Lead Verifier (Signature)

Praful Shinganapurkar
Senior Internal Reviewer
(Signature)

Date: 27/04/2023