

Gold standard for the global goals
Monitoring report



June 2017, version 1

Title of the project	Nepal Biogas Support Program-PoA Nepal Biogas Support Program- CPA 1: 20,000 digesters Nepal Biogas Support Program - CPA 2: 19,927 digesters Nepal Biogas Support Program - CPA 3: 19,959 digesters Nepal Biogas Support Program - CPA 4: 19,970 digesters Nepal Biogas Support Program - CPA 5: 19,842 digesters Nepal Biogas Support Program - CPA 6: 18,504 digesters Nepal Biogas Support Program - CPA 7: 18,392 digesters Nepal Biogas Support Program - CPA 8: 19,445 digesters Nepal Biogas Support Program – CPA 9: 17,304 digesters
Gold Standard project id	Nepal Biogas Support Program-PoA (GS 3110) Nepal Biogas Support Program- CPA 1: 20,000 digesters (GS 3109) Nepal Biogas Support Program - CPA 2: 19,927 digesters (GS 3113) Nepal Biogas Support Program - CPA 3: 19,959 digesters (GS 3114) Nepal Biogas Support Program - CPA 4: 19,970 digesters (GS 3116) Nepal Biogas Support Program - CPA 5: 19,842 digesters (GS 3566) Nepal Biogas Support Program - CPA 6: 18,504 digesters (GS 6393) Nepal Biogas Support Program - CPA 7: 18,392 digesters (GS 6394) Nepal Biogas Support Program - CPA 8: 19,445 digesters (GS 7508) Nepal Biogas Support Program – CPA 9: 17,304 digesters (GS 7509)
Version number of the monitoring report	04
Completion date of the monitoring report	25/06/2020
Date of project design certification	Nepal Biogas Support Program-PoA (14/08/2015) CPA-1 (14/08/2015); CPA 2 (14/08/2015); CPA-3 (14/08/2015); CPA- 4 (14/08/2015); CPA-5 (24/12/2018); CPA-6 (24/12/2018); CPA-7 (24/12/2018), CPA-8 (23/09/2019), CPA-9 (15/05/2019) Transition to GS4GG (01/08/2018)
Start date of crediting period	Nepal Biogas Support Program-PoA (14/08/2013) CPA-1 (14/08/2013); CPA-2 (08/05/2014); CPA-3 (08/05/2014); CPA-4 (08/05/2014); CPA-5 (24/12/2016); CPA-6 (24/12/2016); CPA- 7 (24/12/2016), CPA-8 (23/09/2017), CPA-9 (23/09/2017)
Duration of this monitoring period	Regular verification (CPA-1 to CPA-9): 01/08/2018 to 30/01/2020 Retroactive labelling (CPA-8): 23/09/2017 to 31/7/2018
Duration of previous monitoring period	CPA 1 to CPA-7: 01/08/2017 to 31/07/2018 CPA-8: 23/09/2017 to 31/07/2018 CPA-8 (Retroactive labelling): N/A CPA-9: N/A
Project representative(s)	Alternative Energy Promotion Centre
Host Country	Nepal
Certification pathway (activity certification/impact certification)	Impact Statements and Products
SDG Contributions targeted (as per approved PDD)	SDG 3: Good Health and Well Being (SDG Targets: 3.9.1, 3.9.2, 3.9.3) SDG 7: Affordable and Clean Energy (SDG Target: 7.1.2) SDG 13: Climate Action (SDG Target: 13.3.2)
Gold Standard statement/product certification sought (GSVER/ADALYs/RECs etc.)	GS CER
Selected methodology(ies)	AMS.I.E. Switch from Non-Renewable Biomass for Thermal Applications by the User (version 04)

Estimated amount of annual average certified SDG impact (as per approved PDD)	SDG 13: For regular verification CPA-1: 61,889 tCO₂eq CPA-2: 66,236 tCO₂eq CPA-3: 66,329 tCO₂eq CPA-4: 66,397 tCO₂eq CPA-5: 65,883 tCO₂eq CPA-6: 61,565 tCO₂eq CPA-7: 61,191 tCO₂eq CPA-8: 64,565 tCO₂eq CPA-9: 57,134 tCO₂eq Fore Retroactive labelling (CPA-8): 64,565 tCO₂eq SDG 3: 1) 100% users percept the reduction in indoor air pollution 2) 100% users percept the reduction in different health problem 3) 100% users perceived the time saving for cooking for women due to biogas that reduce the exposure to indoor air pollution 4) 100% increase in use of bio-slurry and reduction in chemical fertilizers 5) 100 % connection of toilets with biogas SDG 7: 1) 100% users with primary reliance on clean fuels and technologies 2) 100% households perceived the time saving for firewood collection of women due to biogas (increasing the access to clean fuel) 3) 0 masons get training to promote biogas plants
Total amount of certified SDG impact (as per approved methodology) achieved in this monitoring period	SDG 13: For regular verification: CPA-1: 78,727 tCO₂eq CPA-2: 91,458 tCO₂eq CPA-3: 83,252 tCO₂eq CPA-4: 89,017 tCO₂eq CPA-5: 96,838 tCO₂eq CPA-6: 76,302 tCO₂eq CPA-7: 78,186 tCO₂eq CPA-8: 91,162 tCO₂eq CPA-9: 40,943 tCO₂eq Fore Retroactive labelling (CPA-8): 42,350 tCO₂eq Total: 768,235 tCO₂eq SDG 3: 1) 96.72% for CPA-8 to 100% users for CPA-7 percept the reduction in indoor air pollution 2) 70% to 99.18% perceived the reduction in different health problem for different CPAs 3) 93.20% to 100% people perceived the time saving for cooking for women for different CPAs 4) 100% increase in use of bio-slurry and reduction in other chemical fertilizers in all CPAs. 5) 71.17% to 99% toilet connection in different CPAs SDG 7: 1) 73.57% to 95.55% users with primary reliance on clean fuels and technologies (Biogas) 2) 92.45% to 100% households perceived the time saving for firewood collection of women due to biogas (increasing the access to clean fuel) for different CPAs 3) 75 Masons got training to promote biogas plants.

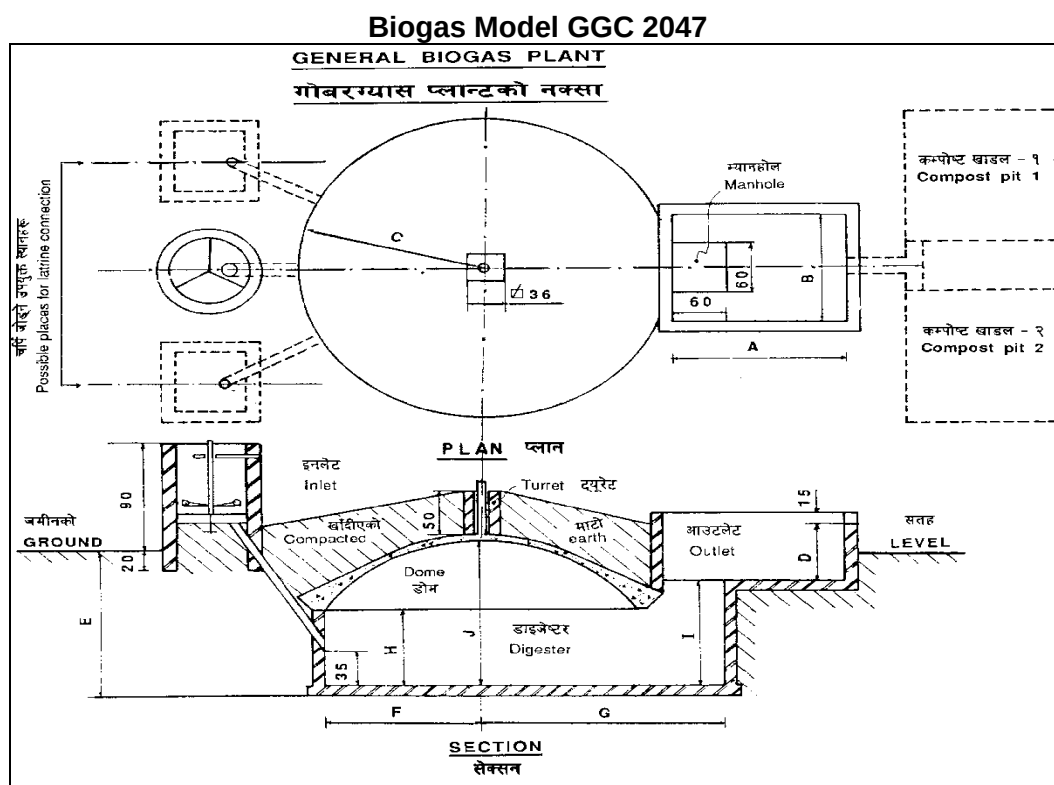
SECTION A. **Description of project**

A.1. Purpose and general description of project

The Biogas Support Program (BSP) aims at implementing household biogas applications. These applications displace firewood and fossil fuels with biogas from animal waste and human excreta. The biogas is used as a fuel for cooking, therefore the displacement of non renewable biomass (NRB) is counted as emission reduction under the Clean Development Mechanism (CDM) and Gold Standard (GS). Target group under the BSP are households with at least one head of cattle (generally cows or buffalos) who currently use non-renewable biomass (firewood) for cooking purpose. The baseline of the PoA considers only non-renewable biomass replaced through household biogas applications. Only households previously using non-renewable biomass are eligible to the PoA.

The technologies used in this PoA are household biogas digesters with a sludge and gas holding capacity range of up to 10 m³. The different sizes of the digesters that would be included in the programme would be of 2, 4, 6, 8 and 10 m³. The programme uses only one design i.e. GGC 2047 model. The biogas digesters are based on a uniform technical design and are manufactured and installed following established technical standards in Nepal. The digester itself is a closed underground container made of concrete or other materials.

Nepal Biogas Support Program-PoA was registered on 31st January 2013 in UNFCCC as CDM PoA. Until now 9 CPAs are already included in the PoA. The UNFCCC reference number of the PoA is 9572. The PoA and corresponding first 4 CPAs are retroactively registered in Gold Standard on 14/08/2015. The PoA is transited to GS4GG on 1st August 2018. Other 5 consecutive CPAs are also included in GS. The first crediting renewable period of the PoA is 31st January 2013 to 30th January 2020. The PoA start date is 22nd June 2007 which belongs to the first date of biogas construction under the PoA. Figure below shows the schematic diagram of the technology implemented under the PoA.



Biogas plants constructed under this PoA comprise of three major components; the inlet, the digester and the outlet, aligned in a straight line. All these structures are prepared of masonry walls of bricks or stones,

depending upon the material availability. Digester unit is a underground chamber where the mixture of animal dung and water is fed into where the microbial activity takes place. The microbes act upon the dung (the substrate) under anaerobic conditions to release methane and carbon dioxide. The methane released from the digester is collected at the dome which is connected to gas hose pipe fitted at turret at the center of the dome. Biogas collected at the dome dispensed to biogas stove through this gas hose pipe via turret. Once the gas pressure is sufficient in dome, it exerts pressure to the slurry in the digester and slurry is released from the outlet.

A.2. Location of project

All the specific case CPAs are implemented across Nepal in different districts. The geographical coordinates of Nepal are:

Latitude – North 26.20 degree to North 30.45 degree

Longitude – East 80.07 degree to East 88.20 degree

The table below provides the overview of the biogas digesters implemented under different CPAs in different districts of Nepal.

SN	Districts	CPA-1	CPA-2	CPA-3	CPA-4	CPA-5	CPA-6	CPA-7	CPA-8	CPA-9
1.	Achham	2	4	0	0	0	0	0	3	0
2.	Arghakhanchi	78	26	30	21	7	15	25	34	49
3.	Baglung	38	46	62	52	35	15	62	32	59
4.	Baitadi	8	1	0	0	2	3	3	0	12
5.	Bajhang	12	36	33	10	148	0	0	0	14
6.	Bajura	2	1	0	0	0	0	0	3	0
7.	Banke	374	489	361	412	434	520	403	514	268
8.	Bara	416	382	356	310	458	338	299	426	291
9.	Bardiya	498	510	599	804	900	1099	875	735	732
10.	Bhaktapur	64	89	67	4	14	11	12	15	12
11.	Bhojpur	0	7	27	18	9	0	1	4	0
12.	Chitwan	1114	1042	935	844	870	889	690	584	301
13.	Dadeldhura	18	1	0	1	15	4	0	1	59
14.	Dailekh	15	24	12	0	0	0	3	9	3
15.	Dang	345	801	751	1230	1327	827	548	494	570
16.	Darchula	45	11	21	0	18	14	9	60	54
17.	Dhading	581	720	876	852	631	558	701	463	626
18.	Dhankuta	7	53	78	25	17	10	91	60	14
19.	Dhanusa	51	26	31	17	33	44	38	98	229
20.	Dolakha	126	112	170	230	76	128	90	62	220
21.	Dolpa	0	4	0	0	0	0	0	0	0
22.	Doti	0	4	1	31	25	0	3	4	6
23.	Gorkha	451	434	376	410	347	338	616	309	850
24.	Gulmi	55	87	61	55	37	19	43	30	19
25.	Humla	0	1	0	1	0	0	0	0	0
26.	Ilam	461 ¹	624	468	559	373	287	934	487	197
27.	Jajarkot	1	0	0	6	6	0	0	37	0
28.	Jhapa	2770	2391	1369	874	925	666	1027	963	684

¹ The digester DGG00471 (Khagendra Kumar Khadka) of CPA-1 in Ilam district, was found to be abandoned during the DoE verification field visit for Monitoring period no: 05, this has not been accounted for accounted for in the ER calculations.

SN	Districts	CPA-1	CPA-2	CPA-3	CPA-4	CPA-5	CPA-6	CPA-7	CPA-8	CPA-9
29.	Jumla	2	2	1	1	0	0	0	0	0
30.	Kailali	730	1011	1080	1571	1630	3119	2172	2738	1367
31.	Kalikot	24	25	11	8	15	9	17	46	24
32.	Kanchanpur	757	776	746	808	914	1523	766	1140	1056
33.	Kapilbastu	333	211	401	353	263	86	239	298	261
34.	Kaski	1051	769	899	773	594	225	384	610	768
35.	Kathmandu	87	40	17	36	16	10	35	20	24
36.	Kavre	506	393	677	575	478	434	480	299	483
37.	Khotang	5	6	7	20	5	9	8	2	8
38.	Lalitpur	192	125	92	141	109	81	72	28	85
39.	Lamjung	673	537	582	620	409	255	281	594	588
40.	Mahottari	82	87	87	92	138	147	180	343	109
41.	Makwanpur	788	1739	2363	1860	2652	1944	835	1019	1042
42.	Morang	1078	827	562	447	547	308	552	566	703
43.	Mugu	0	2	2	4	0	0	0	0	0
44.	Mustang	7	4	1	2	0	0	0	0	0
45.	Myagdi	41	36	85	67	33	14	12	52	7
46.	Nawalparasi	746	614	649	477	432	287	350	315	363
47.	Nuwakot	188	194	64	375	277	395	470	153	260
48.	Okhaldhunga	8	2	0	18	44	37	46	29	67
49.	Palpa	457	380	392	402	401	358	256	466	326
50.	Panchthar	108	64	78	33	36	61	90	49	37
51.	Parbat	24	33	25	18	9	8	19	34	29
52.	Parsa	106	62	25	51	72	144	59	170	63
53.	Pyuthan	47	53	79	119	80	31	137	180	63
54.	Ramechhap	116	66	66	77	181	41	29	63	200
55.	Rasuwa	0	52	46	69	112	133	65	10	38
56.	Rautahat	169	164	124	123	160	270	225	224	160
57.	Rolpa	0	0	15	20	6	5	30	37	85
58.	Rukum	0	4	10	0	5	0	0	0	0
59.	Rupandehi	587	358	419	237	287	61	278	235	146
60.	Salyan	15	24	28	28	2	12	22	8	78
61.	Sankhuwasabha	4	32	42	27	28	26	30	72	20
62.	Saptari	9	13	17	14	16	8	84	154	166
63.	Sarlahi	295	308	309	299	365	320	290	423	270
64.	Sindhuli	581	584	502	527	443	1055	1213	1455	644
65.	Sindhupalchowk	100	54	186	145	126	293	220	186	102
66.	Siraha	37	34	66	31	42	22	11	126	113
67.	Solukhumbu	3	13	23	27	5	5	0	0	48
68.	Sunsari	458	240	157	133	131	57	157	134	137
69.	Surkhet	139	216	185	234	210	116	153	199	504
70.	Syangja	580	453	513	497	433	289	403	452	581
71.	Tanahu	1125	1135	1321	1575	1117	198	384	424	639
72.	Taplejung	4	0	3	16	5	16	4	27	65
73.	Terhathum	15	31	51	45	30	2	22	95	2
74.	Udayapur	191	228	267	209	277	305	839	543	0
	Total	20000	19927	19959	19970	19842	18504	18392	19445	17304

A.3. Reference of applied methodology

AMS.I.E. Switch from Non-Renewable Biomass for Thermal Applications by the User (version 04)

A.4. Crediting period of project

CPAs/ VPAs	CDM Registration Number	CDM Registration/ Inclusion date	GS Registratio n Number	GS inclusion Date	GS Crediting Period start date and type
CPA-1	9572-0001	31/01/2013	3109	14/08/2015	14/08/2013(Renewal)
CPA-2	9572-0002	08/05/2014	3113	14/08/2015	08/05/2014(Renewal)
CPA-3	9572-0003	08/05/2014	3114	14/08/2015	08/05/2014(Renewal)
CPA-4	9572-0004	08/05/2014	3116	14/08/2015	08/05/2014(Renewal)
CPA-5	9572-0005	25/08/2014	3566	24/12/2018	24/12/2016(Renewal)
CPA-6	9572-0006	08/07/2015	6393	24/12/2018	24/12/2016(Renewal)
CPA-7	9572-0007	08/07/2015	6394	24/12/2018	24/12/2016(Renewal)
CPA-8	9572-0008	15/02/2017	7508	23/09/2019	23/09/2017 (Renewal)
CPA-9	9572-0009	15/05/2019	7509	23/09/2019	15/05/2019 (Renewal)

SECTION B. Implementation of project

B.1. Description of implemented project

This monitoring report presents the details of 9 CPAs (CPA#1 to CPA#9) proposed for verification in this monitoring period. All the digesters included in these CPAs are the household biogas digesters based on the anaerobic digestion technologies. The CPAs have the digesters installed with capacity ranging from 2 m³ to 10 m³.

Before this monitoring period, 5 periodic verifications are completed already. The VPA wise monitoring and verification and the corresponding monitoring numbers are given in table below:

CPA number	GS labelling of CERs (Number)						Total GS labelling completed
	MP-1	MP-2	MP-3	MP-4	MP-5	MP-6	
CPA-1	61789	65725	59679	49928	62122	Ongoing	299243
CPA-2	14992	63426	62812	55115	57023	Ongoing	253368
CPA-3	14465	62105	55716	55112	55909	Ongoing	243307
CPA-4	15235	61126	56674	58433	50986	Ongoing	242454
CPA-5	N/A	N/A	N/A	37361	48099	Ongoing	85460
CPA-6	N/A	N/A	N/A	31711	46885	Ongoing	78596
CPA-7	N/A	N/A	N/A	34788	47330	Ongoing	82118
CPA-8	N/A	N/A	N/A	N/A	Ongoing	Ongoing	0
CPA-9	N/A	N/A	N/A	N/A	N/A	Ongoing	0
Total	106481	252382	234881	322448	368354	Ongoing	1284546

Based on the table above, until now PoA is undergone GS verification and monitoring for the monitoring period 5 (MP-5) and now verification is ongoing for monitoring period number 6. However, the monitoring period for different CPAs are different. CPA-1, CPA-2, CPA-3 and CPA-4 completed its monitoring period number 5 and current verification is for the monitoring period number 6. For CPA-5, CPA-6 and CPA-7, monitoring period number 1 (MP-1) and monitoring period number 2 (MP-2) are completed and the current verification is for monitoring period 3 for those CPAs. For CPA-8, current verification and labelling covers the monitoring period 1 (MP-1) and monitoring period number 2 (MP-2). For CPA-9, this verification is for monitoring period 1 (MP-1) for that particular CPAs. Until now, 1,284,546 CERs are GS labelled for this PoA.

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All the biogas digesters implemented under different CPAs of the PoA are maintained by AEPC. AEPC maintains the record of installed biogas digesters. Each biogas installed under different CPAs is identified with its unique dome gas pipe number and hence the uniqueness of the identity is maintained for each digester. Since all the digesters implemented under all CPAs of the PoA are centrally maintained, possibility of the double counting of the digesters between and within CPAs is avoided.

CPA-1:

This CDM Program Activity (CPA) is part of the Nepal Biogas Support Program-Programme of Activity (PoA). This CPA includes 20,000 digesters which were implemented between 22/06/2007 and 18/03/2009. The table below provides the overview of digesters implemented under CPA-1.

Size \ Region	Terai	Hill	Mountain Remote Hill or	Total
4 m ³	416	2,690	5	3,111
6 m ³	9,393	6,129 ²	96	15,618
8 m ³	1,141	118	4	1,263
10 m ³	5	3	0	8
Total	10,955	8,940	105	20,000

CPA-2:

This CDM Program Activity (CPA) is part of the Nepal Biogas Support Program-Programme of Activity (PoA). This CPA includes 19,927 digesters which were implemented between 19/03/2009 and 9/03/2010. The table below provides the overview of digesters implemented under CPA-2.

Size \ Region	Terai	Hill	Mountain or Remote Hill	Total
2 m ³	8	248	0	256
4 m ³	491	3,482	19	3,992
6 m ³	8,993	5,624	124	14,741
8 m ³	852	83	1	936
10 m ³	2	0	0	2
Total	10,346	9,437	144	19,927

CPA-3:

This CDM Program Activity (CPA) is part of the Nepal Biogas Support Program-Programme of Activity (PoA). This CPA includes 19,959 digesters which were implemented between 10/03/2010 and 19/02/2011. The table below provides the overview of digesters implemented under CPA-3.

² One biogas which was found abandoned during verification in Ilam district was not considered for ER calculation.

Size \ Region	Hill	Terai	Mountain or Remote Hill	Total
2 m ³	1,279	38	0	1,317
4 m ³	4,420	651	40	5,111
6 m ³	4,977	7,710	120	12,807
8 m ³	78	645	1	724
Total	10,754	9,044	161	19,959

CPA-4:

This CDM Program Activity (CPA) is part of the Nepal Biogas Support Program-Programme of Activity (PoA). This CPA includes 19,970 digesters which were implemented between 20/02/2011 and 28/02/2012. The table below provides the overview of digesters implemented under CPA-4.

Size \ Region	Hill	Terai	Mountain or Remote Hill	Total
2 m ³	694	20	17	731
4 m ³	5,292	668	48	6,008
6 m ³	4,691	7,784	58	12,533
8 m ³	43	655	0	698
Total	10,720	9,127	123	19,970

CPA-5:

This CDM Program Activity (CPA) is part of the Nepal Biogas Support Program-Programme of Activity (PoA). This CPA includes 19,842 digesters which were implemented between 29/02/2012 and 23/05/2013. The table below provides the overview of digesters implemented under CPA-5.

Size \ Region	Hill	Terai	Mountain or Remote Hill	Total
2 m ³	288	13	3	304
4 m ³	4,932	622	161	5,715
6 m ³	4,391	8,718	64	13,173
8 m ³	58	591	1	650
Total	9,669	9,944	229	19,842

CPA-6:

This CDM Program Activity (CPA) is part of the Nepal Biogas Support Program-Programme of Activity (PoA). This CPA includes 18,504 digesters which were implemented between 24/05/2013 and 04/04/2014. Table below provides an overview of the digesters implemented under CPA-6.

Size \ Region	Hill	Terai	Mountain or Remote Hill	Total
2 m ³	86	2	0	88
4 m ³	1,547	265	11	1,823
6 m ³	5,965	9,772	52	15,789
8 m ³	108	696	0	804
Total	7,706	10,735	63	18,504

CPA-7:

This CDM Program Activity (CPA) is part of the Nepal Biogas Support Program-Programme of Activity (PoA). This CPA includes 18,392 digesters which were implemented between 05/04/2014 and 31/12/2014. Table below provides an overview of the digesters implemented under CPA-7.

Size \ Region	Hill	Terai	Mountain or Remote Hill	Total
2 m ³	22	1	0	23
4 m ³	1,071	167	1	1,239
6 m ³	7,849	8,554	64	16,467
8 m ³	142	521	0	663
Total	9084	9,243	65	18,392

CPA-8:

This CDM Program Activity (CPA) is part of the Nepal Biogas Support Program-Programme of Activity (PoA). This CPA includes 19,445 digesters which were implemented between 01/01/2015 and 08/04/2016. Table below provides an overview of the digesters implemented under CPA-8.

Size \ Region	Hill	Terai	Mountain or Remote Hill	Total
2 m ³	26	1	0	27
4 m ³	1365	187	18	1570
6 m ³	6927	9842	203	16972
8 m ³	223	650	3	876
Total	8541	10680	224	19445

CPA-9:

This CDM Program Activity (CPA) is part of the Nepal Biogas Support Program-Programme of Activity (PoA). This CPA includes 17,304 digesters, which were implemented between 09/04/2016 and 12/07/2018. The table below provides the overview of digesters implemented under CPA-9.

Size \ Region	Terai	Hill	Mountain or Remote Hill	Total
2 m ³	3	3	0	6
4 m ³	110	988	13	1111
6 m ³	7713	7638	567	15918

Size \ Region	Terai	Hill	Mountain or Remote Hill	Total
8 m3	155	99	5	259
10 m3	8	2	0	10
Total	7989	8730	585	17304

B.2. Post-registration changes

B.2.1. Temporary deviations from Certified Key Project Information, Project Design Document, Monitoring & Reporting Plan, applied methodology or applied standardized baseline

N/A.

B.2.2. Corrections

The total number of biogas plants included in CPA-1 for this crediting period is 20,000. However, one biogas which was found abandoned during last verification in Ilam district was not considered for ER calculation. So, total plants considered for the ER calculation for this monitoring period is 19,999.

B.2.3. Changes to start date of crediting period

N/A

B.2.4. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

N/A

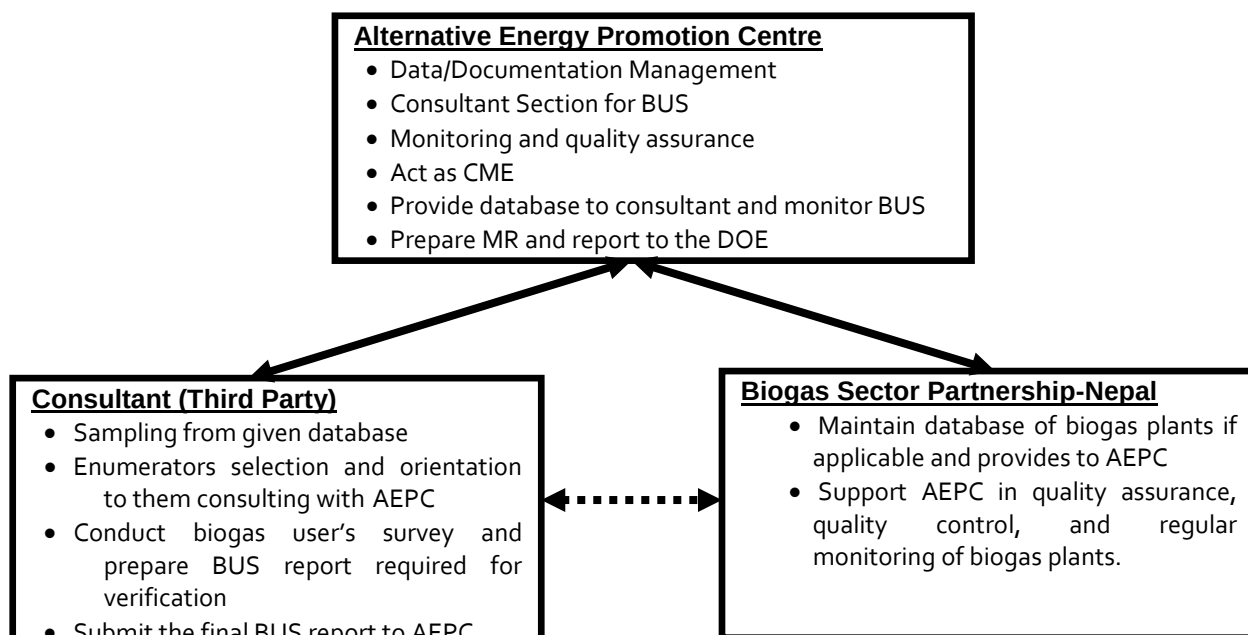
B.2.5. Changes to project design of approved project

Specially for CPA-1, total biogas installed in CPA is 20,000. But the numbers entered for each stratum (Terai, Hill and Remote Hill) was mismatched with the actual database. During registration, the number of biogas in Terai, Hill and Remote hill were 10011, 9,873 and 116. This was due to typo error. So, the numbers in each stratum was revised through the issuance track during the first verification but the total number of biogas has not been changed (i.e. 20,000) under the CPA. The revised distribution for the Terai, Hill and Remote hill are 10955, 8940 and 105 respectively. The PRC was approved on 22nd June 2015. The revised CPA DD and the PRC documents can be viewed in the link below:

https://cdm.unfccc.int/PoAIssuance/iss_db/poaiss339237849/view

SECTION C. Description of monitoring system applied by the project

As a CME as well as CPA implementer, AEPC maintains the database of the biogas plants installed by the pre-qualified companies. On the behalf of AEPC, Biogas Sector Partnership Nepal (BSP-Nepal), a national level non-governmental organization keeps the database for the PoA. BSP-Nepal facilitates and provides technical assistance to biogas companies, processes the subsidy applications and recommend AEPC for subsidy reimbursement to the users through BCs. It also assists in conducting quality control and regular monitoring of the installed biogas digesters and developing skill enhancement among BCs. The Biogas User's Survey is conducted every year as a basis for emission reduction calculation. The third party (consultant) conducts the Biogas User Survey. Based on the survey, AEPC prepares monitoring report and maintain all required documents for verification. The roles and responsibilities of each entity for GHG monitoring are shown below:



SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Relevant SDG Indicator	3.9.1 Mortality rate attributed to household and ambient air pollution
Data/parameter:	NCV _{biomass}
Unit	TJ/tonne
Description	Net calorific value of the non-renewable biomass that is substituted
Source of data	IPCC guidelines.
Value(s) applied)	0.0156
Choice of data or measurement methods and procedures	AMS-I.E. Ver 4 requires using this value.
Purpose of data	Emission reduction calculation
Additional comments	This value is kept up to date with the IPCC guidelines.

Relevant SDG Indicator	13.1.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)
Data/parameter:	EF _{projected_fossil fuel}
Unit	tCO ₂ /TJ
Description	Emission factor for the projected fossil fuel consumption in the baseline.
Source of data	Approved small scale methodology AMS.I.E (version 4.0)
Value(s) applied)	81.6
Choice of data or measurement methods and procedures	AMS-I.E. requires using this value.

Purpose of data	Emission reduction calculation
Additional comments	NA

Relevant SDG Indicator	3.9.1 Mortality rate attributed to household and ambient air pollution
Data/parameter:	$f_{NRB,y}$
Unit	%
Description	Fraction of biomass used in the absence of the project activity in year y that can be established as non renewable biomass using nationally approved methods
Source of data	"Default values of fraction of non-renewable biomass for Least Developed Countries and Small Island Developing States (version 01.0)" EB 67 Annex 22
Value(s) applied)	86%
Choice of data or measurement methods and procedures	Default approved by the CDM EB as the value for the fraction of NRB in Nepal.
Purpose of data	Emission reduction calculation
Additional comments	EB 67 Annex 22 decision stipulates using this value

Relevant SDG Indicator	7.1.2 Proportion of population with primary reliance on clean fuels and technology
Data/parameter:	$N_{s,r}$
Unit	Numbers
Description	Number of digesters in each size category (in m ³) and region (Terai, Hill and, if available, Remote Hill or Mountain) implemented under the CPA
Source of data	CPA database
Value(s) applied)	See Section B.1 of the MR
Choice of data or measurement methods and procedures	The registration procedure of the BSP database avoids double counting of digesters and the registration of digesters that have not been commissioned. The BSP database is the basis for subsidy disbursement. The data used to maintain this database is gathered according to defined procedures, making it a reliable source of information.
Purpose of data	Calculation of baseline emissions
Additional comments	Based on the size category of digester implementation between applicable vintage for each CPAs.

Relevant SDG Indicator	3.9.1 Mortality rate attributed to household and ambient air pollution
Data/parameter:	$Q_{NRB repl.}$
Unit	Tonne per year and appliance
Description	Quantity of woody biomass that is substituted or displaced in tonnes per year and appliance
Source of data	Calculated
Value(s) applied)	3.33
Choice of data or measurement methods and procedures	Calculated based on survey and historic data, such as Biogas User Survey (BUS). The BUS is based on survey techniques and has been confirmed in the context of registered CDM project 5416. ³

³ <http://cdm.unfccc.int/Projects/DB/RWTUV1321020993.82/view>

Purpose of data	Calculation of baseline emissions
Additional comments	To be re-assessed at renewal of crediting period of CPA. - As per paragraph 6 (a) of the methodology By represents: The estimated average annual consumption of woody biomass per appliance (tonnes/year) derived from surveys or historic information. - As per SSC WG clarification SSC 543 the estimate can be fixed ex ante

D.2. Data and parameters monitored

Relevant SDG Indicator	7.1.2 Proportion of population with primary reliance on clean fuels and technology
Data/parameter:	P
Unit	%
Description	The share of digesters operational
Measured/calculated/default	Calculated
Source of data	<u>For regular verification (Monitoring period: 01/08/2018-30/01/2020)</u> Biogas User Survey (General)2018/19 for all CPAs <u>For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)</u> Biogas User Survey (General) 2017/18 for CPA-8
Value(s) of monitored parameter	<u>For regular verification (Monitoring period: 01/08/2018-30/01/2020)</u> CPA-1: 75.71 % CPA-2: 88.27 % CPA-3: 80.22 % CPA-4: 85.73 % CPA-5: 93.86 % CPA-6: 79.31 % CPA-7: 81.76 % CPA-8: 90.16 % CPA-9: 95.55 % <u>For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)</u> CPA-8: 73.57%
Monitoring equipment	Survey
Measuring/reading/recording frequency:	Bi-ennial
Calculation method (if applicable):	Ratio calculated as number of digesters found to be operating from the total number of digesters surveyed
QA/QC procedures:	The Internal Quality Control system samples 5% of the digesters that are newly implemented, 2.5% of the digesters that are two year in operation and 2.5% of the digesters that have been operational for three years as part of the Internal Quality Control System. For the purpose of the current monitoring period, Biogas Users' Survey has been taken as the means to check the operational status of the biogas digester as the user survey gives the up-to-date value. The reliability check is done for each CPA in the BUS survey reports and the margin of error less than 10%.
Purpose of data:	ER calculation
Additional comments:	Requirements as defined in the sampling plan is met.

Relevant SDG Indicator	3.9.1 Mortality rate attributed to household and ambient air pollution
Data/parameter:	Users' perception on reduction in indoor air pollution
Unit	Qualitative
Description	Users' perception on reduction in indoor air pollution

Measured/calculated/default	Calculated
Source of data	<u>For regular verification (Monitoring period: 01/08/2018-30/01/2020) (Table 24 of Following Reports):</u> Biogas User Survey (General) 2018/19 for all CPAs <u>For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)</u> Biogas User Survey (General) 2017/18 for CPA-8 (Table 15)
Value(s) of monitored parameter	<u>For regular verification (Monitoring period: 01/08/2018-30/01/2020)</u> CPA-1: 99.03 % users perceived reduction CPA-2: 97.46% users perceived reduction CPA-3: 99.06 % users perceived reduction CPA-4: 99.13 % users perceived reduction CPA-5: 96.85 % users perceived reduction CPA-6: 99.07 % users perceived reduction CPA-7: 100 % users perceived reduction CPA-8: 96.72% users perceived reduction CPA-9: 98.45% users perceived reduction <u>For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)</u> CPA-8: 100% users perceived reduction
Monitoring equipment	Survey
Measuring/reading/recording frequency:	at least biennial
Calculation method (if applicable):	calculated as % of users perceived the reduction (Reduce and drastically reduce) in indoor air pollution due to the biogas implementation
QA/QC procedures:	The selection of households under the surveys ensures that the percentages of household in different strata are met for each individual CPA included in the PoA; survey tried to capture the view of the women actually involved in cooking.
Purpose of data:	Sustainable Development Assessment.
Additional comments:	Requirements as defined in the sampling plan shall be met.

Relevant SDG Indicator	3.9.1 Mortality rate attributed to household and ambient air pollution
Data/parameter:	Reduction in health problem
Unit	Qualitative
Description	Users' perception on reduction in health problem
Measured/calculated/default	Calculated
Source of data	<u>For regular verification (Monitoring period: 01/08/2018-30/01/2020) (Table 25 of following reports):</u> Biogas User Survey (General) 2018/19 for all CPAs <u>For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)</u> Table 16 of Biogas User Survey (General) 2017/18 for CPA-8

Value(s) of monitored parameter	For regular verification (Monitoring period: 01/08/2018-30/01/2020)			
	CPAs	% HH perceived reduction in		
		Eye infection	Respiratory diseases	Cough
	CPA-1	83.50	85.44	82.52
	CPA-2	97.46	88.14	81.36
	CPA-3	82.08	66.98	77.36
	CPA-4	80.87	91.30	73.91
	CPA-5	95.28	87.40	89.76
	CPA-6	94.39	93.46	91.59
	CPA-7	98.20	92.79	93.69
	CPA-8	99.18	92.62	83.61
	CPA-9	95.35	95.35	94.57
	For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)			
	Reduction in eye infection: 70 % households			
	Reduction in respiratory disease: 76% households			
	Reduction in Cough: 98 % households			
	Reduction in fire related injury: 97% households			
Monitoring equipment	Survey			
Measuring/reading/recording frequency:	at least biennial			
Calculation method (if applicable):	calculated as % of users perceived the reduction of different health problem caused by indoor air pollution after installation of biogas.			
QA/QC procedures:	The selection of households under the surveys ensures that the percentages of household in different strata are met for each individual CPA included in the PoA			
Purpose of data:	Sustainable Development Assessment.			
Additional comments:	Requirements as defined in the sampling plan is met.			

Relevant SDG Indicator	3.9.1 Mortality rate attributed to household and ambient air pollution
Data/parameter:	User's perception in Time saving for the cooking (reduce exposure to indoor air pollution)
Unit	Qualitative
Description	Users' perception on time saving for cooking due to project.
Measured/calculated/default	Calculated
Source of data	For regular verification (Monitoring period: 01/08/2018-30/01/2020) (Table 29 of following reports): Biogas User Survey (General)2018/19 for all CPAs For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018) Table 20 of Biogas User Survey (General) 2017/18 for CPA-8

Value(s) of monitored parameter	<u>For regular verification (Monitoring period: 01/08/2018-30/01/2020)</u>		
	Reduction in time for cooking food (perception)		
	CPAs	% HH perceived reduction in cooking time for	
		Men	Women
	CPA-1	26.21	93.20
	CPA-2	20.34	98.31
	CPA-3	47.17	97.17
	CPA-4	26.27	94.92
	CPA-5	11.02	96.85
	CPA-6	22.43	100
	CPA-7	25.23	97.30
	CPA-8	13.11	100
	CPA-9	21.71	98.45
	<u>For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)</u>		
	Reduction in cooking time of men: 62 % households		
	Reduction in cooking time of women: 99 % households		
	Reduction in cooking time of children: 18 % households		
Monitoring equipment	Survey		
Measuring/reading/recording frequency:	at least biennial		
Calculation method (if applicable):	Calculated as % of users perceived the reduction in cooking time for men, women and children after installation of biogas.		
QA/QC procedures:	The selection of households under the surveys ensures that the percentages of household in different strata are met for each individual CPA included in the PoA		
Purpose of data:	Sustainable Development Assessment.		
Additional comments:	Requirements as defined in the sampling plan is met.		

Relevant SDG Indicator	7.1.2 Proportion of population with primary reliance on clean fuels and technology
Data/parameter:	Time saving (Fuel wood collection)
Unit	Qualitative
Description	Users' perception on time saving due to project for firewood collection
Measured/calculated/default	Calculated
Source of data	<u>For regular verification (Monitoring period: 01/08/2018-30/01/2020) (Table 28 of following reports):</u> Biogas User Survey (General)2018/19 for all CPAs <u>For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)</u> Table 19 of Biogas User Survey (General) 2017/18 for CPA-8

Value(s) of monitored parameter	For regular verification (Monitoring period: 01/08/2018-30/01/2020) Reduction in time for firewood collection (perception) <table border="1"> <thead> <tr> <th rowspan="2">CPAs</th><th colspan="3">% HH perceived reduction in firewood collection time for</th></tr> <tr> <th>Men</th><th>Women</th><th>Children</th></tr> </thead> <tbody> <tr><td>CPA-1</td><td>65.05</td><td>94.17</td><td>12.62</td></tr> <tr><td>CPA-2</td><td>49.15</td><td>97.46</td><td>0.85</td></tr> <tr><td>CPA-3</td><td>72.64</td><td>92.45</td><td>0.94</td></tr> <tr><td>CPA-4</td><td>61.86</td><td>94.92</td><td>5.08</td></tr> <tr><td>CPA-5</td><td>62.20</td><td>98.43</td><td>14.96</td></tr> <tr><td>CPA-6</td><td>54.21</td><td>99.07</td><td>2.80</td></tr> <tr><td>CPA-7</td><td>54.05</td><td>97.30</td><td>1.80</td></tr> <tr><td>CPA-8</td><td>31.15</td><td>100</td><td>0</td></tr> <tr><td>CPA-9</td><td>47.29</td><td>97.67</td><td>0.78</td></tr> </tbody> </table> For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018) Reduction in firewood collection time of men: 61% households Reduction in firewood collection time of women: 100% households Reduction in firewood collection time of children: 19% households			CPAs	% HH perceived reduction in firewood collection time for			Men	Women	Children	CPA-1	65.05	94.17	12.62	CPA-2	49.15	97.46	0.85	CPA-3	72.64	92.45	0.94	CPA-4	61.86	94.92	5.08	CPA-5	62.20	98.43	14.96	CPA-6	54.21	99.07	2.80	CPA-7	54.05	97.30	1.80	CPA-8	31.15	100	0	CPA-9	47.29	97.67	0.78
CPAs	% HH perceived reduction in firewood collection time for																																													
	Men	Women	Children																																											
CPA-1	65.05	94.17	12.62																																											
CPA-2	49.15	97.46	0.85																																											
CPA-3	72.64	92.45	0.94																																											
CPA-4	61.86	94.92	5.08																																											
CPA-5	62.20	98.43	14.96																																											
CPA-6	54.21	99.07	2.80																																											
CPA-7	54.05	97.30	1.80																																											
CPA-8	31.15	100	0																																											
CPA-9	47.29	97.67	0.78																																											
Monitoring equipment	Survey																																													
Measuring/reading/recording frequency:	at least biennial																																													
Calculation method (if applicable):	Calculated as % of users perceived the reduction in cooking time for men, women and children after installation of biogas.																																													
QA/QC procedures:	The selection of households under the surveys ensures that the percentages of household in different strata are met for each individual CPA included in the PoA																																													
Purpose of data:	Sustainable Development Assessment.																																													
Additional comments:	Requirements as defined in the sampling plan is met.																																													

Relevant SDG Indicator	3.9.3 Mortality rate attributed to unintentional poisoning
Data/parameter:	Users perception in reduction of chemical fertilizers
Unit	Qualitative
Description	Users' perception on reduction in use of chemical fertilizers and use of bio-slurry
Measured/calculated/default	Calculated
Source of data	For regular verification (Monitoring period: 01/08/2018-30/01/2020) (Table 34 of following reports): Biogas User Survey (General)2018/19 for all CPAs For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018) Table 26 of Biogas User Survey (General)2017/18: CPA-8

Value(s) of monitored parameter	For regular verification (Monitoring period: 01/08/2018-30/01/2020)					
	Reduction in chemical fertilizer used and use of bio-slurry					
	CPAs	% changes in use of chemical fertilizers and increase in use of bio-slurry				
		Farm Yard Manure	Bio-slurry	Urea	DAP	Potash
	CPA-1	-26.50	100	-26.83	-22.50	-40.0
	CPA-2	-27.36	100	-28.57	-55.56	-83.33
	CPA-3	-36.92	100	-43.59	-36	0
	CPA-4	-25.79	100	-15.38	-5.88	-100
	CPA-5	-37.12	100	-40	-13.33	-25
	CPA-6	-40.71	100	-44.07	-25	-100
	For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)					
	Changes in use of Farm Yard manure: -98%					
	Changes in use of Bio-slurry: 100 %					
	Changes in use of Urea: -23 %					
	Changes in use of DAP: -28 %					
	Changes in use of Potash: -22 %					
Monitoring equipment	Survey					
Measuring/reading/recording frequency:	at least biennial					
Calculation method (if applicable):	Calculated as % use of the Bio-slurry and chemical fertilizers before and after biogas installation which is perceived by biogas users.					
QA/QC procedures:	The selection of households under the surveys ensures that the percentages of household in different strata are met for each individual CPA included in the PoA					
Purpose of data:	Sustainable Development Assessment.					
Additional comments:	Requirements as defined in the sampling plan is met.					

Relevant SDG Indicator	3.9.2 Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services)
Data/parameter:	Improved access to sanitation services
Unit	Number
Description	Users' perception on connection of toilet to biogas
Measured/calculated/default	Calculated
Source of data	For regular verification (Monitoring period: 01/08/2018-30/01/2020) (Table 37 of following reports): Biogas User Survey (General)2018/19 for all CPAs For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018) Table 29 of Biogas User Survey (General)2017/18 for CPA-8

Value(s) of monitored parameter	<u>For regular verification (Monitoring period: 01/08/2018-30/01/2020)</u> <u>Connection of toilet with biogas:</u> CPA-1: 76.70 % CPA-2: 78.81 % CPA-3: 84.91 % CPA-4: 91.30 % CPA-5: 86.61 % CPA-6: 90.65 % CPA-7: 71.17% CPA-8: 85.25% CPA-9: 82.17% <u>For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)</u> Connection of toilet with biogas CPA-8: 99 %
Monitoring equipment	Survey
Measuring/reading/recording frequency:	at least biennial
Calculation method (if applicable):	Calculated as % of households connected the toilet to the biogas.
QA/QC procedures:	The selection of households under the surveys ensures that the percentages of household in different strata are met for each individual CPA included in the PoA
Purpose of data:	Sustainable Development Assessment.
Additional comments:	Requirements as defined in the sampling plan is met.

Relevant SDG Indicator	7.1.2 Proportion of population with primary reliance on clean fuels and technology
Data/parameter:	Trainings to Masons
Unit	Number of people trained to promote Biogas plants
Description	Masons involved in constructing the biogas plants shall receive training on the proper installation of biogas digesters.
Measured/calculated/default	default
Source of data	Training Reports
Value(s) of monitored parameter	Since, all the biogas digesters are already implemented in all CPAs, the monitoring of the training to the masons who constructed the digesters for the 9 CPAs are not applicable for monitoring of the CPAs. But the training to the mason is provided by AEPC/respective biogas companies etc to the biogas technician as and when required. During this monitoring period, Two Mason (Biogas Technician Level-1) Training was conducted for 75 to maintain the sufficient manpower in the market that will help in promoting biogas technology.
Monitoring equipment	Training Report
Measuring/reading/recording frequency:	at least biennial
Calculation method (if applicable):	number of masons trained during the monitoring period.
QA/QC procedures:	N/A
Purpose of data:	Sustainable Development Assessment.
Additional comments:	Requirements as defined in the sampling plan is met.

Relevant SDG Indicator	Safeguarding Principle 4.3.8
Data/parameter:	Impact on Crop Productivity
Unit	Qualitative
Description	Users' perception on Impact on crop productivity
Measured/calculated/default	calculated
Source of data	For regular verification (Monitoring period: 01/08/2018-30/01/2020) (Table 33 of following reports): Biogas User Survey (General)2018/19 for all CPAs For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018) Table 24 of Biogas User Survey (General) 2017/18 for CPA-8
Value(s) of monitored parameter	For regular verification (Monitoring period: 01/08/2018-30/01/2020) % users perceived in increase in productivity due to bio-slurry use from Biogas: CPA-1: 69.90 % CPA-2: 83.90 % CPA-3: 72.38 % CPA-4: 76.52 % CPA-5: 75.59% CPA-6: 75.70 % CPA-7: 80.18% CPA-8: 90.16% CPA-9: 75.19% For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018) % users perceived in increase in productivity due to bio-slurry use from Biogas: 73%
Monitoring equipment	Survey
Measuring/reading/recording frequency:	at least biennial
Calculation method (if applicable):	Calculated as percentage of users perceived the increment in productivity by the use of bio-slurry from biogas
QA/QC procedures:	The selection of households under the surveys ensures that the percentages of household in different strata are met for each individual CPA included in the PoA
Purpose of data:	Sustainable Development Assessment.
Additional comments:	Requirements as defined in the sampling plan is met.

Confirmation of replacing non-renewable biomass

In addition to the monitoring of the, confirmation of non-renewable biomass was also monitored as per the PoA-DD. Basically this was confirmed by monitoring the following during user survey:

Trend in time to reach the forest

Trends in distance travelled for firewood gathering or trends in time needed for firewood gathering indicating depletion of resources available was monitored through perception survey and found following results:

Type	% of people perceived								
	CPA-1	CPA-2	CPA-3	CPA-4	CPA-5	CPA-6	CPA-7	CPA-8	CPA-9
Increased	96.12	97.46	98.11	96.52	88.98	98.13	89.19	97.54	96.90
Same as Previous	3.88	1.69	0.94	0	10.24	1.87	10.81	2.46	3.10
Decreased	0.00	0.85	0.94	3.48	0.79	0	0	0	0

Trends in price of firewood

The households were interviewed on the perceived price of firewood in 1989, 2000 and 2018. The results are summerized below:

Year	Average price of fuelwood (NPR)								
	CPA-1	CPA-2	CPA-3	CPA-4	CPA-5	CPA-6	CPA-7	CPA-8	CPA-9
1989	45	49	41	48	54	47	50	56	55
2000	129	124	103	123	126	112	122	136	135
2019	354	332	349	307	351	315	323	352	362

Increased use of low grade biomass

The households were asked on changes in trends in the quality of biomass fuel that suggest the scarcity of woody biomass for cooking. the result is presented below:

Response	% of respondent responding to the use of low grade biomass								
	CPA-1	CPA-2	CPA-3	CPA-4	CPA-5	CPA-6	CPA-7	CPA-8	CPA-9
Yes	93.20	96.61	76.79	93.91	86.61	94.39	90.99	91.80	88.37
No	6.80	3.39	13.21	6.09	13.39	5.61	9.01	8.20	11.63

From results above, majority of the respondents felt that the time to reach the forest has been increased whereas the cost of firewood is also in increasing trends. The majority of people also perceived that the use of low grade biomass has been increased. The results suggest the scarcity of woody biomass for cooking hence confirming the displacement or substitution of the non-renewable woody biomass by each CPAs.

D.3. Implementation of sampling plan

Since the monitoring parameters for all CPAs implemented under the PoA are same, the CME adopts a common monitoring framework for all the specific case CPAs implemented under the PoA. Annual monitoring was conducted through the biogas users' surveys where the following parameters were monitored as stipulated in the section E.7.2 of the registered PoA-DD and the specific VPA-DDs and the transition documents.

1. Digester performance
2. Displacement of Non renewable biomass
3. Other Socio-economic Parameters stipulated in CPA-DD for SDG monitoring

The coordinating/managing entity opted for a monitoring system where each CPA within the PoA is monitored (Please refer to section C of the PoA DD). The monitoring parameter stipulated in the PoA DD is the "digester performance". In order to monitor this parameter, CME commissioned an independent consultant through a competitive bidding process. The consultant, aligning with the monitoring requirements of the PoA estimated the sample required for the monitoring, drafted the questionnaires and mobilized the team for on-site survey. Having accumulated the information from the on-site survey, the consultant team prepared the reports for each CPA and submitted the same to the AEPC.

(a) Sample Size Determination

Sample size was determined using stratified random sampling consistent with the monitoring plan of the registered PoA-DD and respective CPA-DDs and for sampling and surveys for CDM project activities and programme of activities and as specified in the registered PoA-DD (annex 4). The sampling was performed within the level of precision of 10% and a confidence level of 90%.

The sample size calculation was carried out using formula as provided in the guidelines.

$$n \geq \frac{1.645^2 NV}{(N-1) \times 0.1^2 + 1.645^2 V} \dots\dots\dots 1$$

Where,

$$V = \frac{SD^2}{\bar{p}^2} = \frac{\text{overall variance}}{\bar{p}^2} \text{ and } \bar{p} \text{ is the overall proportion.} \dots\dots\dots \text{eq 2}$$

$$SD^2 = \frac{(g_a \times p_a (1-p_a)) + (g_b \times p_b (1-p_b)) + \dots\dots\dots (g_k \times p_k (1-p_k))}{N} \dots\dots\dots \text{eq. 3}$$

$$\bar{p} = \frac{(g_a \times p_a) + (g_b \times p_b) + (g_c \times p_c) + \dots + (g_k \times p_k)}{N} \text{----- eq. 4}$$

Where,

Symbol	Description	CPA-1	CPA-2	CPA-3	CPA-4	CPA-5	CPA-6	CPA-7	CPA-8	CPA-9
g ₁	total number of plants in Remote Hill	105	144	161	123	229	63	65	224	585
p ₁	Expected Proportion of operational plants in Remote Hill in 2018/19 (based on BUS 2017/18)	0.25	0.5	0.75	0.75	0.5	0.75	1	0.5	0.5
g ₂	total number of plants in Hill	8940	9437	10754	10720	9669	7706	9084	8541	8730
p ₂	Expected Proportion of operational plants in Hill in 2018/19 (based on BUS 2017/18)	0.86	0.67	0.78	0.62	0.70	0.71	0.64	0.65	0.65
g ₃	total number of plants in Terai	10955	10346	9044	9127	9944	10735	9243	10,680	7989
p ₃	Expected Proportion of operational plants in Terai in 2018/19 (based on BUS 2017/18)	0.93	0.97	0.84	0.87	0.70	0.75	0.85	0.81	0.81
N	total number of plants under specific CPA	20000	19927	19959	19970	19842	18504	18392	19445	17304
n	required sample size for each CPA	30	48	64	89	116	99	88	94	102
n	Actual number of samples taken for sampling	135	135	135	135	135	135	135	135	135

The sample size has been calculated as per the annex 4 of the registered PoA-DD. The registered PDD for PoA has retained 72 sample households for monitoring during annual surveys. However, the sample size for the CPAs of the PoA is dependent on “p”, the proportion of biogas digester expected to be operational. The change in value of “p” therefore changes the total sample size required. Based on the observed operational status of biogas plants in remote hills, hills and Terai, in the previous biogas user survey for each CPA, the expected ‘p’ value has been applied and required sample size has been calculated. For the CPA-9, values applied for CPA-8 has been used. Further, in order to avoid any low response rate and answers bias, the sample size has been enlarged. For the purpose of current monitoring period, the CME used a higher sample size of 135 instead of the required minimum and accordingly the survey agency conducted the survey to arrive at the results as presented. Furthermore, taking into account the proportional allocation, it is also ensured that the individual stratum size is also higher than the required minimum as presented below. The sample size calculation is presented in the CER sheets.

Same approach was followed to calculate the sample size for the monitoring period 2017/18 for CPA-8. The CERs for that monitoring period was already issued from UNFCCC on 7 November 2019.

(b) Allocation of samples

As stratified sampling has been used, minimum sample required for the Terai, Hill and Remote hill have been met. The tables below depict the sample allocation against the installed digesters in respective CPAs.

CPA-1

Ecological Belts	Installed Biogas Plants		Sample Required	Sample Biogas Plants
	Number	Proportion		Number
Remote Hill	105	0.52	1	4
Hill	8940	44.70	14	59
Terai	10955	54.78	17	72
Total	20000⁴	100	32	135

CPA-2

Ecological Belts	Installed Biogas Plants		Sample Required	Sample Biogas Plants
	Number	Proportion		Number
Remote Hill	144	0.72	1	4
Hill	9437	47.36	23	61
Terai	10346	51.92	25	70
Total	19927	100	49	135

CPA-3

Ecological Belts	Installed Biogas Plants		Sample Required	Sample Biogas Plants
	Number	Proportion		Number
Remote Hill	161	0.81	1	4
Hill	10754	53.88	35	69
Terai	9044	45.31	30	62
Total	19,959	100	66	135

CPA-4

Ecological Belts	Installed Biogas Plants		Sample Required	Sample Biogas Plants
	Number	Proportion		Number
Remote Hill	123	0.62	1	4
Hill	10720	53.68	48	69
Terai	9127	45.70	41	62
Total	19,970	100	90	135

CPA-5

Ecological Belts	Installed Biogas Plants		Sample Required	Sample Biogas Plants
	Number	Proportion		Number
Remote Hill	229	1.15	2	5
Hill	9669	48.73	57	61
Terai	9944	50.12	59	69
Total	19,842	100	118	135

CPA-6

Ecological Belts	Installed Biogas Plants		Sample Required	Sample Biogas Plants
	Number	Proportion		Number
Remote Hill	63	0.34	1	4
Hill	7706	41.65	42	54

⁴ One biogas which was found abandoned during verification in last monitoring in Ilam district is not considered for ER calculation. However, 20,000 biogas plants are applied while calculating the samples conservatively.

Terai	10735	58.01	58	77
Total	18504	100	101	135

CPA-7

Ecological Belts	Installed Biogas Plants		Sample Required	Sample Biogas Plants
	Number	Proportion		Number
Remote Hill	65	0.35	1	4
Hill	9084	49.39	44	65
Terai	9243	50.26	45	66
Total	18392	100	90	135

CPA-8

Ecological Belts	Installed Biogas Plants		Sample Required	Sample Biogas Plants
	Number	Proportion		Number
Remote Hill	224	1.15	2	4
Hill	8541	43.92	42	58
Terai	10680	54.92	52	73
Total	19445	100	96	135

CPA-9

Ecological Belts	Installed Biogas Plants		Sample Required	Sample Biogas Plants
	Number	Proportion		Number
Remote Hill	585	3.38	4	5
Hill	8730	50.45	52	68
Terai	7989	46.17	48	62
Total	17304	100	104	135

For the monitoring period of 2017/18 for CPA-8, same approach was followed. following were the sample allocation for CPA-8 for monitoring period 2017/18:

CPA-8

Ecological Belts	Installed Biogas Plants		Sample Required	Sample Biogas Plants
	Number	Proportion		Number
Remote Hill	224	1.15	1	8
Hill	8541	43.92	15	55
Terai	10680	54.92	19	72
Total	19445	100	35	135

(c) Survey

For regular verification (Monitoring period: 01/08/2018-30/01/2020)

Sample household were selected accordingly using "Rand" function in Excel. Survey of those households were conducted from 10 February-5 April 2019 for CPA-1 to CPA-8 and between 20 May 2019-31 May 2019 for CPA-9. The total of 10 enumerators were mobilized for the data collection. The enumerators were trained on structured questionnaire for 3 days. Enumerators were mobilized in a group of two persons. Having accumulated the data collected during the survey, the consultant analyzed the data using appropriate tools and prepared the "Biogas User Survey" report for individual CPAs.

The results from the monitoring for the operational status of the CPAs are given below:

Particulars	CPA-1	CPA-2	CPA-3	CPA-4	CPA-5	CPA-6	CPA-7	CPA-8	CPA-9
No of Plants in Remote Hill	105	144	161	123	229	63	65	224	585
Sample Taken in Remote Hill	4	4	4	4	5	4	4	4	5
Operational Status of sample in Remote Hill	100.00%	50.00%	0.00%	50.00%	100.00%	75.00%	100.00%	100.00%	100.00%
No of Plants in Hill	8940	9437	10754	10720	9669	7706	9084	8541	8730

Sample Taken in Hill	59	61	69	69	61	54	65	58	68
Operational Status of Sample in Hill	71.19%	88.52%	79.71%	75.36%	90.16%	72.22%	67.69%	81.03%	92.65%
No of Plants in Terai	10955	10346	9044	9127	9944	10735	9243	10680	7989
Sample Taken in Terai	72	70	62	62	69	77	66	73	62
Operational status in Terai	79.17%	88.57%	82.26%	98.39%	97.10%	84.42%	95.45%	97.26%	98.39%
Total no of Biogas Plants installed	20000	19927	19959	19970	19842	18504	18392	19445	17304
Weighted average operational status of CPA (Population)	75.71%	88.27%	80.22%	85.73%	93.75%	79.31%	81.76%	90.16%	95.55%

For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)

Survey was conducted in the month of 20 February 2018 to 22 March, 2018. A total of 12 enumerators were mobilized for the survey. This has been already verified by UNFCCC and the CERs were issued on 7th November 2019. The results from the monitoring for the operational status of the CPAs are given below:

Particulars	CPA-8
No of Plants in Remote Hill	224
Sample Taken in Remote Hill	8
Operational Status of sample in Remote Hill	50.00%
No of Plants in Hill	8541
Sample Taken in Hill	55
Operational Status of Sample in Hill	65.45%
No of Plants in Terai	10680
Sample Taken in Terai	72
Operational status in Terai	80.56%
Total no of Biogas Plants installed	19445
Weighted average operational status of CPA (Population)	73.57%

(d) Quality Assurance/Quality Control

Efforts were made to ensure the quality of the data collected from the field. QA/QC measures were implemented to attain the desired 90/10 confidence/precision for the parameters under consideration. In order to assure the quality of data collected, the questionnaires were pre-tested prior to their introduction in the field. The data was collected by deploying the enumerators to the field. The enumerators were provided with the printed copy of the questionnaires to fill it in site. The collected information was recorded in a systematic database format. The data was presented and interpreted by using different statistical tools. The data collected from the field survey was encoded in Excel and analyzed by a qualified statistician. To minimize the risk of data discrepancies and for assurance of the quality of data collected, the enumerators were trained and the questionnaires were pre-tested prior to their introduction in the field under the supervision and guidance of the statistician. While transferring the data from questionnaires into Excel, qualified statistician prepared the encoded database format. The data from questionnaires were transferred to that database format based on the codes provided for each response in questionnaires under the supervision of qualified statistician. AEPC follows the appropriate procedure to provide the feedback to user survey report. Once the draft report is received, AEPC also checks the database against the filled in questionnaire in a sample basis and provide the feedback to the third party for correction and preparation of final report. So, the efforts are made to ensure the quality of data collected, data entry and data analysis for minimizing the data discrepancies.

SECTION E. Calculation of SDG outcomes

E.1. Calculation of baseline value or estimation of baseline situation of each SDG outcome

According to AMS-I.E. version 04, para 04, the emission reductions under a CPA are calculated as the following:

$$ER_y = B_y \cdot f_{NRB,y} \cdot NCV_{biomass} \cdot EF_{projected, fossilfuel}$$

In which:

ER_y	Emissions Reductions during the year y (tCO _{2e})
B_y	Quantity of woody biomass that is substituted or displaced in tonnes
$f_{NRB,y}$	Default value of fraction of non renewable biomass for Nepal, (86% fixed ex-ante)
$NCV_{biomass}$	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.0156 TJ/tonne . (Updated IPCC value)
$EF_{projected, fossilfuel}$	Emission factor for substitution of non renewable woody biomass by similar consumers. Use a value of 81.6 tCO₂/TJ . (Fixed Ex-ante)

Following option a) of paragraph 6, B_y is “calculated as the product of the number of appliances multiplied by the estimate of average annual consumption of woody biomass per appliance (tonnes/year)”.

In the case of the present CPA, “the number of appliances” as deducted from the internal records (commissioning report / database) is corrected with the share of digesters actually in operation.

The “average annual consumption of woody biomass per appliance (tonnes/year)” is the biomass substituted or displaced, which is fixed ex- ante at 3.33 tonnes/year per appliance.

Thus, B_y is calculated as follows:

$$B_y = N_{sr} \times P \times Q_{NRB repl.}$$

In which:

N_{sr}	The number of appliances. The parameter refers to the number of digesters in each size and category and is hence unitless.
P	Performance of digesters as the share of digesters implemented that is actually operational, determined through survey methods (%)
$Q_{NRB repl.}$	Average quantity of biomass replaced per appliance and year (tonnes/year)

Calculating the ERY for regular verification (Monitoring period: 01/08/2018-30/01/2020)

CPA-1

$Q_{NRB repl.}$: 3.33 ton/year/appliance (ex-ante fixed)

$P = 75.71\%$ (Calculated using user survey result: see ER calculation spreadsheet for actual value)

N_{sr} : 20,000 (data base), since one biogas plant is found abandoned during last verification, that is not considered for the ER calculation for this monitoring period. So, the number of plants considered for ER calculation is 19,999.

So, using equation above, $B_y = 75698.68$ ton for monitoring period

Using the values:

$f_{NRB,y}$: 86%

$NCV_{biomass}$: 0.0156 TJ/tonne

$EF_{projected, fossilfuel}$: 81.6 tCO₂/TJ

The value of ERY (using above eq) is calculated as 82870.80 tCO_{2eq}.

Similarly, substituting the values for B_y , $f_{NRB,y}$, $NCV_{biomass}$, $EF_{projected, fossilfuel}$, N_{sr} , P , and $Q_{NRB repl.}$ from the above equations, the respective emission reduction for other CPAs are calculated as under:

CPA-2: 96272.60 tCO₂e

CPA-3: 87634.63 tCO₂e

CPA-4: 93702.72 tCO₂e

CPA-5: 101935.45 tCO₂e

CPA-6: 80318.31 tCO₂e

CPA-7: 82301.41 tCO₂e

CPA-8: 95960.01 tCO₂e

CPA-9: 43098.57 tCO₂e

For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)

Baseline emission calculated and approved by UNFCCC: 44,579.12 tCO₂eq

Other SDGs

The baseline value for other SDGs are not applicable as those values are monitor ex-post qualitatively.

E.2. Calculation of project value or estimation of project situation of each SDG outcome

The default factor of 0.05 is used to account for any potential leakage, as prescribed by the methodology (AMS I E Version 4, para 10). Thus the leakage emission under a CPA is calculated using the equation given below:

$$LE_y = 0.05 \times B_y \cdot f_{NRB,y} \cdot NCV_{biomass} \cdot EF_{projected_fossilfuel}$$

Calculating the leakage emission for regular verification (Monitoring period: 01/08/2018-30/01/2020)

For CPA-1

$f_{NRB,y}$: 86%

$NCV_{biomass}$: 0.0156 TJ/tonne

$EF_{projected.fossilfuel}$: 81.6 tCO₂/TJ

B_y : 75698.68 ton

Using the equation above, the leakage emission for CPA-1 is 4143.54. Substituting the corresponding values for other CPAs, the leakage emission for remaining CPAs are calculated as below:

CPA-2: 4813.63 tCO₂e

CPA-3: 4381.73 tCO₂e

CPA-4: 4685.14 tCO₂e

CPA-5: 5096.77 tCO₂e

CPA-6: 4015.92 tCO₂e

CPA-7: 4115.07 tCO₂e

CPA-8: 4798.00 tCO₂e

CPA-9: 2154.93 tCO₂e

For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)

Leakage emission calculated and approved by UNFCCC: 2228.96 tCO₂eq

Other SDGs

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Other SDG parameters are monitored directly which is given in section D.2. The result shows that there is positive impacts of the projects on SDGs.

E.3. Calculation of net benefits as difference of baseline and project values or direct calculation for each SDG outcome

Calculating the net emission reduction for regular verification (Monitoring period: 01/08/2018-30/01/2020)

Net emission reduction achieved is calculated as a difference of baseline emission and the leakage:
For CPA-1:

Baseline Emission: 82,870.80 tCO_{2eq}.

Leakage: 4,143.54 tCO_{2eq}.

So, net emission reduction achieved 78,727 tCO_{2eq}.

Similarly, the net emission reductions achieved are as follows for remaining CPAs:

CPA-2: 91,458 tCO_{2eq}.

CPA-3: 83,252 tCO_{2eq}.

CPA-4: 89,017 tCO_{2eq}.

CPA-5: 96,838 tCO_{2eq}.

CPA-6: 76,302 tCO_{2eq}.

CPA-7: 78,186 tCO_{2eq}.

CPA-8: 91,162 tCO_{2eq}.

CPA-9: 40,943 tCO_{2eq}.

For retroactive labelling of CPA 8 (Monitoring period: 23/09/2017-31/07/2018)

Net emission reduction achieved for CPA-8 and approved by UNFCCC: 49544 tCO_{2eq}. So, net emission reduction achieved during the monitoring period is 42,350 tCO_{2eq}.

Other SDGs

Other SDG parameters are monitored directly which is given in section D.2. The result shows that there is positive impacts of the projects on SDGs.

E.4. Summary of ex-post values of each SDG outcome for the current monitoring period

Item	Baseline estimate	Project estimate	Net benefit																																																																																																																																										
SDG 3	0% users perceived reduction in indoor air pollution	Regular verification: CPA-1: 99.03 % users perceived reduction CPA-2: 97.46% users perceived reduction CPA-3: 99.06 % users perceived reduction CPA-4: 99.13 % users perceived reduction CPA-5: 96.85 % users perceived reduction CPA-6: 99.07 % users perceived reduction CPA-7: 100 % users perceived reduction CPA-8: 96.72% users perceived reduction CPA-9: 98.45% users perceived reduction Retroactive labelling: CPA-8: 100 % users perceived reduction	Regular verification: CPA-1: 99.03 % CPA-2: 97.46% CPA-3: 99.06 % CPA-4: 99.13 % CPA-5: 96.85 % CPA-6: 99.07 % CPA-7: 100 % CPA-8: 96.72% CPA-9: 98.45% Retroactive labelling: CPA-8: 100 %																																																																																																																																										
	0% users perceived the reduction in different health problem	<table><tr><th rowspan="2">CPAs</th><th colspan="4">% HH perceived reduction in</th></tr><tr><th>Eye infect ion</th><th>Respi rator y</th><th>Coug h</th><th>Fire relat ed</th></tr><tr><td colspan="5">Regular</td></tr><tr><td>CPA-1</td><td>83.50</td><td>85.44</td><td>82.52</td><td>80.58</td></tr><tr><td>CPA-2</td><td>97.46</td><td>88.14</td><td>81.36</td><td>83.90</td></tr><tr><td>CPA-3</td><td>82.08</td><td>66.98</td><td>77.36</td><td>74.53</td></tr><tr><td>CPA-4</td><td>80.87</td><td>91.30</td><td>73.91</td><td>76.52</td></tr><tr><td>CPA-5</td><td>95.28</td><td>87.40</td><td>89.76</td><td>89.76</td></tr><tr><td>CPA-6</td><td>94.39</td><td>93.46</td><td>91.59</td><td>93.46</td></tr><tr><td>CPA-7</td><td>98.20</td><td>92.79</td><td>93.69</td><td>92.79</td></tr><tr><td>CPA-8</td><td>99.18</td><td>92.62</td><td>83.61</td><td>92.62</td></tr><tr><td>CPA-9</td><td>95.35</td><td>95.35</td><td>94.57</td><td>93.02</td></tr><tr><td colspan="5">Retroactive</td></tr><tr><td>CPA-8</td><td>70.00</td><td>76.00</td><td>98.00</td><td>97.00</td></tr></table>	CPAs	% HH perceived reduction in				Eye infect ion	Respi rator y	Coug h	Fire relat ed	Regular					CPA-1	83.50	85.44	82.52	80.58	CPA-2	97.46	88.14	81.36	83.90	CPA-3	82.08	66.98	77.36	74.53	CPA-4	80.87	91.30	73.91	76.52	CPA-5	95.28	87.40	89.76	89.76	CPA-6	94.39	93.46	91.59	93.46	CPA-7	98.20	92.79	93.69	92.79	CPA-8	99.18	92.62	83.61	92.62	CPA-9	95.35	95.35	94.57	93.02	Retroactive					CPA-8	70.00	76.00	98.00	97.00	<table><tr><th rowspan="2">CPAs</th><th colspan="4">% HH perceived reduction in</th></tr><tr><th>Eye infect ion</th><th>Respi rator y</th><th>Coug h</th><th>Fire relat ed</th></tr><tr><td colspan="5">Regular</td></tr><tr><td>CPA-1</td><td>83.50</td><td>85.44</td><td>82.52</td><td>80.58</td></tr><tr><td>CPA-2</td><td>97.46</td><td>88.14</td><td>81.36</td><td>83.90</td></tr><tr><td>CPA-3</td><td>82.08</td><td>66.98</td><td>77.36</td><td>74.53</td></tr><tr><td>CPA-4</td><td>80.87</td><td>91.30</td><td>73.91</td><td>76.52</td></tr><tr><td>CPA-5</td><td>95.28</td><td>87.40</td><td>89.76</td><td>89.76</td></tr><tr><td>CPA-6</td><td>94.39</td><td>93.46</td><td>91.59</td><td>93.46</td></tr><tr><td>CPA-7</td><td>98.20</td><td>92.79</td><td>93.69</td><td>92.79</td></tr><tr><td>CPA-8</td><td>99.18</td><td>92.62</td><td>83.61</td><td>92.62</td></tr><tr><td>CPA-9</td><td>95.35</td><td>95.35</td><td>94.57</td><td>93.02</td></tr><tr><td colspan="5">Retroactive</td></tr><tr><td>CPA-8</td><td>70.00</td><td>76.00</td><td>98.00</td><td>97.00</td></tr></table>	CPAs	% HH perceived reduction in				Eye infect ion	Respi rator y	Coug h	Fire relat ed	Regular					CPA-1	83.50	85.44	82.52	80.58	CPA-2	97.46	88.14	81.36	83.90	CPA-3	82.08	66.98	77.36	74.53	CPA-4	80.87	91.30	73.91	76.52	CPA-5	95.28	87.40	89.76	89.76	CPA-6	94.39	93.46	91.59	93.46	CPA-7	98.20	92.79	93.69	92.79	CPA-8	99.18	92.62	83.61	92.62	CPA-9	95.35	95.35	94.57	93.02	Retroactive					CPA-8	70.00	76.00	98.00	97.00
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CPA-3	82.08	66.98	77.36	74.53																																																																																																																																									
CPA-4	80.87	91.30	73.91	76.52																																																																																																																																									
CPA-5	95.28	87.40	89.76	89.76																																																																																																																																									
CPA-6	94.39	93.46	91.59	93.46																																																																																																																																									
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CPA-5	95.28	87.40	89.76	89.76																																																																																																																																									
CPA-6	94.39	93.46	91.59	93.46																																																																																																																																									
CPA-7	98.20	92.79	93.69	92.79																																																																																																																																									
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	0% users perceived the time saving for cooking for women due to biogas that reduce the exposure to indoor air pollution	Regular verification: CPA-1: 93.20% CPA-2: 98.31% CPA-3: 97.17% CPA-4: 94.92% CPA-5: 96.85% CPA-6: 100% CPA-7: 97.30% CPA-8: 100% CPA-9: 98.45% Retroactive labeling CPA-8: 99%	Regular verification: CPA-1: 93.20% CPA-2: 98.31% CPA-3: 97.17% CPA-4: 94.92% CPA-5: 96.85% CPA-6: 100% CPA-7: 97.30% CPA-8: 100% CPA-9: 98.45% Retroactive labeling CPA-8: 99%																																																																																																																																										
	0% increase in use of bio-slurry and reduction in chemical fertilizers	100% increase in bio-slurry use and decrease in chemical fertilizer use	100% increase in bio-slurry use and decrease in chemical fertilizer use																																																																																																																																										

	o % connection of toilets with biogas	Regular verification: CPA-1: 76.70% CPA-2: 78.81% CPA-3: 84.91% CPA-4: 91.30% CPA-5: 86.61% CPA-6: 90.65% CPA-7: 71.17% CPA-8: 85.25% CPA-9: 82.17% Retroactive labeling CPA-8: 99%	Regular verification: CPA-1: 76.70% CPA-2: 78.81% CPA-3: 84.91% CPA-4: 91.30% CPA-5: 86.61% CPA-6: 90.65% CPA-7: 71.17% CPA-8: 85.25% CPA-9: 82.17% Retroactive labeling CPA-8: 99%
SDG 7	o% users with primary reliance on clean fuels and technologies	Regular verification: CPA-1: 75.71% CPA-2: 88.27% CPA-3: 80.22% CPA-4: 85.73% CPA-5: 93.86% CPA-6: 79.31% CPA-7: 81.76% CPA-8: 90.16% CPA-9: 95.55% Retroactive labeling CPA-8: 73.57%	Regular verification: CPA-1: 75.71% CPA-2: 88.27% CPA-3: 80.22% CPA-4: 85.73% CPA-5: 93.86% CPA-6: 79.31% CPA-7: 81.76% CPA-8: 90.16% CPA-9: 95.55% Retroactive labeling CPA-8: 73.57%
	o% households perceived the time saving for firewood collection of women due to biogas (increasing the access to clean fuel)	Regular verification: CPA-1: 94.17% CPA-2: 97.46% CPA-3: 92.45% CPA-4: 94.92% CPA-5: 98.43% CPA-6: 99.07% CPA-7: 97.30% CPA-8: 100% CPA-9: 97.67% Retroactive labeling CPA-8: 100%	Regular verification: CPA-1: 94.17% CPA-2: 97.46% CPA-3: 92.45% CPA-4: 94.92% CPA-5: 98.43% CPA-6: 99.07% CPA-7: 97.30% CPA-8: 100% CPA-9: 97.67% Retroactive labeling CPA-8: 100%
	o Masons got training to promote biogas plants	75 Mason got training	75 mason got training

SDG 13	CPA-1: 82870.80 tCO ₂ e		
	CPA-2: 96272.60 tCO ₂ e		
	CPA-3: 87634.63 tCO ₂ e		
	CPA-4: 93702.72 tCO ₂ e	CPA-1: 4143.54 tCO ₂ e	CPA-1: 78727 tCO ₂ eq
	CPA-5: 101935.45 tCO ₂ e	CPA-2: 4813.63 tCO ₂ e	CPA-2: 91458 tCO ₂ eq
	CPA-6: 80318.31 tCO ₂ e	CPA-3: 4381.73 tCO ₂ e	CPA-3: 83252 tCO ₂ eq
	CPA-7: 82301.41 tCO ₂ e	CPA-4: 4685.14 tCO ₂ e	CPA-4: 89017 tCO ₂ eq
	CPA-8: 95960.01 tCO ₂ e	CPA-5: 5096.77 tCO ₂ e	CPA-5: 96838 tCO ₂ eq
	CPA-9: 43098.57 tCO ₂ e	CPA-6: 4015.92 tCO ₂ e	CPA-6: 76302 tCO ₂ eq
	CPA-8 (Retroactive labeling): 44579.12 tCO ₂ eq	CPA-7: 4115.07 tCO ₂ e	CPA-7: 78186 tCO ₂ eq
	Total: 808,674 tCO₂e	CPA-8: 4798.00 tCO ₂ e	CPA-8: 91162 tCO ₂ eq
		CPA-9: 2154.93 tCO ₂ e	CPA-9: 40943 tCO ₂ eq
		CPA-8 (Retroactive labeling): 2228.96 tCO ₂ eq Total: 40,434 tCO₂e	CPA-8 (Retroactive labeling): 42350 tCO ₂ eq Total: 768235 tCO₂e

E.5. Comparison of actual value of outcomes with estimates in approved PDD

Item	Values estimated in ex ante calculation of approved PDD	Actual values achieved during this monitoring period
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SDG 3	100% users percept reduction in indoor air pollution (for al CPAs)	Regular verification: CPA-1: 99.03 % users perceived reduction CPA-2: 97.46% users perceived reduction CPA-3: 99.06 % users perceived reduction CPA-4: 99.13 % users perceived reduction CPA-5: 96.85 % users perceived reduction CPA-6: 99.07 % users perceived reduction CPA-7: 100 % users perceived reduction CPA-8: 96.72% users perceived reduction CPA-9: 98.45% users perceived reduction Retroactive labelling: CPA-8: 100 % users perceived reduction																																																																					
	100% users percept the reduction in different health problem (For all CPAs)	<table><tr><th rowspan="2">CPAs</th><th colspan="4">% HH perceived reduction in</th></tr><tr><th>Eye infection</th><th>Respiratory Disease</th><th>Cough</th><th>Fire related</th></tr><tr><td colspan="5">Regular</td></tr><tr><td>CPA-1</td><td>83.50</td><td>85.44</td><td>82.52</td><td>80.58</td></tr><tr><td>CPA-2</td><td>97.46</td><td>88.14</td><td>81.36</td><td>83.90</td></tr><tr><td>CPA-3</td><td>82.08</td><td>66.98</td><td>77.36</td><td>74.53</td></tr><tr><td>CPA-4</td><td>80.87</td><td>91.30</td><td>73.91</td><td>76.52</td></tr><tr><td>CPA-5</td><td>95.28</td><td>87.40</td><td>89.76</td><td>89.76</td></tr><tr><td>CPA-6</td><td>94.39</td><td>93.46</td><td>91.59</td><td>93.46</td></tr><tr><td>CPA-7</td><td>98.20</td><td>92.79</td><td>93.69</td><td>92.79</td></tr><tr><td>CPA-8</td><td>99.18</td><td>92.62</td><td>83.61</td><td>92.62</td></tr><tr><td>CPA-9</td><td>95.35</td><td>95.35</td><td>94.57</td><td>93.02</td></tr><tr><td colspan="5">Retroactive</td></tr><tr><td>CPA-8</td><td>70.00</td><td>76.00</td><td>98.00</td><td>97.00</td></tr></table>	CPAs	% HH perceived reduction in				Eye infection	Respiratory Disease	Cough	Fire related	Regular					CPA-1	83.50	85.44	82.52	80.58	CPA-2	97.46	88.14	81.36	83.90	CPA-3	82.08	66.98	77.36	74.53	CPA-4	80.87	91.30	73.91	76.52	CPA-5	95.28	87.40	89.76	89.76	CPA-6	94.39	93.46	91.59	93.46	CPA-7	98.20	92.79	93.69	92.79	CPA-8	99.18	92.62	83.61	92.62	CPA-9	95.35	95.35	94.57	93.02	Retroactive					CPA-8	70.00	76.00	98.00	97.00
CPAs	% HH perceived reduction in																																																																						
	Eye infection	Respiratory Disease	Cough	Fire related																																																																			
Regular																																																																							
CPA-1	83.50	85.44	82.52	80.58																																																																			
CPA-2	97.46	88.14	81.36	83.90																																																																			
CPA-3	82.08	66.98	77.36	74.53																																																																			
CPA-4	80.87	91.30	73.91	76.52																																																																			
CPA-5	95.28	87.40	89.76	89.76																																																																			
CPA-6	94.39	93.46	91.59	93.46																																																																			
CPA-7	98.20	92.79	93.69	92.79																																																																			
CPA-8	99.18	92.62	83.61	92.62																																																																			
CPA-9	95.35	95.35	94.57	93.02																																																																			
Retroactive																																																																							
CPA-8	70.00	76.00	98.00	97.00																																																																			
	100% users perceived the time saving for cooking for women due to biogas that reduce the exposure to indoor air pollution (for all CPAs)	Regular verification: CPA-1: 93.20% CPA-2: 98.31% CPA-3: 97.17% CPA-4: 94.92% CPA-5: 96.85% CPA-6: 100% CPA-7: 97.30% CPA-8: 100% CPA-9: 98.45% Retroactive labeling CPA-8: 99%																																																																					
	100% increase in use of bio-slurry and reduction in chemical fertilizers	100% increase in bio-slurry use and decrease in chemical fertilizer use																																																																					

	100 % connection of toilets with biogas	Regular verification: CPA-1: 76.70% CPA-2: 78.81% CPA-3: 84.91% CPA-4: 91.30% CPA-5: 86.61% CPA-6: 90.65% CPA-7: 71.17% CPA-8: 85.25% CPA-9: 82.17% Retroactive labeling CPA-8: 99%
SDG 7	100% users with primary reliance on clean fuels and technologies	Regular verification: CPA-1: 75.71% CPA-2: 88.27% CPA-3: 80.22% CPA-4: 85.73% CPA-5: 93.86% CPA-6: 79.31% CPA-7: 81.76% CPA-8: 90.16% CPA-9: 95.55% Retroactive labeling CPA-8: 73.57%
	100% households perceived the time saving for firewood collection of women due to biogas (increasing the access to clean fuel)	Regular verification: CPA-1: 94.17% CPA-2: 97.46% CPA-3: 92.45% CPA-4: 94.92% CPA-5: 98.43% CPA-6: 99.07% CPA-7: 97.30% CPA-8: 100% CPA-9: 97.67% Retroactive labeling CPA-8: 100%
	o Masons got training to promote biogas plants	75 Mason got training
SDG 13	Regular verification: CPA-1: 61,889 tCO₂eq CPA-2: 66,236 tCO₂eq CPA-3: 66,329 tCO₂eq CPA-4: 66,397 tCO₂eq CPA-5: 65,883 tCO₂eq CPA-6: 61,565 tCO₂eq CPA-7: 61,919 tCO₂ CPA-8: 64,565 tCO₂eq CPA-9: 57,134 tCO₂eq Retroactive labeling CPA-8: 64,565 tCO₂eq	Regular verification: CPA-1: 78,727 tCO₂eq CPA-2: 91,458 tCO₂eq CPA-3: 83,252 tCO₂eq CPA-4: 89,017 tCO₂eq CPA-5: 96,838 tCO₂eq CPA-6: 76,302 tCO₂eq CPA-7: 78,186 tCO₂ CPA-8: 91,162 tCO₂eq CPA-9: 40,943 tCO₂eq Retroactive labeling CPA-8: 42,350 tCO₂eq

Regular Verification

CPA	2018	2019	2020	Total
CPA-1	21980	52437	4310	78727
CPA-2	25535	60917	5006	91458
CPA-3	23244	55451	4557	83252
CPA-4	24853	59290	4874	89017
CPA-5	27037	64500	5301	96838
CPA-6	21303	50821	4178	76302
CPA-7	21829	52076	4281	78186
CPA-8	25452	60720	4990	91162
CPA-9	0	36237	4706	40943
Total	191233	492449	42203	725885

Retroactive labelling

CPA	2017	2018	Total
CPA-8 (labeling)	13573	28777	42350
Total	13573	28777	42350

E.6. Remarks on difference from estimated value in approved PDD

Since the emission reduction calculation is based on the digester operational, corresponding values for the calorific value of woody biomass and the corresponding monitoring period. So, the reasons for the differences from estimated values for each CPAs are elaborated below:

CPA-1:

For the CPA-1, ex-ante annual estimate for the emission reduction is 61,889 tCO₂eq which was estimated based on the operational status of 93.3% and the net calorific value of the woody biomass as 0.015 TJ/tonne. During this monitoring period (548 days), the operational status of the CPA-1 is found as 75.71% and the actual value of the net calorific value for the woody biomass is 15.6 TJ/Gg (i.e. 0.0156 TJ/Tonne) is taken as per the IPCC guideline as stipulated in PDD. The calculation for corresponding ex-ante estimate for the monitoring period is 92,918 tCO₂eq whereas the emission reduction achieved is 78,727 tCO₂eq. So, the reduction in achieved value is due to the lower operational status than the value used in ex-ante calculation. For other SDGs, as the survey was based on the perception, the deviation was found accordingly. The value achieved for this monitoring period is higher than the annual estimate given in PDD due to the longest monitoring period (more than 1 year).

CPA-2:

For the CPA-2, ex-ante annual estimate for the emission reduction is 66,236 tCO₂eq which was estimated based on the operational status of 99.8 % and the net calorific value of the woody biomass as 0.015 TJ/tonne. During this monitoring period (548 days), the operational status of the CPA-2 is found as 88.27% and the actual value of the net calorific value for the woody biomass is 15.6 TJ/Gg (i.e. 0.0156 TJ/Tonne) is taken as per the IPCC guideline as stipulated in PDD. The calculation for corresponding ex-ante estimate for the monitoring period is 99,445 tCO₂eq whereas the emission reduction achieved is 91,458 tCO₂eq. So, the reduction in achieved value is due to the lower operational status than the value used in ex-ante calculation. For other SDGs, as the survey was based on the perception, the deviation was found accordingly. The value achieved for this monitoring period is higher than the annual estimate given in PDD due to the longest monitoring period (more than 1 year).

CPA-3:

For the CPA-3, ex-ante annual estimate for the emission reduction is 66,329 tCO₂eq which was estimated based on the operational status of 99.8 % and the net calorific value of the woody biomass as 0.015 TJ/tonne. During this monitoring period (548 days), the operational status of the CPA-3 is found as 80.22% and the actual value of the net calorific value for the woody biomass is 15.6 TJ/Gg (i.e. 0.0156 TJ/Tonne) is taken as per the IPCC guideline as stipulated in PDD. The calculation for corresponding ex-ante estimate for the monitoring period is 99,584 tCO₂eq whereas the emission reduction achieved is 83,252 tCO₂eq. So, the reduction in achieved value is due to the lower

operational status than the value used in ex-ante calculation. For other SDGs, as the survey was based on the perception, the deviation was found accordingly. The value achieved for this monitoring period is higher than the annual estimate given in PDD due to the longest monitoring period (more than 1 year).

CPA-4:

For the CPA-4, ex-ante annual estimate for the emission reduction is 66,397 tCO₂eq which was estimated based on the operational status of 99.8 % and the net calorific value of the woody biomass as 0.015 TJ/tonne. During this monitoring period (548 days), the operational status of the CPA-4 is found as 85.73% and the actual value of the net calorific value for the woody biomass is 15.6 TJ/Gg (i.e. 0.0156 TJ/Tonne) is taken as per the IPCC guideline as stipulated in PDD. The calculation for corresponding ex-ante estimate for the monitoring period is 99,686 tCO₂eq whereas the emission reduction achieved is 89,017 tCO₂eq. So, the reduction in achieved value is due to the lower operational status than the value used in ex-ante calculation. For other SDGs, as the survey was based on the perception, the deviation was found accordingly. The value achieved for this monitoring period is higher than the annual estimate given in PDD due to the longest monitoring period (more than 1 year).

CPA-5:

For the CPA-5, ex-ante annual estimate for the emission reduction is 65,883 tCO₂eq which was estimated based on the operational status of 99.8 % and the net calorific value of the woody biomass as 0.015 TJ/tonne. During this monitoring period (548 days), the operational status of the CPA-5 is found as 93.86 % and the actual value of the net calorific value for the woody biomass is 15.6 TJ/Gg (i.e. 0.0156 TJ/Tonne) is taken as per the IPCC guideline as stipulated in PDD. The calculation for corresponding ex-ante estimate for the monitoring period is 98,915 tCO₂eq whereas the emission reduction achieved is 96,838 tCO₂eq. So, the reduction in achieved value is due to the lower operational status than the value used in ex-ante calculation. For other SDGs, as the survey was based on the perception, the deviation was found accordingly. The value achieved for this monitoring period is higher than the annual estimate given in PDD due to the longest monitoring period (more than 1 year).

CPA-6:

For the CPA-6, ex-ante annual estimate for the emission reduction is 61,565 tCO₂eq which was estimated based on the operational status of 99.8 % and the net calorific value of the woody biomass as 0.015 TJ/tonne. During this monitoring period (548 days), the operational status of the CPA-6 is found as 79.31 % and the actual value of the net calorific value for the woody biomass is 15.6 TJ/Gg (i.e. 0.0156 TJ/Tonne) is taken as per the IPCC guideline as stipulated in PDD. The calculation for corresponding ex-ante estimate for the monitoring period is 92,432 tCO₂eq whereas the emission reduction achieved is 76,302 tCO₂eq. So, the reduction in achieved value is due to the lower operational status than the value used in ex-ante calculation. For other SDGs, as the survey was based on the perception, the deviation was found accordingly. The value achieved for this monitoring period is higher than the annual estimate given in PDD due to the longest monitoring period (more than 1 year).

CPA-7:

For the CPA-7, ex-ante annual estimate for the emission reduction is 61,191 tCO₂eq which was estimated based on the operational status of 99.8 % and the net calorific value of the woody biomass as 0.015 TJ/tonne. During this monitoring period (548 days), the operational status of the CPA-7 is found as 81.76 % and the actual value of the net calorific value for the woody biomass is 15.6 TJ/Gg (i.e. 0.0156 TJ/Tonne) is taken as per the IPCC guideline as stipulated in PDD. The calculation for corresponding ex-ante estimate for the monitoring period is 91,870 tCO₂eq whereas the emission reduction achieved is 78,186 tCO₂eq. So, the reduction in achieved value is due to the lower operational status than the value used in ex-ante calculation. For other SDGs, as the survey was based on the perception, the deviation was found accordingly. The value achieved for this monitoring period is higher than the annual estimate given in PDD due to the longest monitoring period (more than 1 year).

CPA-8:

For the CPA-8, ex-ante annual estimate for the emission reduction is 64,565 tCO₂eq which was estimated based on the operational status of 99.8 % and the net calorific value of the woody biomass as 0.015 TJ/tonne. The values are monitored for the CPA-8 for two consecutive monitoring periods. For the retroactive labelling of the CERs issued MP-5 of PoA, the monitoring period of 312 days only is taken and the operational status for that period was found as 73.57% and the actual value of the net calorific value for the woody biomass is 15.6 TJ/Gg (i.e. 0.0156 TJ/Tonne) is taken as per the IPCC guideline as stipulated in PDD. The calculation for corresponding ex-ante estimate for the monitoring period is 55,190 tCO₂eq whereas the emission reduction achieved is 42,350 tCO₂eq. So, the reduction in achieved value is due to the lower operational status than the value used in ex-ante calculation. Also, the monitoring period considered is less than one year, the achieved value is lower than the annual estimate given in PDD.

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For the monitoring period 6 (MP-6) of the PoA, the monitoring period covers 548 days. The operational status of the CPA-8 during this period is found as 90.16 % and the actual value of the net calorific value for the woody biomass is 15.6 TJ/Gg (i.e. 0.0156 TJ/Tonne) is taken as per the IPCC guideline as stipulated in PDD. The calculation for corresponding ex-ante estimate for the monitoring period is 96,936 tCO₂eq whereas the emission reduction achieved is 91,162 tCO₂eq. So, the reduction in achieved value is due to the lower operational status than the value used in ex-ante calculation. For other SDGs, as the survey was based on the perception, the deviation was found accordingly. The value achieved for this monitoring period is higher than the annual estimate given in PDD due to the longest monitoring period (more than 1 year).

CPA-9:

For the CPA-9, ex-ante annual estimate for the emission reduction is 57,134 tCO₂eq which was estimated based on the operational status of 99.8 % and the net calorific value of the woody biomass as 0.015 TJ/tonne. During this monitoring period (261 days), the operational status of the CPA-9 is found as 95.55 %. The calculation for corresponding ex-ante estimate for the monitoring period is 40,855 tCO₂eq whereas the emission reduction achieved is 40,943 tCO₂eq. The emission reduction achieved during the monitoring period is higher than the ex-ante value calculated for the monitoring period even the monitored operational percentage is slightly lower than the assumed operational percentage for ex-ante calculation. The main reason is the use of updated value of the calorific value for the non-renewable biomass as per the approved PoA-DD. Page 24 of the registered PoA-DD mentioned the use of up-to-date value as per IPCC guideline for the calculation. The net calorific value used for the ex-ante calculation was 0.015 TJ/tonne whereas the actual value of the net calorific value for the woody biomass is 15.6 TJ/Gg (i.e. 0.0156 TJ/Tonne). This value has been updated in the methodology AMS I.E version 8 (see para 14 of the AMS I.E version 8 for the reference). So, due to the use of calorific value of 0.0156 TJ/tonne instead of 0.015 TJ/tonne for this monitoring period, the ER value is slightly higher than ex-ante for CPA-9. This is in-line with the registered PoA-DD. For other SDGs, as the survey was based on the perception, the deviation was found accordingly. However, the total emission reduction for the monitoring period is lower than the annual estimate given in PDD as the monitoring period is less than one year.

For calculation of the ex-ante emission reduction for corresponding monitoring period and the emission reduction achieved during the monitoring period are given in ER calculation sheet.

SECTION F. Stakeholder inputs and legal disputes

- F.1. List all inputs/grievances which have been received for the project during the monitoring period together with their respective answers/actions**

No any grievances/input was received during this monitoring period.

- F.2. List all inputs/grievances from previous monitoring period where follow up action is to be verified in this monitoring period**

Not applicable as all the grievances from previous monitoring period was addressed where no follow-up are required

- F.3. Provide details of any legal contest or dispute that has arisen with the project during the monitoring period**

No such legal disputes/contest has arisen during the monitoring period