Biogas Carbon Offset Units (CoUs)

Domestic Biogas Carbon Offset Projects are feasible where non-renewable biomass used for cooking and heating water can be replaced with methane produced from cattle and kitchen waste. These projects provide rural women with a smoke free cooking environment, ridding them of the necessity to gather firewood and depend on irregular supply of kerosene through the public distribution system.

UCR reviewed information regarding the prevalence of biogas digesters in rural India has found that in the absence of biogas use as a cooking fuel, conventional fossil fuel in the form of LPG or kerosene, and non renewable biomass fuel combustion using inefficient wood stoves, is the norm. Given the common practice definition above, building and operating biogas digester plants for the purpose of generating cooking gas for households in India is clearly not common practice. Therefore, a Project that meets the regulatory criteria above and installs a biogas plant can be considered **beyond business as usual and clearly conforms to the positive list**.

Biogas Projects make measurable contribution to sustainable development of the poor and benefit their communities.

- •Replacing traditional cook stoves with biogas will eliminate indoor air pollution and improve the health of women and children
- •By converting dung to slurry, a large number of bacteria are destroyed, thus decreasing pathogen loads
- •Biogas slurry manure is far superior to farm yard manure in NPK content. It reduces the use of chemical fertilizers and increases crop production
- •Reduces pressure on natural forests and common property resources, thus arresting degradation of forests, deforestation, and leading habitat conservation
- •Creates job opportunities to local communities

The use of biogas as a cooking fuel brings an improvement in the overall quality of life. It reduces the drudgery of rural women, who have easy access to energy at the turn of a knob. Time saved can be used by them to undertake activities outside the realm of their gender rote roles.

Typically, a domestic biogas digester generates 2.7 to 3.5 tCO2-e or CoUs per annum (see table below).

Though the primary objective of these projects is to provide clean and smoke-free cooking environment to poor women in the villages, an additional objective is for them to benefit from carbon trading and get a regular and assured income through the use of their Biogas Units.

Implementation

Biogas Project implementation involves 3 phases — construction, maintenance and monitoring the emission reductions (ER). All 3 tasks are carried out in identified villages for individual families named in the Project Concept Note (PCN). Village CBOs play a vital role in the selection of participating families, assisting individual families during actual construction, and later in the CoU monitoring phase.

Construction

- •Selection of Participating Families
- •Selection & Training of Masons
- •Identifying Material Suppliers

•Actual Construction — i.e. Marking, Excavation, Supplying material and hardware; Concreting, brick work and plastering; Filling Gobar; Fixing pipes and stove; Fixing safety grills

•Commissioning

•Generating End User Agreements

Maintenance

•Logging Breakdowns & Repairs

•Setting up mutual assistance systems in the villages

•Conducting Repairs & Replacement

Monitoring

•Daily Usage Monitoring

•Generating Reports & Calculating Emission Reductions

•Verification by a DOE

•Issuance of CoUs

CoUs or Offset credits for small-scale biogas units are based on approved fossil fuel emission displacement rates established by the IPCC and other scientific studies across Asia. These rates have taken into account the size of the biogas unit, fossil fuel displaced and size of a household.

Standard biogas units (1&2 m^3) in a rural setting across Asia are credited annually at the rate of 3.5 metric tons of CO2 per unit/year, 3 m^3 will be at 4.5 metric tons of CO2 unit/year, 4 m^3 at 5.3 metric tons of CO2 unit/year and 5 m^3: 5.5 metric tons of CO2 unit/year.

Estimated emission reductions(rounded down)

Type	1-2 cubic meter	3 cubic meter	4 cubic meter	5 cubic meter	>5 cubic meter
CoUs	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 rates.

Units of larger sizes may use the applicable methodology to calculate the crediting rate and will be credited at the 5 cubic meters rates.

Some biogas units larger than 5 cubic meters could be used for generation of power for self use, for large scale units the metering of the units would need to be used in the calculations and also the methane avoidance crediting would be taken into account. In such cases, units may be generating electricity for grid/private use and can avail renewable energy emission avoidance as well.

Other Default Values:

The objective is to formulate an emission displacement factor that is representative of the cooking fuel mix in rural areas of India. This emission displacement factor provides the basis for crediting biogas digester plants under the rationale explained earlier in the UCR Program Protocol. The

general approach to estimating the Rural India Emission Displacement Factor involves computing the business as usual energy usage from fossil fuel and non renewable biomass sources in India. The fuel mix in rural India relies heavily on traditional biomass based fuels (fuel wood, crop residue and animal dung) along with Kerosene and LPG which account for about 2% of total rural energy consumption. The quantity and type of fuel mix in a representative rural Indian household can then be converted, using standard fuel emission factors, to provide the emission displacement factors. The underlying assumption is that rural Indian households with biogas units will rely solely upon biogas to meet their cooking fuel needs. While this is predominantly the case, a combination of conservative crediting rules and appropriate monitoring and verification procedures are used herein to confirm that this assumption.

The next section provides the basis for estimating the fuel mix for a representative household in rural India.

Estimation of Fuel Mix per Household in Rural India

Fuel Wood

Fuel wood is the primary domestic energy source contributing 78% of rural energy needs. Household consumption of fuel wood used depends on a variety of factors including availability and ease of collection, proximity to urban areas, socio-economic status, availability of clean and efficient forms of commercial fossil energy (LPG and Kerosene), fuel efficient cooking equipment, relative price of fuels and inter-fuel substitutability.

For the purpose of arriving at a realistic national figure for avoided emissions, we use estimates from several peer reviewed literature sources to arrive at a standard fuel wood consumption estimate of **3306 kilograms per year per rural household**.

NCV Net calorific value of the non-renewable woody biomass that is substituted	Use IPCC default for wood fuel: 0.0156 TJ/tonne
$f_{NRB,y}$ or fraction of non-renewable biomass	Use 65% (conservative estimate)

It is important to distinguish between the renewable and non renewable portions of the above fuel woods. There is a range of estimates that suggests that 65% to 80% of the above fuel wood occurs through forest extraction. This fuel wood is necessarily extracted illegally as there is a ban on fuel wood extraction from forests in India.

This portion of biomass is considered non-renewable in the sense that the Forest Department is not able to plan, and therefore keep up with the required replanting to supply sufficient biomass fuel for combustion for cooking and water heating. For purposes of this estimation and in the interest of being conservative, we use the lower bound of estimates (i.e. 65%) to account for the non-renewable portion of total fuel wood usage will be utilized.

Kerosene and LPG consumption

The per capita consumption of kerosene in rural India has been estimated to be 0.68 litres per month. Using these figures average kerosene consumption for a medium sized rural household (i.e. 5 family members) in India is computed to be 40.8 liters per year.

Similarly, per capita LPG consumption in rural areas is 0.04 kilograms per month. Using these figures average LPG consumption for a medium sized rural household in India is computed to be 2.4 kilograms per year.

The next section of the document uses standard IPCC emission factors to determine the Rural Emission Displacement Factor. Although burning fire wood in efficient basic mud stoves that

dominate rural households produce variety of other potentially global warming gases such as Non methane hydrocarbons (NMHC) and carbon monoxide. The current analysis accounts for the release of conventional GHG's of CO2, methane and nitrous oxide from wood burning.

Table 1 provides greater detail on estimating the household displacement factor for rural Asia based on the above data.

Table 1	Data	Emission Coeff	Emission Reductions tCO2
Household Size	5 members		
Total firewood (kilograms) /year	3306		
Non renewable firewood (kilograms) [65% of total wood]	2149	1784.6 grams per kg wood	3.83
Kerosene (liters) /yr	40.8	0.0026 metric tons per liter	0.106100
LPG (kilograms) /yr	2.4	0.003 per kilogram	0.00720
		Total	3.94000
CoU conservative estimate 10% discount			3.50 CoU/yr

Estimated emission reductions(rounded down)

Type	1-2 cubic meter	3 cubic meter	4 cubic meter	5 cubic meter	>5 cubic meter
CoUs	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 rates.