Comments on I.K. – Solar Cookers for Households (Version 01)
Submitted by Solar Household Energy

Estimation of Emission Factor

The latest CDM Methodology **I.K. –Solar Cookers for Household (Version 01)** appears to have embraced the lessons from previous projects in determining emission factor values. A Clean Development Mechanism solar cookstove project in Indonesia has used measures of effective power and efficiency of replaced cookstove along with an approximation of time of cookstove operation. The emission factor used for computation in this project was 0.10963 kgCO_2/MJ. This emission factor is based on the carbon emission factor of solid biomass (CDM, 2005). In other CDM solar cookstove projects carried out in China, an emission factor of coal at 0.0946 kg$C0_2$/MJ is used for computation (CDM,2006; CDM,2006a; CDM, 2006b).

The current I.K. methodology for Solar Cookers, relyies on AMS I.E. Version 04 to establish an emission factor for non-renewable woody biomass at 0.0816 kgCO_2/MJ. This approximation acknowledges solid biomass (coal), liquid fossil fuel (LPG) (kerosene), and gaseous fuel (LPG) as existing and possible substitutes for fuel wood. I.K. Version 01 is based on the premise that fuel wood will be replaced by coal (50%), kerosene (50%), or LPG (50%). This is questionable as many studies reveal that fuel wood is used for majority of cooking and households continue to depend on it. Additionally, no mention is made of transferring to solar cooking, which actually produces no emissions.

Several studies reveal an emission factor of wood-burning cookstoves. Bhattacharya and Albina (2002) have carried out experiments with 24 wood burning cookstoves to determine the ratio of CO_2 (in grams) over wood (in kgs). The following table summarizes the findings of this study.

Table 1: Emission Factors of Wood Burning Cookstoves
Source: (Bhattacharya and Albina, 2002)

Cookstoves		**Emission Factors (g/ kg fuelwood)**					**Emission Factor (kgC02e/ MJ)***
	Efficiency	**CO**	**CO_2**	**CH_4**	**TNMOC**	**NO_x**	**CO2**
Wood as Fuel							
Cambodian Traditional	11	25.3±0.9	1580	2.7±0.4	22.4±1.2	0.010±0.001	0.081025641
Lao Traditional	14.3	27.3±0.8	1597	8.4±0.5	16.3±1.4	0.100±0.001	0.081897436
Vietnamese Traditional	15	38.6±1.0	1608	3.9±0.4	3.3±0.6	0.070±0.001	0.082461538
Nepalese One-pot Ceramic	10.5	136±3.7	1344	26.8±1.7	20.4±1.6	0.100±0.001	0.068923077
Thai Bucket Cookstove	14	26.4±0.7	1596	10±0.6	8.9±0.5	0.120±0.001	0.081846154

Roi-et Clay	11.2	22.1±0.9	1626	4.2±1.3	2.8±0.4	0.100±0.001	0.083384615
Roi-et Cement	11.4	20.05±1.0	1625	5.0±0.6	3.4±0.4	0.120±0.001	0.083333333
RTFD Improved Wood/Char	15	19.1±2.4	1603	10.8±0.6	6.5±1.0	0.110±0.001	0.082205128
Rungsit Stove	12	25.2±1.2	1584	11±0.5	10.2±1.3	0.100±0.001	0.081230769
Chinese Traditional	12.2	24.4±2.2	1570	5.4±0.8	8.4±1.2	0.100±0.001	0.080512821
Malaysian Traditional	9.5	28.7±1.9	1562	8.1±0.2	6.2±0.4	0.160±0.001	0.080102564
QB Phil Charcoal/Wood	23	45.1±4.8	1568	9.7±0.4	9.5±0.4	0.200±0.004	0.080410256
Phil. Charcoal/Wood	12	28.6±1.2	1603	8.9±0.6	7.5±0.6	0.170±0.004	0.082205128
Nepali One-pot Metal	13	136±9	1344	26.8±4.6	20.4±4.9	0.070±0.004	0.068923077
Nepali Two-pot Ceramic	13	113±11	1408	29.5±6.6	7.8±1.2	0.050±0.004	0.072205128
Nepali Two-pot Metallic	15	45.6±4.5	1530	18.9±2.8	14.2±1.9	0.070±0.002	0.078461538
Lao Improved Cookstove	18.4	51.9±2.5	1565	6.0±0.6	10.0±0.3	0.190±0.003	0.08025641
Vietnamese Improved Cookstove	17.5	47.1±4.5	1577	5.3±1.0	7.6±0.8	0.150±0.004	0.080871795
Indian “Harsha” Cookstove	25.2	41.2±1.6	1597	12.3±0.9	7.7±0.4	0.200±0.003	0.081897436
Saengpen, nam Char/Wood Clay	20.2	16.8±1.4	1613	10.0±0.4	5.3±0.8	0.200±0.003	0.082717949
Saengpen, nam Char/Wood Cement	17.5	15.4±2.0	1612	10.5±0.3	5.5±0.8	0.150±0.004	0.082666667
Bang Sue Stove	18.2	22.1±0.5	1585	12.4±1.2	9.5±0.3	0.110±0.004	0.081282051
Bang Sue Modified Stove	21.7	24.7±0.8	1581	14.0±1.9	7.9±0.8	0.130±0.004	0.081076923
Malaysian Improved Stove	19.7	18.7±1.8	1603	13.7±1.2	9.3±0.3	0.110±0.004	0.082205128

*Computed with $C0_2$ data (only) and by using 19.5 MJ/kg as heating value for wood as used in Bhattacharya and Albina (2002)

It can be observed from the table above that emission factors, estimated with data from Bhattacharya and Albina (2002) and with heating value of dry fuel wood approximated at 19.5 MJ/kg, are comparable and more representative than the emission factor suggested by the IPCC in this methodology.

Monitoring

The suggested method of monitoring could support encourage interactions between households on issues relating to solar cooking. Social mechanisms like responsible groups and peer monitoring have been used by Microfinance Institutions (MFIs) to increase access to finance and to encourage sound financial investments. User groups can be formed within communities targeted by solar cookstove programs and similar dynamics of peer monitoring can be employed to ensure households successfully adopt solar cookstoves.

The implications could be even greater where solar cookstoves are financed by intermediaries. The returns from solar stoves are related positively with frequency of use. Assortative matching allows users that have higher application and users that have lower application of solar stoves to assemble into different groups. Assortative matching can reduce interest rates for all groups borrowing from finanical intermediaries to purchse solar cookstoves. Further, for the lending agencies, group lending gives the opportunity to identify attributes of households most likely to use solar stoves. Groups of borrowers well informed of each other cannot only help in resolving adverse selection and in benefiting the financers but can also contribute to maintaining successful adoption(use) rate. This can help in creating positive perception of solar stoves during early stages of dissemination.

In group lending schemes with joint liability, members of the groups can be expected to encourage each other to increase their frequency of use. In group liability schemes without joint liability but with group (public) meetings, borrowers sensitive to their reputation may choose to increase their use rate and thus their savings (returns) from solar stoves. In either case, the increase in use rate among the borrowers increases repayments by the borrowers.Adoption of solar stoves might depend as much on behavioral changes as it may depend on economic benefits. Under group lending schemes, the borrowers have sufficient incentives to monitor the cooking behavior of their peers such that their payoffs and that of the group as a whole increases.Therefore concerns of economic benefits among the borrowers can induce behavioral changes after financing of solar stoves.

Projects relying on meeting carbon offset goals for financing may be able to develop innovative incentive structures if they engage in participatory monitoring.

Finally, it is important to emphasize that the monitoring and evaluation objectives should support program objectives, rather than pursue their own methodological objectives. An example of counterproductive Monitoring and Evaluation design would be to select program beneficiaries in a way prescribed by the methodology (randomize within an inappropriate sample universe) but not in a way that would support the program's desired impact (randomize within universe of potential users).

References

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