Calculating Emissions Reductions

ARECOP PIN workshop, Phnom Penh 3rd -7th September

Emission Reductions

$$ER,y = BE,y – (PE,y + L)$$

ER,y = Emission Reductions per year

BE,y = Baseline Emissions per year

PE,y = Project Emissions per year

L = Leakage

Methodology

UNFCCC category-Type II [Energy Efficiency Improvement Projects]
The Sub-category is part of the voluntary market:
Voluntary Emission Reductions - Improved Efficiency in Use of Non-Renewable Biomass as issued by the Climate Care Trust, based on modifications of proposed methodology SSC.II.G. by the Joanneum Institute.

Emissions Reductions Equation

$$ER,y = B_{y,savings} * NCV_{biomass} * EF_{non\text{-}renewable\ biomass,\ CO2}$$

$$B_{y,savings} = B_{y,old} - B_{y,\ new}$$

$$B_{y,\ savings} = By * (1 - \eta_{old} / \eta_{new})$$

1) Calculating Biomass Savings

Step 1. How many stoves are replaced ?	
Data Requirement	**Data Source**
Number of stoves produced	Stove sales data (producer)
How long from production to use?	Stove sales data (retailer)
Equipment ratio	Number of stoves per family
Replacement rate	Stove lifetime

Y	M	Monitoring Period		$n_{stoves\ sold}$	$n_{stoves\ sold,\ m-36}$	$n_{stoves\ in\ use,\ m}$
		from	to	Qty sold		
1	**1**	10-May-03	9-Jun-03	2205	0	
	2	10-Jun-03	9-Jul-03	2331	0	2205
	3	10-Jul-03	9-Aug-03	2362	0	4536
	4	10-Aug-03	9-Sep-03	2630	0	6898
	5	10-Sep-03	9-Oct-03	2341	0	9528
	6	10-Oct-03	9-Nov-03	3035	0	11869
	7	10-Nov-03	9-Dec-03	2261	0	14904

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2) Calculating Baseline emissions

Step 2: Calculate traditional consumption /Baseline consumption

Province / City	Frequency
Phnom Penh	175.00
Kg. Chhnang	55.00
Kendal (Tamou)	36.00
Siem Reap	40.00
Kg. Thom	34.00
Kg. Chham	45.00
Total	385.00

Stove Type	Number	Average Consumption	KG/ Month	KG/ Day	Tones/month
TLBS (CHARCOAL)	256.03	7638.86	32.12	1.06	0.03212
TLBS (WOOD)	256.03	8942.02	37.64	1.24	0.03764

Wood charcoal ratio 6:1 (IPCC)

y	m	Monitoring Period		$n_{stoves\ sold}$	$n_{stoves\ sold,\ m-36}$	$n_{stoves\ in\ use,\ m}$	$B_{wood\ m,y}$	$B_{charcoal\ m,y}$
		from	to	Qty sold				
1	**1**	10-May-03	9-Jun-03	2205	0			
	2	10-Jun-03	9-Jul-03	2331	0	2205	64.8	356.91
	3	10-Jul-03	9-Aug-03	2362	0	4536	133.4	683.0
	4	10-Aug-03	9-Sep-03	2630	0	6898	202.8	1038.6
	5	10-Sep-03	9-Oct-03	2341	0	9528	280.2	1434.6
	6	10-Oct-03	9-Nov-03	3035	0	11869	349.0	1787.1
	7	10-Nov-03	9-Dec-03	2261	0	14904	438.3	2244.1
2	**8**	10-Dec-03	9-Jan-04	2251	0	17165	504.8	2584.5

3. Calculate biomass savings

Household Fuel Cooking Test (HFCT) to compare two models of stoves in a field condition to estimate the fuel consumption.

- Sample households are identified based on the number of stoves distributed in a particular area. The identification is based on the records of the stove buyers from the retail shops.

- Family members of the participating household are identified and the equivalent adults calculated based on the format provided by UNICEF.

	Number of people	Conversion factor	Equivalent adult
Children under 14		X 0.5	
Female above 14 years		X 0.8	
Adult men above 14 and under 59 years		X 1	
Adult men above 59 years		X 0.8	
Total equivalent adult			

The Household fuel Cooking test

- A menu is prepared for each day of the week and will be repeated cooking with the other stove type.

	Breakfast	Lunch	Dinner
Monday		fried fish ,fried bean	sour soup with ingredients, grilled beef
Tuesday	fried pork	fried cabage, fried egg	boiled chicken, fried vegetable
Wednesday		sour soup with cabage,grilled fish	grilled fish, fried pork
Thursday		Somlor Praher in Khmer,grilled fish	boiled chicken,grilled fish
Friday		Vietnamese sour soup,fried fish	fried pork
Saturday	boiled egg	beet soup, fried fish	cooking with sea fish
Sunday	fried fish	Somlor Praher in Khmer,grilled fish	grilled fish

The Household fuel Cooking test

Fuelwood is provided to each household with identical humidity content, size and species of wood. After the test the remaining fuelwood is measured to determine the amount of fuelwood used.

The families are instructed to only use water from the water containers provided by the technicians. The water from the water containers are only for cooking purposes. Each day the containers are filled up again by the technicians so the exact amount of water used for cooking can be determined.

Rice is used from the inventory. The cooks know how much they need per meal. The amount of rice used every day was recorded.

Every morning (before lunch time), the quantity of rice cooked, daily water used and amount of wood used for cooking is checked for every household participating in the test.

All the household members who were present in traditional cookstove testing period should be also available in improved cookstove testing period.

The Household Fuel Cooking test

Traditional Stove test

Average	Rice	Water	Charcoal	PFS %
Consumption/week for one family(kg)	13.6	94.2	14.8	
Consumption/day for one family(kg)	1.9	13.5	2.1	
Consumption/week/eq.adult	2.9	20.2	3.2	
Consumption/day/eq.adult	0.4	2.9	0.5	

Improved Stove Test

Average	Rice	Water	Charcoal	
Consumption/week for one family(kg)	13.6	94.4	11.6	
Consumption/day for one family(kg)	1.9	13.3	1.7	21.8
Consumption/week/eq.adult	2.9	20.3	2.5	
Consumption/day/eq.adult	0.4	2.9	0.4	

NB Rainy and Dry seasons

y	m	monitoring	period		$n_{stoves\ sold}$	$n_{stoves\ sold,\ m-36}$	$n_{stoves\ in\ use,\ m}$	$B_{wood\ m,y}$	$B_{charcoal\ m,y}$	$B_{m,wood\ saving}$	$B_{m,charcoalsaving}$	$B_{m,saving}$
		from	to	Qty sold								
1	**1**	10-May-03	9-Jun-03	2205	0							
	2	10-Jun-03	9-Jul-03	2331	0	2205	64.8	356.91	13.5	75.7	89.2
	3	10-Jul-03	9-Aug-03	2362	0	4536	133.4	683.0	27.9	144.8	172.7
	4	10-Aug-03	9-Sep-03	2630	0	6898	202.8	1038.6	42.4	220.2	262.6
	5	10-Sep-03	9-Oct-03	2341	0	9528	280.2	1434.6	58.5	304.1	362.7
	6	10-Oct-03	9-Nov-03	3035	0	11869	349.0	1787.1	72.9	378.9	451.8
	7	10-Nov-03	9-Dec-03	2261	0	14904	438.3	2244.1	91.6	475.8	567.3
2	**8**	10-Dec-03	9-Jan-04	2251	0	17165	504.8	2584.5	105.4	547.9	653.4

$$ERy = B_{y,savings} * NCV_{biomass} * EF_{non\text{-}renewable\ biomass}$$

Intergovernmental Panel on Climate Change default value (IPCC,2006) : 15.6 mj/kg

$$ERy = B_{y,savings} * NCV_{biomass} * EF_{non\text{-}renewable\ biomass,\ CO2}$$

$$EF_{non\text{-}renewable\ biomas,\ CO2} = \frac{1}{2} \cdot (EF_{CO2,\ start} + EF_{CO2,\ end})$$

$$EF_{CO2,\ start} = EF_{CO2\ non\text{-}renewable\ biomass}$$

$$EF_{CO2,\ end} = X * (\frac{\varepsilon_{stoves,\ biomass}}{\varepsilon_{stoves,\ fossil}} \cdot EF_{CO2,\ fossil}) + (1 - X) * EF_{CO2,biomass}$$

Share of fossil fuel used at the time when the project ends according to current trends.

Biomass 112 t_{co2}/TJ
Kerosene 71.5t_{co2}/TJ
LPG 63 $t_{co2/}$TJ

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												15.6	112
													temp
		from	to	Qty sold								ER m	
1	**1**	10-May-03	9-Jun-03	2205	0								
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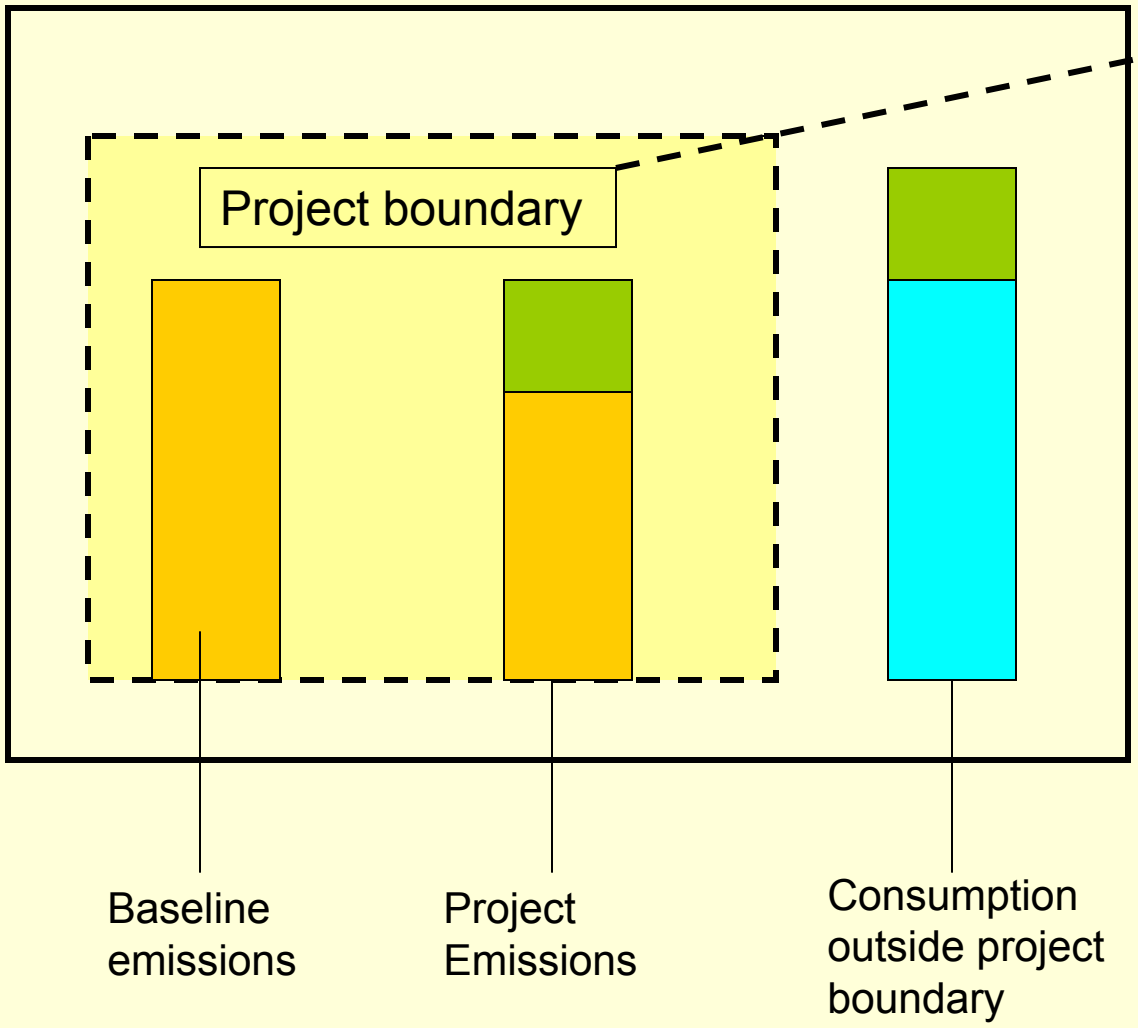
	5	10-Sep-03	9-Oct-03	2341	0	9528	280.2	1434.6	58.5	304.1	362.7	634	
	6	10-Oct-03	9-Nov-03	3035	0	11869	349.0	1787.1	72.9	378.9	451.8	789	
	7	10-Nov-03	9-Dec-03	2261	0	14904	438.3	2244.1	91.6	475.8	567.3	991	3331
2	**8**	10-Dec-03	9-Jan-04	2251	0	17165	504.8	2584.5	105.4	547.9	653.4	1142	

Leakage

Savings of non-renewable biomass due to the project activity lead to greater use of non-renewable biomass outside the project boundary



The project boundary is the physical, geographical area of the use of non-renewable biomass

If cannot accurately gauge leakage use

15% deduction

y	m	monitoring	period	$n_{stoves\ sold}$	$n_{stoves\ sold,\ m-36}$	$n_{stoves\ in\ use,\ m}$	$B_{wood\ m,y}$	$B_{charcoal\ m,y}$	$B_{m,woodsaving}$	$B_{m,charcoalsaving}$	$B_{m,saving}$	NCV biomass	Efbiomass	leakage 15%	
												15.6	112		
													temp		
		from	to	Qty sold								ER m	BE		**ER y**
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2	**8**	10-Dec-03	9-Jan-04	2251	0	17165	504.8	2584.5	105.4	547.9	653.4	1142			

Panel Discussion

Explain and check calculations for indicative calculation?

Does the project have enough data to make a full calculation?

What studies need to be carried out?