



POWERSOLVE
CARBON PROJECT TRACKING

MODEL VERIFICATION

Client	Carbon World
Project	Ubuntu Cookstoves
Monitoring Period	1
Monitoring Period Date	01 Oct 2023 - 31 Mar 2024
Project methodology	Gold Standard
Model methodology	VMR0006
Model methodology version	v1
Sampling method	Habit Survey

Project: Ubuntu Cookstoves

Inputs

Fixed Parameters	Units	Value
Efwf,CO2	tCO2e/TJ	112
Efwf,non-CO2	tCO2e/TJ	26,23
NCVbiomass	TJ/tonne of wood	0,0156
ηold	fraction	0,1
Ly	fraction	0,95
DF	fraction	0,99
ηnew	fraction	0,383

Outcome

Measure	Value
Avg. ERs per device (per annum)	1.38
Avg. Fuel savings (t) per Household	2.61
No. of ERs	48,058

Instances

Instance	Usage Rate	Baseline Usage Factor	Device Days	Devices			ERyTotalAfterDiscount
				New	Existing	Total	
Botho	82%	47%	5 583 417	2 935	29 981	32 916	48 058
Hunhu	0%	0%	7 161 431	26 679	16 941	43 620	0
Total			12 744 848	29 614	46 922	76 536	48 058

ERs By Age

Device Vintage	nNew,y	Bold,adjusted	By,Savings	Tech Days	ERy per device before usage discount			ERy per device after usage discount		
					Per device	Per day	Total ERy	Per device	Per day	Total ERy
< 1 yr old	0.3637	3.9549	2.8673	10,622,499	5.5991	0.015340	180 719	1.573110	0.002809	29 834
> 1 yr old (< 2 yrs)	0.3600	2.9097	2.1015	2,122,349	3.8315	0.010497	22 279	3.134167	0.008587	18 224
Total				12 744 848			202 998			48 058

ERs By Year

Year	nNew,y	Bold,adjusted	By,Savings	Tech Days	ERy per device before usage discount			ERy per device after usage discount		
					Per device	Per day	Total ERy	Per device	Per day	Total ERy
2023	0.3624	3.6065	2.6120	5,921,172	5.0099	0.013726	93 055	2.093463	0.003971	23 512
2024	0.3624	3.6065	2.6120	6,823,676	5.0099	0.013726	109 943	2.093463	0.003597	24 546
Total				12 744 848			202 998			48 058

Instance: Botho

Inputs

Fixed Parameters	Units	Value
Bold,i	tonnes/year	5.49
fNRB,b,y	fraction	0.89
Monitored Parameters	Units	Value
Device usage rate (Ny,i,j)	fraction	0.818
Baseline device usage factor (uy)	fraction	0.47
Device Count (N)	value	32,916

Outcome

Measure	Value
Avg. ERs per device (per annum)	3.14
Avg. Fuel savings (t) per Household	2.11
ER per day per device	0.008607
No. of Existing devices	29,981
No. of New devices	2,935

ERs By Age

Device Vintage	nNew,y	Bold,adjusted	By,Savings	Tech Days	ERy per device before usage discount			ERy per device after usage discount		
					Per device	Per day	Total ERy	Per device	Per day	Total ERy
< 1 yr old	0.3637	2.9097	2.1096	3,461,068	3.8462	0.010538	36 471	3.146221	0.008620	29 834
> 1 yr old (< 2 yrs)	0.3600	2.9097	2.1015	2,122,349	3.8315	0.010497	22 279	3.134167	0.008587	18 224
Total				5 583 417			58 750			48 058

ERs By Year

Year	nNew,y	Bold,adjusted	By,Savings	Tech Days	ERy per device before usage discount			ERy per device after usage discount		
					Per device	Per day	Total ERy	Per device	Per day	Total ERy
2023	0.3618	2.9097	2.1055	2,728,271	3.8389	0.010517	28 743	3.140194	0.008618	23 512
2024	0.3618	2.9097	2.1055	2,855,146	3.8389	0.010517	30 007	3.140194	0.008597	24 546
Total				5 583 417			58 750			48 058

Instance: Hunhu

Inputs

Fixed Parameters	Units	Value
Bold,i	tonnes/year	5
fNRB,b,y	fraction	0.99
Monitored Parameters	Units	Value
Device usage rate (Ny,i,j)	fraction	0
Baseline device usage factor (uy)	fraction	0
Device Count (N)	value	43,620

Outcome

Measure	Value
Avg. ERs per device (per annum)	0.00
Avg. Fuel savings (t) per Household	3.63
ER per day per device	0.000000
No. of Existing devices	16,941
No. of New devices	26,679

ERs By Age

Device Vintage	nNew,y	Bold,adjusted	By,Savings	Tech Days	ERy per device before usage discount			ERy per device after usage discount		
					Per device	Per day	Total ERy	Per device	Per day	Total ERy
< 1 yr old	0.3637	5.0000	3.6251	7,161,431	7.3520	0.020142	144 248	0.000000	0.000000	0
Total				7 161 431			144 248			0

ERs By Year

Year	nNew,y	Bold,adjusted	By,Savings	Tech Days	ERy per device before usage discount			ERy per device after usage discount		
					Per device	Per day	Total ERy	Per device	Per day	Total ERy
2023	0.3637	5.0000	3.6251	3,192,901	7.3520	0.020142	64 313	0.000000	0.000000	0
2024	0.3637	5.0000	3.6251	3,968,530	7.3520	0.020142	79 936	0.000000	0.000000	0
Total				7 161 431			144 248			0

Appendix A - Definitions

Definition	Description
Age	Age of the device in years
Bold,i	Quantity of biomass consumed in baseline scenario (tonnes per household per year)
DF	Discount Factor
E _{fwf,CO2}	CO2 emission factor of biomass that is substituted or reduced
E _{fwf,non-CO2}	CO2 emission factor of biomass that is substituted or reduced
ERs	Emissions Reductions (tCO2e/yr)
ER _y	Emission reduction for total project/instance activity in year y (tCO2e/yr)
f _{NRB,b,y}	Fraction of biomass used in baseline scenario, which can be established as non-renewable
L _y	Default leakage adjustment factor
MRV	
NCV _{biomass}	Net calorific value of biomass
N _{new}	Efficiency of project cookstove (fraction) determined at the start of the project activity.
N _{old}	Efficiency of the baseline cookstove being replaced
N _{y,i,j}	Device usage rate
Tech Days	Device total Days in operation
U _y	Baseline device usage factor
Vintage	Year in which the device was distributed

Appendix B - Formulas

Formula	Description
Nnew,y	$N_{new,y} * (DF^{(DeviceAge-1)}) * 0.94;$
Bold,Adjusted	$Bold,i * (1-BaselineDeviceUsageFactor)$
By,Savings	$Bold,Adjusted * (1-(Nold / Nnew,y))$
ERyPerDeviceBeforeDiscount	$By,Savings * fNRB,b,y * NCVbiomass * (E_{fwf,CO2} + E_{fwf,non-CO2}) * 1 * Ly$
ERyPerDevicePerDay	$[ERyPerDeviceBeforeDiscount] / 365$
ERyBeforeDiscount	$[ERyPerDevicePerDay] * [Tech\ days]$
ERyAfterDiscount	$[ERyBeforeDiscount] * N_{y,i,j}$
ERyPerDevicePerDayDiscounted	$[ERyAfterDiscount] / [Tech\ Days]$
ERyPerDeviceAfterDiscount	$([ERyAfterDiscount] / [Tech\ Days]) * 365$

Appendix C - Rules

Rule	Description
Period Start Date	Period Start Date must be before the Period End Date
Period Start Date	Period Start Date must be greater than or equal to the Project Inception Date
Period End Date	Period End Date must be before the Project End Date
Period	A model cannot overlap an existing active model. Actuals must be sequentially created
Model	Only a single Active / Open model is allowed for a project