



Improved Cook Stove Project Forecast Methodology Parameters

September 2022

The following is a table of parameters to be used in the Improved Cook Stove Project Forecast Methodology. The values in this table have been approved for use in this methodology by the Climate Action Reserve.

Equation No.	Data / Parameter / Description	Unit	Country / Region	Default Value	Source
5.1	Life span (Rocket stove)	years	All Sub-Saharan African (SSA) countries	7	The project device was determined to have a seven-year lifespan based on independent testing. Mizia J., Greer K., Energy Institute Colorado State University. C-Quest Capital Brick Stove Temperature Testing, 18 May 2017. The World Bank (2006) <i>World Bank</i> .

Equation No.	Data / Parameter / Description	Unit	Country / Region	Default Value	Source
5.2	μ_y Adjustment to account for continued use of pre-project device	fraction	All SSA countries	0.75	C-Quest Capital LLC. Note on Multiple Stove Use Adjustment Factors in Sub-Saharan African Improved Cookstove Projects, June 2017. Applying an adjustment of 0.75 to Bold (household woody biomass consumption) to take into consideration the continued occasional use of pre-project devices during the crediting period. This default adjustment factor takes into consideration the highest adjustment factor (worst-case scenario) determined by baseline surveys conducted in Malawi ¹ , Senegal ² , Zambia ³ , and Nigeria. ⁴ The highest factor was found in Nigeria at 0.8130 and the default value includes an additional decrease of 0.063 to bring it to a round 0.75 value. This additional amount goes above and beyond the worst-case scenario determined from four Sub-Saharan African baseline studies and accounts for any possible under-reporting of the use of baseline stoves in the crediting period.

¹ Malawi Firewood Baseline Study:

<https://cdm.unfccc.int/UserManagement/FileStorage/D6K9VSP75ZEOH3MRQFILTA0CW1NG4J>

² Senegal Firewood Baseline Study: <https://cdm.unfccc.int/UserManagement/FileStorage/D26A8Z03ICGOMEQLHWPBJVFK47P1TX9>

³ Zambia Firewood Baseline Study: <https://cdm.unfccc.int/UserManagement/FileStorage/YQIELRUOXMVNJ724FA6WDP98C0TKGB>

⁴ Nigeria Firewood Baseline Study: <https://cdm.unfccc.int/UserManagement/FileStorage/D26A8Z03ICGOMEQLHWPBJVFK47P1TX9>

Equation No.	Data / Parameter / Description	Unit	Country / Region	Default Value	Source
5.2	$f_{NRB,y}$ Fraction of woody biomass that can be established as non-renewable biomass	fraction	Malawi	0.97	Malawi: Hunter R., C4 EcoSolutions, Improved Cooking Stove Programme (Malawi): Calculating the National Non-Renewable Biomass fraction (f_{NRB}) using CDM Methodology. For C-Quest Capital LLC, March 2012. ⁵
			Nigeria	0.93	Nigeria: C-Quest Capital LLC. Fraction of Non-Renewable Biomass Assessment Nigeria, 12/11/2012. ⁶
			Zambia	0.84	Zambia: Hunter R., C4 EcoSolutions, Improved Cooking Stove Programme (Zambia): Calculating the National Non-Renewable Biomass fraction (f_{NRB}) using CDM Methodology. For C-Quest Capital LLC, October 2012. ⁷
			Kenya	0.92	Kenya: POA 5341: Improved Cooking Stoves Programme of Activities in Africa, Registered 06 December 2012. ⁸ f_{NRB} cited from CPA No. 00007 (Kenya), Included on 06 November 2017, page 14. ⁹
			Uganda	0.92	Uganda: POA 7014: Improved Cook Stoves for East Africa (ICSEA), Registered 17 August 2012. ¹⁰ f_{NRB} cited from CPA No. 0006 (Uganda), Included on 31 October 2016, page 33. ¹¹
			Zimbabwe	0.97	Zimbabwe: POA 9007: Distribution of Improved Cook Stoves in Sub-Saharan Africa. Registered 25 April 13. Renewed 01 July 2021. f_{NRB} cited from CPA 008 (Zimbabwe), Included on 19 November 2019, page 7. ¹²
5.2	NCV_{NRB} Energy value of "air-dried" firewood replaced or substituted	TJ / tonne	All countries	0.0156	IPCC (2006) <i>IPCC Guidelines for National Greenhouse Gas Inventories</i> , Vol. 2 Energy, Chapter 1, Table 1.2. ¹³

⁵ Malawi f_{NRB} : <https://cdm.unfccc.int/UserManagement/FileStorage/S32CRUG0WBNZQ16H85EVXAO9DKJTF7>

⁶ Nigeria f_{NRB} : <https://cdm.unfccc.int/UserManagement/FileStorage/T093JDIFC7Q8PLOB2KUGRYV1A64XHS>

⁷ Zambia f_{NRB} : <https://cdm.unfccc.int/UserManagement/FileStorage/ZW110RCV4AHTYXFJKD86QP39LUOBEM>

⁸ POA 5341 (Kenya): https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/T0ZKV3S1F2JH8RL75D9GQ6AMO4XNIC/view

⁹ CPA 5341-00007 (Kenya): <https://cdm.unfccc.int/UserManagement/FileStorage/H1J7ILOMAQTCKWV2XPZFDER4U6GB05>

¹⁰ POA 7014 (Uganda): https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/QMD6V3B5IHFRYW4NLX0JTKOAE21ZGS/view

¹¹ CPA 7014-0006 (Uganda): <https://cdm.unfccc.int/UserManagement/FileStorage/9BK5UTNWCVM84FG01QXLR6P3AZ2YS>

¹² POA 9007 (Zimbabwe): https://cdm.unfccc.int/ProgrammeOfActivities/cpa_db/90HPU6JXECG7MS4OYV2QIBLA3WTZ51/view

¹³ https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

Equation No.	Data / Parameter / Description	Unit	Country / Region	Default Value	Source
5.2	CO₂-EF_{NRB} Emission factor of non-renewable woody biomass that is substituted or reduced	tCO ₂ /TJ	All countries	112	2006 IPCC Guidelines for National Greenhouse Gas Inventories – Volume 2 Energy; Chapter 2 Stationary Combustion Table 2.5. ¹⁴
5.2	Non-CO₂-EF_{NRB} Non-CO ₂ (methane and nitrous oxide) Emission factor of non-renewable woody biomass that is substituted or reduced	tCO _{2e} /TJ	All countries	9.46	2006 IPCC Guidelines for National Greenhouse Gas Inventories – Volume 2 Energy; Chapter 2 Stationary Combustion, Table 2.5. ¹³ Global Warming Potential values: IPCC Fifth Assessment Report (AR5) Gold Standard Methodology: Reduced Emissions from Cooking and Heating – Technologies and Practices To Displace Decentralized Thermal Energy Consumption (TPDDTEC)., version 4.
5.2	NTG leakage Net to gross adjustment factor to account for leakage	Fraction	All countries	0.95	UNFCCC CDM AMS-II.G. Small-scale methodology: Energy efficiency measures in thermal applications of non-renewable biomass Version 08.0. ¹⁵
5.3	η_{old} Efficiency of old devices, specifically open fires such as three-stone fires or traditional pot supports	Fraction	All countries	0.10	UNFCCC CDM AMS-II.G. Small-scale methodology: Energy efficiency measures in thermal applications of non-renewable biomass Version 08.0. ¹⁶

¹⁴ http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf

¹⁵ <https://cdm.unfccc.int/methodologies/DB/DCO8WRRQVTGLH1GHQBCL035F5M13R8>

¹⁶ <https://cdm.unfccc.int/methodologies/DB/DCO8WRRQVTGLH1GHQBCL035F5M13R8>

Equation No.	Data / Parameter / Description	Unit	Country / Region	Default Value	Source
5.4	B_{old,HH} Annual quantity of woody biomass that would have been consumed using old device	Tonnes / household / year	Malawi	3.41	Malawi: Jagoe K., Bates L., Rouse J., HED Consulting Ltd. Rural Malawi AMS IIG Baseline Firewood Consumption Study, For C-Quest Capital LLC. 11 December 2012. ¹⁷ Published unadjusted B _{old} = 9.34 kg/household/day (pg. 13, Table 3.3) equivalent to 3.41 tonnes/hh/year.
			Nigeria	6.29	Nigeria: ABHAssociates. Firewood Consumption Study: Kaduna and Kano States, Nigeria, Baseline Study For C-Quest Capital LLC, 25 November 2012 (Full reported Annexed to CDM PoA 9007: Distribution of Improved Cook Stoves in Sub-Saharan Africa ¹⁸). Published unadjusted B _{old} = 17.23 kg/household/day (Section 3.2 of Study Report) equivalent to 6.29 tonnes/hh/year.
			Zambia	5.23	Zambia: Rouse J., Jagoe K., Bates L., HED Consulting Ltd. Zambia Baseline Wood Fuel Consumption Study, For C-Quest Capital LLC, 25th September 2012. ¹⁹ Published unadjusted B _{old} = 14.32 kg/household/day (pg. 33, Section 6.4) equivalent to 5.23 tonnes/hh/year.
			Kenya	4.176	Kenya: POA 5341: Improved Cooking Stoves Programme of Activities in Africa, Registered 06 December 2012. ²⁰ B _{old} cited from CPA No. 00007 (Kenya), Included on 06 November 2017, page 13. ²¹
			Uganda	3.5	Uganda: POA 7014: Improved Cook Stoves for East Africa (ICSEA), Registered 17 August 2012. ²² B _{old} cited from CPA No. 0006 (Uganda), Included on 31 October 2016, page 31. ²³
			Zimbabwe	5.92	Zimbabwe: POA 9007: Distribution of Improved Cook Stoves in Sub-Saharan Africa. Registered 25 April 13. Renewed 01 July 2021. fNRB cited from CPA 008 (Zimbabwe), Included on 19 November 2019, page 11. ²⁴
5.5	η_{new} Initial efficiency of the project device at the time of installation	fraction	All countries	0.345	Results of Testing the TLC 16 Brick Rocket Stove, conducted by Aprovecho Research Center, Advanced Studies in Appropriate Technology, October 2015. Copy of study results provided to Reserve.

¹⁷ Malawi Firewood Baseline Study: <https://cdm.unfccc.int/UserManagement/FileStorage/D6K9VSP75ZEOH3MRQFILTA0CW1NG4J>

¹⁸ Nigeria Firewood Baseline Study: <https://cdm.unfccc.int/UserManagement/FileStorage/D26A8Z03ICGOMEQLHBJVFK47P1TX9>

Equation No.	Data / Parameter / Description	Unit	Country / Region	Default Value	Source
5.5	TLR_{new} Annual loss rate in thermal efficiency of project device	fraction	All SSA countries	0.01	<p>Berkeley Air Monitoring Group. Zambia Stove Survey and Water Boiling Test, For C-Quest Capital, April 2017.</p> <p>An independent service provider, Berkeley Air Monitoring Group, provided quality assurance over a series of Water Boiling Tests (WBT) conducted in accordance with WBT protocols, by CQC and Community Markets for Conservation (COMACO) in Zambia to quantify any changes in stove thermal efficiency over time, and, if feasible, extrapolate declines in stove efficiency for older vintages. The result was that thermal efficiency increased in second year stoves compared to first year stoves, due to the bricks becoming drier over time and limiting the retained moisture in the combustion chamber. Thus, an efficiency decline of 1% per year for the entire crediting period is conservative.</p>
5.6	SLR Annual loss rate of project devices	fraction	All SSA countries	0.149	<p>Berkeley Air Monitoring Group. Zambia Stove Survey and Water Boiling Test, For C-Quest Capital, April 2017.</p> <p>The 14.9% stove loss rate was determined from a clustered random sampling survey designed and conducted by Berkeley Air in Zambia (2017). The population sampled was designed to achieve a 90/10 precision level and ended up resulting in an 8% level of precision (lower and more accurate than the 10%).</p> <p>A default schedule of linear decrease (14.9%) in stove population per year shall be applied to a specific batch of stoves until the stove population in that batch reaches zero.</p>

¹⁹ Zambia Firewood Baseline Study: <https://cdm.unfccc.int/UserManagement/FileStorage/YQIELRUOXMVNJ724FA6WDP98C0TKGB>

²⁰ POA 5341 (Kenya): https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/T0ZKV3S1F2JH8RL75D9GQ6AMO4XNIC/view

²¹ CPA 5341-00007 (Kenya): <https://cdm.unfccc.int/UserManagement/FileStorage/H1J7ILOMAQTCKWV2XPZFDER4U6GB05>

²² POA 7014 (Uganda): https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/QMD6V3B5IHFRYW4NLX0JTKOAE21ZGS/view

²³ CPA 7014-0006 (Uganda): <https://cdm.unfccc.int/UserManagement/FileStorage/9BK5UTNWCVM84FG01QXLR6P3AZ2YS>

²⁴ POA 9007 (Zimbabwe): https://cdm.unfccc.int/ProgrammeOfActivities/cpa_db/90HPU6JXECG7MS4OYV2QIBLA3WTZ51/view