



**Verified Carbon
Standard**

TUIK RUCH LEW IMPROVED COOKSTOVE PROJECT FOR LAKE ATITLAN, GUATEMALA



Document Prepared by: Ava Scott, Candis Krummel, Andy Pethan

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Prepared By	Ava Scott, Candis Krummel, Andy Pethan
Contact	Cameron Krummel, Canton Xechivoy, Santiago Atitlan, Sololá Guatemala, +502 7933 - 3061, programdevelopment@trlearnth.org , trlearnth.org

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APPENDIX

1 PROJECT DETAILS

1.1 Summary Description of the Project

TRL's Improved Cookstove (ICS) Project enables community access to sustainable energy technology by providing, installing, and maintaining energy efficient cookstoves at a subsidized rate. This social service directly addresses energy poverty in addition to several other socio-economic challenges facing the indigenous communities in the Sololá Department as a consequence of years of systemic discrimination and neglect. Through the distribution of ONIL stoves, this grouped project reduces demand for wood fuel, slowing local deforestation and empowering the Tz'utujil Maya people of Lake Atitlán, a community disadvantaged daily by extreme economic, environmental, and public health struggles.

In the project area, traditional cooking methods use a three-stone hearth to prepare meals, driving unsustainable wood consumption. By replacing open cooking fires with ICS technology and performing energy efficiency improvements in existing biomass fired cookstoves, the project reduces energy demand in the form of wood fuel, thus generating net GHG reductions. Together, the two project activities generate an estimated 12,000 tCO₂e GHG emission reductions over the seven-year project crediting period.

1.2 Sectoral Scope and Project Type

The project falls under VCS Sectoral Scope 3: Energy demand, Type II – Energy Efficiency Improvement Project, non-AFOLU, Grouped Project.

1.3 Project Eligibility

The VCS Program Guide, V4, section states “The scope of the VCS Program covers all those activities related to the generation of GHG emission reductions and removals, including jurisdictional programs and nested REDD+ projects.” By driving down energy demand, the TRL ICS Project generates net GHG emission reductions and/or removals, as measured in tCO₂e. The CDM AMS-II.G. Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass, Version 10.0, Sectoral scope(s): 03 includes the introduction of high efficiency biomass fired project devices to replace the existing devices and/or energy efficiency improvements in existing biomass fired cookstoves or ovens or dryers. The TRL ICS Project replaces traditional open cooking fires with energy efficient ONIL

stoves and performs energy efficiency improvements in existing ONIL stoves. As per the VCS Standard, V4 paragraph 2.1.1, these project activities are eligible.¹

1.4 Project Design

The project has been designed to include two project activities, each with multiple project activity instances. Both project activities apply AMS-II.G. Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass, Version 10.0. The project is a grouped project, to allow for additional project activity instances subsequent to validation/verification.

Eligibility Criteria

The project ensures that inclusion of all new project activity instances will abide by the following eligibility criteria:²

Project Activity One: Introduction of high-efficiency biomass fired project devices to replace open cooking fires		
Criterion		Achieved by:
(1)	Meet the applicability conditions as defined in CDM AMS-II.G. Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass (Version 10.0, Section 2.2).	New instances (e.g. ONIL stove installs) will meet all applicability conditions listed in section 3.2.
	Use the technologies or measures specified in the project description.	At this time and for forecasted instances, no other project device type will be used, other than ONIL stove technology.
	Apply the technologies or measures in the same manner as specified in the project description.	New instances will only apply the ONIL stove technology as specified in section 1.1.

¹ The VCS Standard, V4 paragraph 2.1.1, states, "4) Project activities supported by a methodology approved under a VCS approved GHG program, unless explicitly excluded under the terms of Verra approval."

² Developed per requirements detailed in the VCS Standard (Version 4, 3.5.15)

	<p>Are installed within the geographic area specified in Section 1.12, thus subject to the same baseline scenario determined in Section 3.4</p>	<p>The project shall only add new instances within the Sololá Department.</p>
	<p>Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area.</p>	<p>All new instances will achieve additionality via application of section 5 paragraph 10 of Tool 21: Methodological tool: Demonstration of additionality of small-scale project activities, Version 12.0, "Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers in accordance with the applied methodology." (see section 3.5).</p>

<p>Project Activity Two: Energy efficiency improvements in existing biomass fired cookstoves</p>		
<p>Criterion</p>		<p>Achieved by:</p>
<p>(1)</p>	<p>Meet the applicability conditions as defined in CDM AMS-II.G. Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass (Version 10.0, Section 2.2).</p>	<p>New instances (e.g. energy efficiency improvements in existing ONIL stoves) will meet all applicability conditions listed in section 3.2.</p>

	<p>Use the technologies or measures specified in the project description.</p>	<p>At this time and for forecasted instances, no other measure will be used other than the energy efficiency improvement in an existing ONIL stove as specified in section 1.11 .</p>
	<p>Apply the technologies or measures in the same manner as specified in the project description.</p>	<p>New instances will only apply the improved ONIL stove technology as specified in section 1.11.</p>
	<p>Are installed within the geographic area specified in Section 1.12, Project Location, thus subject to the same baseline scenario determined in Section 3.4</p>	<p>The project will only perform energy efficiency improvements in existing ONIL stoves within the Sololá Department.</p>
	<p>Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area.</p>	<p>All new instances will achieve additionality via application of section 5 paragraph 10 of Tool 21: Methodological tool: Demonstration of additionality of small-scale project activities, Version 12.0, "Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers in accordance with the applied methodology." (see section 3.5).</p>

1.5 Project Proponent

Organization name	Tuik Ruch Lew/Helping the Earth
Contact person	Cameron Krummel
Title	Administrative Director
Address	Canton Xechivoy, Santiago Atitlan, Sololá 07919, Guatemala
Telephone	+502 7933 - 3061
Email	programdevelopment@trlearth.org

1.6 Other Entities Involved in the Project

TRL is the sole entity involved in the project.

1.7 Ownership

Escritura Pública Número 802 (see appendix 3) establishes the Project Proponent as a registered not-for profit association in Guatemala. Although TRL beneficiaries possess ownership of the equipment, before installation of each project instance, beneficiaries enter into a verbal contractual agreement with TRL. Beneficiaries agree to allow TRL, as a not-for profit association, to:

- (1) Claim the GHG emission reductions and/or removals generated by the equipment used in the TRL ICS Project.
- (2) Conduct follow-up visits for monitoring purposes.³

All communication is conducted in Tz'utujil, the native language of the beneficiary.⁴ The verbal agreement is designed by our local Outreach Team to explain the environmental benefits of the ONIL stove and communicate to our beneficiaries how claiming benefits will enable the project to remain financially viable. This verbal agreement vests project ownership in the Project Proponent.⁵

1.8 Project Start Date

³ According to schedule detailed in Section 1.11

⁴ Or, in Spanish, in the rare case that the beneficiary's native language is such

⁵ Per program ownership requirements 1 and 5 detailed in the VCS Standard (Version 4, 3.6.1)

The Project Start date is Sep 1, 2018. Previously, TRL had focused on providing maintenance to the 569 stoves installed since the association's founding, and 1,355 legacy stoves installed under the Cojolya Association of Maya Women Weavers. On Sep 1, 2018, TRL began a new series of installations under the new, Improved Cookstove Project.

1.9 Project Crediting Period

The project crediting period will be from Sep 1, 2018 - Sep 1, 2025, for a total of seven years, twice renewable.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	X
Large project	

Year	Estimated GHG emission reductions or removals (tCO _{2e})
Sept 2018 - Aug 2019	400
Sept 2019 - Aug 2020	925
Sept 2020 - Aug 2021	1392
Sept 2021 - Aug 2022	1807
Sept 2022 - Aug 2023	2172
Sept 2023 - Aug 2024	2489
Sept 2024 - Aug 2025	2764
Total estimated ERs	11949
Total number of crediting years	7
Average annual ERs	1707

1.11 Description of the Project Activity

With over 30 years of combined experience in the community, the TRL team subsidizes the purchase, installation and maintenance of ONIL stoves in Guatemalan homes in the Solola Department. ONIL stoves cost Q1,200/each, including procurement and installation. However, we make them available to our clients for Q350. In addition to procurement and installation, TRL provides ongoing technological adaptation support, environmental education, and maintenance to all ONIL stove users (see SD VISTA Project Description section 1.1.2). These services are delivered across a five-visit schedule during the first year of installation and biennially over the lifetime of the ONIL stove.

Project Activity One: Introduction of high-efficiency, biomass fired project devices to replace existing devices

Beneficiaries who switch from three-stone open cooking fires to ONIL stove use for cooking purposes experience significant reduction in wood use. By replacing open cooking fires with ICS technology, TRL drives down energy demand in the form of wood fuel. Resulting yearly savings in the quantity of woody biomass burned per ONIL stove user generate net GHG emission reductions (see Section 3).⁶ The ICS technology complies with all relevant UNFCCC requirements for the Clean Development Mechanism.



Figure 2: TRL's TAS presents at a group educational seminar on ICS technology.



Figure 1: ICS Equipment - ONIL Stove

⁶ As calculated by CDM AMS-II.G. Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass (Version 10.0).

According to manufacturer specifications, the average lifetime of the equipment (see figure 2) is 10 years.⁷ Thermal efficiency is 24%⁸⁹ Stoves are manufactured locally in San Antonio Suchitepéquez.

Existing installed capacities since the project start date total 61 cookstoves. Forecast installed capacities total 600 additional stoves over the next six years (to complete the seven-year project crediting period).

Project Activity Two: Provision of energy efficiency improvements in existing biomass fired cookstoves

TRL frequently performs maintenance on ONIL stoves with severely damaged combustion chambers that are performing at subpar efficiency. For beneficiaries who undergo energy efficiency improvements to replace existing damaged ONIL stoves with new combustion chambers, the improved devices provide for significant reduction in wood use. By performing energy efficiency improvements in the existing cookstoves, TRL drives down energy demand in the form of wood fuel. Resulting yearly savings in the quantity of woody biomass burned per improved ONIL stove user generate net GHG emission reductions (see Section 3). The ICS technology complies with all relevant UNFCCC requirements for the Clean Development Mechanism.

Based on industry standards, the average lifetime of the equipment is 10 years. Specific Fuel Consumption of a new stove using a 20-tortilla Clean Cooking Test is 590g cooked tortillas per kg of wood fuel. Combustion chambers are manufactured locally in El Tejar, Chimaltenango.

Existing capacities since the project start date total 100 improved ONIL stoves. Forecast capacities total 600 additional improved ONIL stoves over the next five years (to complete the seven-year project crediting period).

1.12 Project Location

⁷ However, ONIL stoves installed and maintained by TRL are still functioning correctly after more than 15 years of use.

⁸ Aprovecho Research Center, 2004, HELPS "ONIL" Griddle Stove Fuel efficiency and Emissions, page 2.

⁹ Project Description: Distribution of ONIL Stoves – Mexico, CPA 002, page 37

The project takes place within the Sololá Department (14.70°N, 91.25°W), which includes the “Área de Uso Múltiple Cuenca del Lago Atitlán.”¹⁰ 14°38'17.63"N, 91°13'44.44"W are the coordinates of Santiago Atitlán, headquarters of the project. See KML file attached.

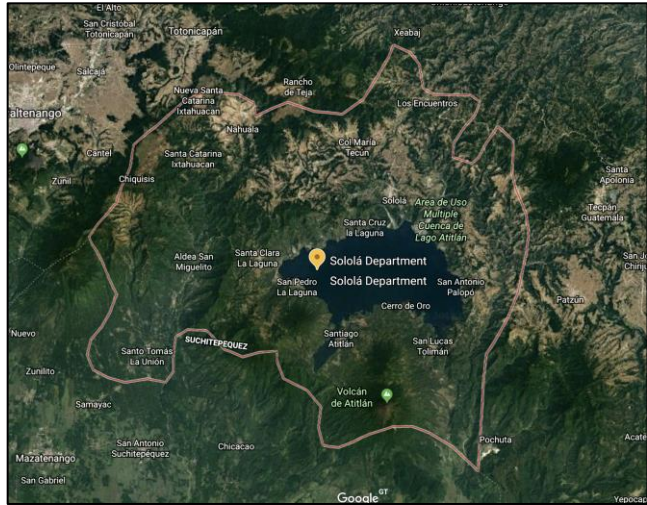


Figure 4: Map of Project Area

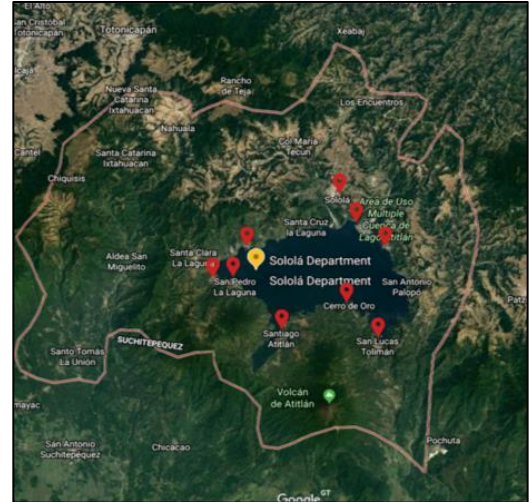


Figure 3: Geographic distribution of project devices

1.13 Conditions Prior to Project Initiation

The annual wood deficit in Guatemala is 5.7 million tons.¹¹ In the project location, the Sololá Department, 84% of homes use wood as the primary energy source for cooking.¹² The project objective is to reduce demand for wood fuel by replacing open cooking fires with ONIL stoves and performing energy efficiency improvements in existing cookstoves. Enabling access to ICS technology, the project addresses TRL's mission, which is to implement solutions to the environmental, health, and development challenges that threaten the livelihood of the Tz'utujil Maya people living in the Lake Atitlán basin.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

In 2016 Tuik Ruch Lew became a registered Guatemalan nonprofit, adhering to the registration process and all subsequent local and national laws governing nonprofit activities in the country. See Appendices 1, 2 and 3).

¹⁰ The Lake Atitlan Basin, a nature preserve designated for multiple use

¹¹ <https://www.url.edu.gt/publicacionesurl/FileCS.ashx?Id=40402>, page 6

¹² Elaboración propia a partir de los datos del Censo de Población y Vivienda 2018, Guatemala.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

To date, the project has not been registered, nor is it seeking registration under any other GHG program.

1.15.2 Projects Rejected by Other GHG Programs

To date, the project has not been rejected by any other GHG program.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

To date, project activities are not included in an emissions trading program or any other mechanism that includes GHG allowance trading.

1.16.2 Other Forms of Environmental Credit

To date, the project has not sought or received any other form of GHG-related environmental credit.

1.17 Additional Information Relevant to the Project

Leakage Management

Not applicable. The project uses a net gross adjustment factor of 95% to account for leakage.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Sustainable Development

Distribution of ICS technology is listed among Guatemala's stated sustainable development priorities.¹³

Further Information

¹³ <https://sustainabledevelopment.un.org/content/documents/16626Guatemala.pdf>, page 96

Not applicable. No additional legislative, technical, economic, sectoral, social, environmental, geographic, site-specific, and/or temporal information is relevant to the quantification of the project's net GHG emission reductions or removals.

2 SAFEGUARDS

2.1 No Net Harm

No potential negative environmental or socio-economic impacts have been identified for the project.

2.2 Local Stakeholder Consultation

In July of 2018, TRL conducted a local stakeholder consultation as part of the Second Annual International Symposium on Continental Waters of the Americas held in Panajachel, Sololá. Hosted by the Centro de Estudios Atilán - Universidad del Valle de Guatemala, the symposium brought together key stakeholders with vested interest in confronting the ecological threats facing the Lake Atilán basin. Various groups were in attendance, including CONAP,¹⁴ Amigos del Lago de Atilán,¹⁵ Legambiente,¹⁶ Africa 70,¹⁷ and ADECCAP,¹⁸ among others. TRL presented the ONIL stove technology and ICS project design to symposium attendees. Here TRL was able to gather useful feedback from several stakeholder groups, including social and environmental public-sector agencies as well as civil society organizations, and use it to modify the project design.

¹⁴ The Consejo Nacional de Áreas Protegidas is the national agency dedicated to the conservation and the sustainable use of the biological diversity and protected areas of Guatemala.

¹⁵ A local environmental NGO that works to educate, investigate, and ensure the conservation of the lake in cooperation with neighbors, scientists, local and national authorities, organizations, and universities.

¹⁶ <https://www.legambiente.it/>

¹⁷ <http://www.africa70.org/>

¹⁸ The Asociación de Desarrollo Comunitario del Cantón Panabaj is an organization dedicated to the community development of Panabaj, a neighborhood of Santiago frequently serviced by TRL.



Figure 5: TRL consults with stakeholders at the Second Annual International Symposium on Continental Waters of the Americas.

Noting the absence of several key stakeholders at this event, TRL made the decision to expand its informal consultation activities to reach affected parties with limited access to such meetings. Various relevant socio-economic and cultural barriers in the project area could impede the participation of marginalized members of the local community (e.g. registration fees, transportation fees, lack of free time). Consequently, TRL seeks consultation from these groups through direct community engagement. Consultation activities have been undertaken on an informal basis using participatory methods with previous, current, and prospective project beneficiaries. TRL staff have worked with beneficiaries, the majority of whom are indigenous women, on ICS projects for over ten years. Initially approaching the projects as an opportunity for joint experimentation, TRL installed ONIL stoves in the homes of members of the local weaving cooperative, Cojolya, constantly requesting feedback through semi-structured interviews. Leaning on this expertise, TRL has changed and adapted the systems used as well as organizational policies to reflect positive and negative feedback. The outcome of these consultations is evident in current project elements, such as the price structure and multi-visit maintenance and technology adaptation follow-up schedule.

This consultation process has been formalized within the current ICS Project. Before and after installations, beneficiaries are continually consulted through a digital survey platform to gauge successes and challenges associated with technology adoption. These consultations are conducted in the home of the beneficiary, during the morning hours when our female and elderly beneficiaries are most likely to be available. Furthermore, all consultation is conducted in Tz'utujil, by local Outreach Team Members so that beneficiaries are able to openly and clearly communicate constructive feedback and grievances. This model is intended to overcome the above-mentioned barriers to engagement in traditional stakeholder meetings. See SD VISTa Project Description section 2.28 for more detailed information and stakeholder mapping.

To document consultation outcomes, TRL's program development team generates internal reports that are shared with all staff at weekly Friday meetings. Survey data are also visualized in the project's annual reports. After discussing the consultation outcomes, if relevant, findings are used to inform modifications to project design.

2.3 Environmental Impact

No environmental impact assessments are required for the project.

2.4 Public Comments

All comments received during the public comment period will be reviewed by the Program Development and Outreach Team in a timely manner. Once jointly reviewed and discussed at weekly team meetings, TRL staff will determine if comments justify updates to the project design. If comments are deemed insignificant or irrelevant, TRL will provide written documentation of the reasoning discussed.

2.5 AFOLU-Specific Safeguards

Not required because the Improved Cookstove Project is a non-AFOLU project.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

CDM AMS-II.G. Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass, Version 10.0. Tool 30: Calculation of the fraction of

non-renewable biomass, Version 2.0. Tool 21: Methodological tool: Demonstration of additionality of small-scale project activities, Version 12.0.

3.2 Applicability of Methodology

Project Activity One: Introduction of high-efficiency, biomass fired project devices to replace the existing devices		
	Applicability Condition	Project Justification
1.	The aggregate energy savings of a single project activity will not exceed the equivalent of 60 GWh per year, or 180 GWh thermal per year in fuel input.	Aggregate energy savings do not exceed the threshold due to current and forecasted install capacities (see section 1.11). With an overestimate of 1.5 tonnes of wood saved per stove per year, and 0.005 GWh thermal energy per tonne, it would take 24,000 retrofitted stoves to reach 180 GWh of themer energy savings.
2	Non-renewable biomass has been used in the project region since 31 December 1989, using survey methods or referring to published literature, official reports or statistics.	<p>Per the following official reports and statistics, non-renewable biomass has been used in the project region since at least 1989:</p> <p>In the department of Sololá, 84% of homes use wood as the primary energy source for cooking.¹⁹</p> <p>The FAO reports that between 1990 and 2010, Guatemala lost an average of 54,550 ha of forest cover (1.15%) per year. In total, between 1990 and 2010, Guatemala lost 23.0% of its forest cover, or around 1,091,000 ha.²⁰</p> <p>According to the FAO report, "State of the World's Forests,"</p>

¹⁹ Elaboración propia a partir de los datos del Censo de Población y Vivienda 2018, Guatemala.

²⁰ <https://rainforests.mongabay.com/deforestation/2000/Guatemala.htm>

		<p>Carbon stock in living forest biomass were depleting in Guatemala, from 1990 to 2010, demonstrating a negative annual change rate.²¹</p> <table border="1"> <thead> <tr> <th colspan="4">Carbon stock in living forest biomass in Guatemala (million tonnes)</th> </tr> <tr> <th>1990</th> <th>2000</th> <th>2005</th> <th>2010</th> </tr> </thead> <tbody> <tr> <td>365</td> <td>324</td> <td>303</td> <td>281</td> </tr> </tbody> </table> <p>Remote sensing data from Global Forest Watch shows that from 2001 to 2018, Sololá lost 2.48kha of tree cover, equivalent to a 3.1% decrease in tree cover since 2000.²²</p>	Carbon stock in living forest biomass in Guatemala (million tonnes)				1990	2000	2005	2010	365	324	303	281
Carbon stock in living forest biomass in Guatemala (million tonnes)														
1990	2000	2005	2010											
365	324	303	281											
3	When the biomass is sourced from renewable sources, project participants should use a corresponding Type I methodology.	Not applicable. Tool 30 is applied to determine fNRB .												
4	If the project device requires a specific fuel for this device (e.g. briquettes, pellets, woodchips), the consumption of the fuel should be monitored during the crediting period.	Quantity of woody biomass used by project devices in tonnes per device of type i is surveyed during the crediting period (see section 5.3).												

Project Activity Two: Provision of energy efficiency improvements in existing biomass fired cookstoves		
	Applicability Condition	Project Justification
2.	The aggregate energy savings of a single project activity shall not exceed the equivalent	Aggregate energy savings do not exceed the threshold due to current and forecasted

²¹ <http://www.fao.org/3/a-i2000e.pdf>, page 125

²²

<https://www.globalforestwatch.org/map/country/GTM/19?mainMap=eyJzaG93QW5hbHlzaXMiOnRydWV9&map=eyJjZW50ZXliOnsibGF0IjoxNC43MDQ0MzE4NDgzNzExMDEslmxuZyl6LTkxLjl4NzU1MDAwMDAwMDAxfSwiYmVhcmluZyl6MCwicGI0Y2giOjAsInpvc20iOiJEWLjM0MDgyNDI4MDcyOTcyOSwiY2FuQm91bmQiOmZhbHNILCJiYm94IjpbXX0%3D>

	of 60 GWh per year or 180 GWh thermal per year in fuel input.	energy efficiency improvement capacities (see section 1.11) . With an overestimate of 3 tonnes of woody biomass savings per improved stove per year, and 0.005 GWh thermal energy per tonne, it would take 12,000 new stoves to reach 180 GWh of thermal energy savings.												
2	Non-renewable biomass has been used in the project region since 31 December 1989, using survey methods or referring to published literature, official reports, or statistics.	<p>Per the following official reports and statistics, non-renewable biomass has been used in the project region since at least 1989:</p> <p>In the department of Sololá, 84% of homes use wood as the primary energy source for cooking²³</p> <p>The FAO reports that between 1990 and 2010, Guatemala lost an average of 54,550 ha of forest cover (1.15%) per year. In total, between 1990 and 2010, Guatemala lost 23.0% of its forest cover, or around 1,091,000 ha.²⁴</p> <p>According to the FAO report, "State of the World's Forests," Carbon stock in living forest biomass were depleting in Guatemala, from 1990 to 2010, demonstrating a negative annual change rate.²⁵</p> <table border="1" data-bbox="1003 1499 1430 1692"> <thead> <tr> <th colspan="4">Carbon stock in living forest biomass in Guatemala (million tonnes)</th> </tr> <tr> <th>1990</th> <th>2000</th> <th>2005</th> <th>2010</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Carbon stock in living forest biomass in Guatemala (million tonnes)				1990	2000	2005	2010				
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²³ Censo de Población y Vivienda 2018, Guatemala.

²⁴ <https://rainforests.mongabay.com/deforestation/2000/Guatemala.htm>

²⁵ <http://www.fao.org/3/a-i2000e.pdf>, page 125

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365	324	303	281			
3	When the biomass is sourced from renewable sources, the project participants should use a corresponding Type I methodology.	Not applicable. Tool 30 is applied to determine fNRB .				
4	If the project device requires a specific fuel for this device (e.g. briquettes, pellets, woodchips), the consumption of the fuel should be monitored during the crediting period.	Specific fuel consumption during year y of the device(s) of type i deployed as part of the project that is fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour, respectively, with the age a is monitored using a CCT (see section 5.3).				

3.3 Project Boundary

Source	Gas	Included?	Justification/Explanation
Baseline Source 1	CO ₂	yes	CO ₂ is the primary output of burning wood.
	CH ₄	x	CH ₄ contributes too small of a fraction of the emitted gas and is excluded to make a conservative estimate.
	N ₂ O	x	N ₂ O contributes too small of a fraction of the emitted gas and is excluded to make a conservative estimate.

²⁶

<https://www.globalforestwatch.org/map/country/GTM/19?mainMap=eyJzaG93QW5hbHlzaXMiOnRydWV9&map=eyJjZW50ZXliOnsibGF0IjoxNC43MDQ0MzE4NDgzNzExMDRlbnx0ZyYl6LTkxLjI4NzU1MDAwMDAwMDAxfSwiYmVhcmluZyYl6MCwicGl0Y2giOjAsInpvc20iOjEwLjM0MDgyNDI4MDcyOTcyOSwiY2FuQm91bmQiOmZhbHNILCJiYm94IjpbXX0%3D>

Project	Source 1	Other	x	There are no other major sources of emissions.
		CO ₂	yes	CO ₂ is the primary output of burning wood.
		CH ₄	x	CH ₄ contributes too small of a fraction of the emitted gas and is excluded to make a conservative estimate.
		N ₂ O	x	N ₂ O contributes too small of a fraction of the emitted gas and is excluded to make a conservative estimate.
		Other	x	There are no other major sources of emissions.

3.4 Baseline Scenario

Project Activity One: Introduction of high-efficiency, biomass fired project devices to replace the existing devices

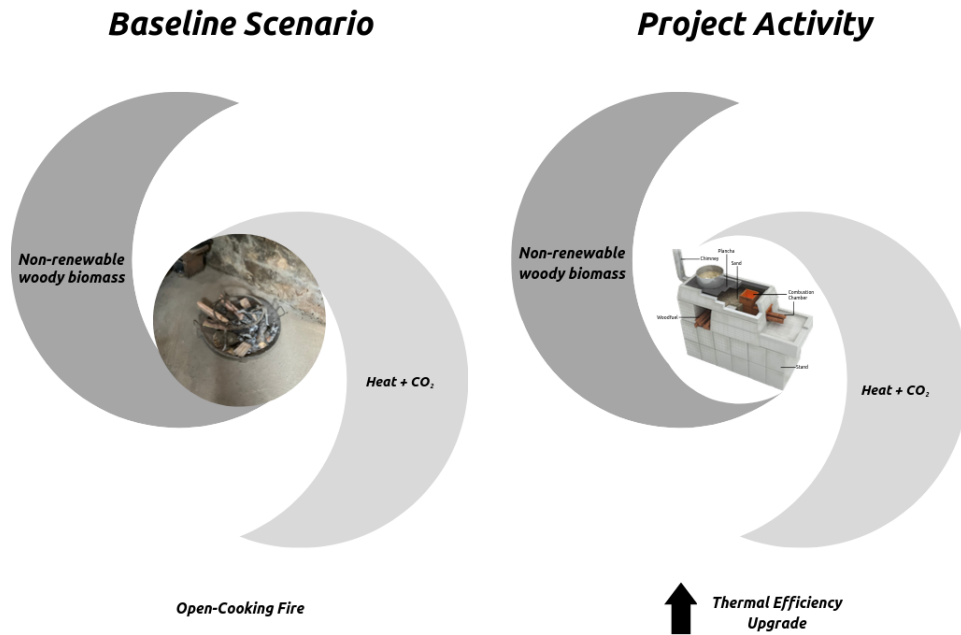


Figure 6: Diagram of energy flows, project activity one

In the absence of the project activity, traditional open fire cooking methods would be used to prepare meals in Guatemalan homes in the project area. The baseline scenario would

be the projected use of wood fuel needed for an open cooking fire to meet similar thermal energy needs as those provided by the ONIL stove.²⁷

Project Activity Two: Provision of energy efficiency improvements in biomass fired cookstoves

In the absence of the project activity, existing, damaged, inefficient biomass fired cookstoves would be used to prepare meals in Guatemalan homes in the project area. The energy efficiency improvement consists of installing a new combustion chamber and performing the corresponding maintenance to improve the efficiency of the biomass fired cookstove, similar to the method detailed above in which a ONIL stove replaces an open cooking fire. The thermal efficiency upgrade is quantified using a Controlled Cooking Test (CCT).²⁸ The baseline scenario would be the projected use of wood fuel needed for the damaged biomass fired cookstove to meet similar thermal energy needs as those provided by the improved ONIL stove.



Figure 8: Baseline scenario project activity two

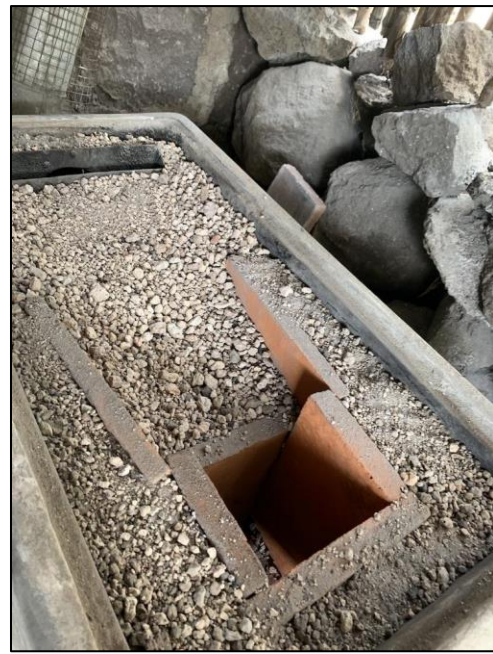


Figure 7: Project device after energy efficiency improvement

3.5 Additionality

²⁷ Per procedure set out in section 5.3 of CDM AMS-II.G. Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass (Version 10.0)

²⁸ Per procedure set out in section 5.3, 28-32 of CDM AMS-II.G. Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass (Version 10.0)

The following additionality assessment uses section 5 paragraph 10 of Tool 21:

Methodological tool: Demonstration of additionality of small-scale project activities, Version 12.0, "Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers in accordance with the applied methodology."

The project activities would not have occurred anyway due to the following barriers:

(1) Investment barrier: "a financially more viable alternative to the project activity would have led to higher emissions."

Project Activity One: ONIL stoves cost Q1,200/each including procurement and installation. The ICS Project subsidizes the project devices, making them available to our clients for Q350. The financially more viable alternative includes open cooking fires. This alternative leads to higher emissions.

(2) Other barriers: "without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher."

Project Activities One and Two: In addition to procurement and installation, TRL provides ongoing technological adaptation support and maintenance to all ONIL stove users (see SD VISTA Project Description section 1.1.2). These services address the barriers associated with limited access to sustainable energy technology present in the communities served.²⁹ In rural Guatemala, beneficiaries have limited access to information regarding alternative cooking methods and limited capacity to absorb ICS technology without support. The project activity couples technological adaptation with environmental education over the first year of stove installation. Our Technological Adaptation Specialist (TAS), an early adopter of ICS technology guides beneficiaries through the adjustment period from a three-stone fire to a clean cookstove based on her own experience. All communication is conducted in the beneficiary's primary language, Tz'utujil, with strong emphasis placed on the relationship between the beneficiary and TRL. This strategic approach provides for sustainable adoption of the technology to ensure lasting environmental benefits for stove owners and the surrounding community. In the absence of support exists the possibility that the technology could go unused post-installation or that frustrations could provoke damage to the technology that would negatively affect efficiency

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https://www.earthedintl.org/CourseMats/SustCentralAm/Readings/07_WayForward_RE_in_CentralAm.pdf, pages 53-54

levels. Additionally, due to misuse and/or wear and tear that occurs over time, existing biomass fired cookstoves may deteriorate or undergo damage. In these cases, TRL locally sources replacement parts such as a new combustion chamber, identifies families with inefficient, damaged ONIL stoves, and installs the new combustion chambers to improve cookstove efficiency. Without all these provisions of the project activity, emissions would be higher.

3.6 Methodology Deviations

Not applicable. No methodology deviations were applied.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Not applicable. See section 4.4 for the calculation of Net GHG Emission Reductions and Removals.

4.2 Project Emissions

CDM AMS-II.G. Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass, Version 10.0. defines the procedure to calculate emission reductions. The calculation of project emissions separate from baseline emissions is thus not applicable.

4.3 Leakage

The project uses a net gross adjustment factor of 95% to account for leakage. Section 5.4 paragraph 34 of CDM AMS-II.G. Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass, Version 10.0. states "Alternatively, By savings, i, j is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required."

4.4 Net GHG Emission Reductions and Removals

Per section 5.3 of CDM AMS-II.G. Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass, Version 10.0, emission reductions are calculated as:

$$ER_y = \sum_i \sum_j ER_{y,i,j} - LE_y$$

Where:

i = Indices for the situation where more than one type of project device is introduced to replace the pre-project devices. Only one type of project device, the ONIL stove, is introduced by the project activity.

j = Indices for the situation where there is more than one batch of project device. There are seven batches, each corresponding to the calendar year in which each ONIL stove that is generating emission reductions was installed.

ER_y = Emission reductions during year *y* in t CO₂e

ER_{y,i,j} = Emission reductions by project device of type *i* and batch *j* during year *y* in t CO₂e, as determined by Equation (2)

LE_y = Leakage emissions in the year *y*. Not applicable (see section 4.3)

TOOL 30

$$fNRB = \frac{NRB}{NRB + RB}$$

Where:

fNRB = Fraction of non-renewable biomass in the country/region or project area (fraction or %)

NRB = Quantity of non-renewable biomass (t/yr) in the country/region or project area, determined as per equation (3)

RB = Quantity of renewable biomass in the country/region or project area, determined as per equation (6)

Equation (3)

$$NRB = B_{old,total} - RB$$

Where

$B_{old,total}$ = Total annual consumption of wood in the project area in the absence of the project activity, as determined per equation (5)

Equation (5)

$$B_{old,total} = HW_{project} \times N_{project} + TI_{project}$$

The amount of wood consumed per household in the project region is determined by organizational surveys conducted over the past six years with clients who used three-stone fires for cooking. The resulting wood use assumes that families have similar wood consumption as our client surveys throughout the region (based on similar demographics and cultural preferences). The resulting average usage number is 5.3297 tonnes per year per family, option C of the $HW_{project}$ variable.

Variable / Units	Value
$HW_{project}$ (client survey data of pre-project device woody biomass usage per household)	5.3297 tonnes / family / year
$N_{project}$ (2018 census data of families using wood as primary cooking fuel source)	71,910 families
$TI_{project}$ (conservative value -- low commercial woody biomass use in region)	0 tonnes
$B_{old,total} : HW_{project} \times N_{project} + TI_{project}$	383259.97 tonnes

Equation (6)

Renewable biomass (RB) in the country/region/project area is estimated using the equation below.

$$RB = \sum (MAI_{forest,i} \times (F_{forest,i} - P_{forest})) + \sum (MAI_{other,i} \times (F_{other,i} - P_{other}))$$

Where:

$MAI_{forest,i}$ = Mean Annual Increment of woody biomass growth per hectare in sub-category i of forest areas (t/ha/yr)

$MAI_{other,i}$ = Mean Annual Increment of woody biomass growth per hectare in sub-category i of other wooded land areas (t/ha/yr)

$F_{forest,i}$ = Extent of forest in sub-category i (ha)

$F_{other,i}$ = Extent of other wooded land in sub-category i (ha)

P_{forest} = Extent of non-accessible area (e.g. protected area where extraction of wood is prohibited, geographically remote area) within forest areas (ha)

P_{other} = Extent of non-accessible area (e.g. protected area where extraction of wood is prohibited, geographically remote area) within other wooded land areas (ha)

i = Sub-category i of forest areas and other wooded land areas

Land Type	Total Amount of Land	Protected Land	Unprotected Land (Total - Protected)	Growth Rate MAI	Total Renewable Biomass (Unprotected * MAI)
Forest	$F_{forest,i}$: 91,100 ha	$P_{forest,i}$: 77,684 ha (Conservative estimate only including land in the national forest)	13,416 ha	$MAI_{forest,i}$: 0.9 tonnes/ha/yr	12,074.4 tonnes/yr
Other (Grass and Shrub)	$F_{other,i}$: 13,950 ha	$P_{other,i}$: 0 ha (Conservative estimate)	13,950 ha	$MAI_{other,i}$: 1.0 tonnes/ha/yr	13,950 tonnes/yr
Total					RB=26,024.4 tonnes/yr

Project Activity One

Equation (7)

$$B_{y,savings,i,j} = B_{y=1,new,i,j,survey} \times \left(\frac{\eta_{new,i,j}}{\eta_{old,i,j}} - 1 \right)$$

Where:

$B_{y=1,new,i,j,survey}$ = Quantity of woody biomass used by project devices in tonnes per device of type i and batch j

$B_{y=1,new,i,j,survey}$ = 2.340181121 tonnes/stove/year

$\eta_{old,i,j}$ = 10.0%

Age of Project device	$\eta_{new,i,j}$ =	$B_{y,savings,i,j}$ =
j=0	24.0%	3.276
j=1	23.6%	3.183
j=2	23.2%	3.089
j=3	22.8%	2.995
j=4	22.4%	2.902
j=5	22.0%	2.808
j=6	21.6%	2.715 ³⁰
j=7	21.2%	2.621
j=8	20.8%	2.527
j=9	20.4%	2.434
j=10	20.0%	2.340

Equation (2)

$$ER_{y,i,j} = B_{y,savings,i,j} \times N_{y,i,j} \times \mu_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil\ fuel}$$

Where:

$B_{y,savings,i,j}$ = Quantity of woody biomass that is saved in tonnes per cookstove device of type i and batch j during year y, as determined per equation (7). Use values above.

³⁰ Final year factored into calculation of emission reductions for project crediting period

$f_{NRB,y}$ = Fraction of woody biomass that can be established as non-renewable biomass (fNRB), as determined by Tool 30: Methodological tool: Calculation of the fraction of non-renewable biomass, Version 02.0. Use a Value of 0.932.

$NCV_{biomass}$ = Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.0156 TJ/tonne, based on the gross weight of the wood that is 'air-dried')

$EF_{projected_fossilfuel}$ = Emission factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers. Use a value of 63.7 t CO₂/TJ₈

μ_y = Adjustment to account for any continued use of pre-project devices during the year y, Use a value of 1 when applying equation (7)

The following table below demonstrates how equation (2) is applied to determine emission reductions by project device of type i and batch j during year y in t CO₂e.³¹

Equation (2) Project Activity One								
Age of Project device	0	1	2	3	4	5	6	
$B_{y,savings,i,j}$	3.276	3.183	3.089	2.995	2.902	2.808	2.715	
Ly adjust (.95)	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
$f_{NRB,y}$	0.932	0.932	0.932	0.932	0.932	0.932	0.932	
$NCV_{biomass}$	0.0156	0.0156	0.0156	0.0156	0.0156	0.0156	0.0156	
$EF_{projected_fossilfuel}$	63.7	63.7	63.7	63.7	63.7	63.7	63.7	
μ_y	1	1	1	1	1	1	1	
ER per Project Device	2.883	2.801	2.718	2.636	2.553	2.471	2.389	Total Annual ER
2018	61							175.856
2019	120	58						508.375
2020	120	114	55					814.702

³¹ Operating under the conservative assumption that an estimated six project devices will be decommissioned annually.

2021	120	114	108	52				1095.823
2022	120	114	108	102	49			1352.729
2023	120	114	108	102	96	46		1586.407
2024	120	114	108	102	96	90	43	1797.846
Total								7331.737

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
2018	X	X	X	175.856
2019	X	X	X	508.375
2020	X	X	X	814.702
2021	X	X	X	1095.823
2022	X	X	X	1352.729
2023	X	X	X	1586.407
2024	X	X	X	1797.846
Total	X	X	X	7331.737

Project Activity Two

Equation (8)

$$B_{y,savings,i,j} = B_{old,i,j} \times \left(1 - \frac{SC_{new,i,j}}{SC_{old}}\right)$$

Where:

SC_{old} = Specific fuel consumption or fuel consumption rate of the pre-project devices

SC_{new,i,j} = Specific fuel consumption or the fuel consumption rate of the devices of type i and batch j deployed as part of the project

Based on the Clean Cooking Test, the value of SC_{old} was 1132.3g cooked tortilla per kg of wood fuel based on the average of several trials of stoves before undergoing our improvement procedure and new components. The values under the same procedure after improvement, and estimates for the life of the project activity (which will be updated annually as part of the ongoing monitoring), are below.

Age of Project device	$SC_{new,i,j} =$	$B_{y,savings,i,j} =$
j=0	590.6	2.550
j=1 (estimate)	644.8	2.295
j=2 (estimate)	698.9	2.040
j=3 (estimate)	753.1	1.785
j=4 (estimate)	807.3	1.530
j=5 (estimate)	861.5	1.275
j=6 (estimate)	915.6	1.020
j=7 (estimate)	969.8	0.765
j=8 (estimate)	1024.0	0.510
j=9 (estimate)	1078.1	0.255
j=10	1132.3	0.000

Equation (2)

$$ER_{y,i,j} = B_{y,savings,i,j} \times N_{y,i,j} \times \mu_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil\ fuel}$$

Where:

$B_{y,savings,i,j}$ = Quantity of woody biomass that is saved in tonnes per cookstove device of type i and batch j during year y, as determined per Equation (8)

$f_{NRB,y}$ = Fraction of woody biomass that can be established as non-renewable biomass (fNRB), as determined by Tool 30: Methodological tool: Calculation of the fraction of non-renewable biomass, Version 02.0. Use a Value of 0.932.

$NCV_{biomass}$ = Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.0156 TJ/tonne, based on the gross weight of the wood that is 'air-dried')

$EF_{projected_fossilfuel}$ = Emission factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers. Use a value of 63.7 t CO₂/TJ⁸

μ_y = Adjustment to account for any continued use of pre-project devices during the year y, Use a value of 1 as the energy efficiency improvement performed eliminates the possibility of continued use of pre-project devices.

The following table below demonstrates how equation (2) is applied to determine emission reductions by project device of type i and batch j during year y in t CO₂e.³²

Equation (2) Project Activity 2								
Age of Project device	0	1	2	3	4	5	6	
$B_{y,savings,i,j}$	2.550	2.295	2.040	1.785	1.530	1.275	1.020	
L_y adjust (.95)	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
$f_{NRB,y}$	0.932	0.932	0.932	0.932	0.932	0.932	0.932	
$NCV_{biomass}$	0.0156	0.0156	0.0156	0.0156	0.0156	0.0156	0.0156	
$EF_{projected_fossilfuel}$	63.7	63.7	63.7	63.7	63.7	63.7	63.7	
μ_y	1	1	1	1	1	1	1	
ER per Project Device	2.244	2.019	1.795	1.571	1.346	1.122	0.897	Total Annual ER
2018	100							224.363
2019	100	95						416.194
2020	100	95	90					577.735
2021	100	95	90	85				711.231

³² Operating under the conservative assumption that an estimated five project devices will be decommissioned annually.

2022	100	95	90	85	80			818.926
2023	100	95	90	85	80	75		903.062
2024	100	95	90	85	80	75	70	965.884
Total								4617.395

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
2018	X	X	X	224.363
2019	X	X	X	416.194
2020	X	X	X	577.735
2021	X	X	X	711.231
2022	X	X	X	818.926
2023	X	X	X	903.062
2024	X	X	X	965.884
Total	X	X	X	4617.395

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	N _{p,HH}
Data unit	Number
Description	Average number of persons served per household before project implementation.
Source of data	2018 Census Data ³³

³³ <https://www.censopoblacion.gt>

Value applied	4.92
Justification of choice of data or description of measurement methods and procedures applied	For demographic data, the 2018 Census is timely, relevant, complete, and categorized by department. This source was chosen to accurately demonstrate current statistics reflective of the project area.
Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Comments	No additional comments.

Data / Parameter	N_{project}
Data unit	Number
Description	Number of households consuming wood fuel for thermal applications within the project area (households)
Source of data	2018 Census Data ³⁴
Value applied	71909.88
Justification of choice of data or description of measurement methods and procedures applied	<p>For demographic data, the 2018 Census is timely, relevant, complete, and categorized by department. This source was chosen to accurately demonstrate current statistics reflective of the project area.</p> <p>To calculate this value, the percent of households using wood as the primary energy source for cooking (84%) applied to the number of households in the Sololá Department (85607).</p>
Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Comments	No additional comments.

Data / Parameter	Tl_{project}
Data unit	Number
Description	All woody biomass consumption for non-energy applications (construction, furniture) that are extracted

³⁴ <https://www.censopoblacion.gt>

	from forests or land areas in the project area for which the estimate of fNRB is to be made (t/yr).
Source of data	For the project area, it may be determined through surveys..
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	0 is a conservative low estimate. Used to calculate the value of $f_{NRB,y}$ according to Tool 30: Calculation of the fraction of non-renewable biomass, Version 2.0
Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Comments	No additional comments.

Data / Parameter	$\eta_{new,i,j}$
Data unit	Percent
Description	Efficiency of the device of each type i and batch j implemented as part of the project activity.
Source of data	Aprovecho Research Center, 2004, HELPS "ONIL" Griddle Stove Fuel efficiency and Emissions, page 2.
Value applied	24%, decreasing through the lifespan of the project device as prescribed by the methodology. ³⁵
Justification of choice of data or description of measurement methods and procedures applied	Aprovecho data on the thermal efficiency of the ONIL stoves is widely cited by ICS projects, including those already validated verified to issue VCU's .
Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Comments	The value is fixed ex-ante

³⁵ "A default schedule of linear decrease in efficiency up to the terminal efficiency assumed as 20 per cent shall be applied through the lifespan of the project device." *CDM AMS-II.G. Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass, Version 10.0., page 9*

Data / Parameter	$\eta_{old,i,j}$
Data unit	Percent
Description	Efficiency of pre-project device, which is a three-stone fire using firewood (not charcoal), or a conventional device with no improved combustion air supply or flue gas ventilation that is without a grate or a chimney.
Source of data	AMS-II.G. Default
Value applied	10%
Justification of choice of data or description of measurement methods and procedures applied	AMS-II.G. prescribes a default of .1 for the efficiency of pre-project device, which is a three-stone fire using firewood (not charcoal), or a conventional device with no improved combustion air supply or flue gas ventilation, that is without a grate or a chimney.
Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Comments	The value is fixed ex-ante

Data / Parameter	μ_y
Data unit	Fraction
Description	Adjustment to account for any continued use of pre-project devices during the year y
Source of data	AMS-II.G. Default when applying equation 7
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	AMS-II.G. prescribes a default of 1 when applying equation 7, which is used in ER calculations for project activity one. For project activity two, equation 8 is used; however the pre-project device ceases to exist as a consequence of the project activity. Thus the default is also applied to reflect consistency and accuracy.
Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions

Comments	The value is fixed ex-ante
Data / Parameter	$HW_{project}$
Data unit	t/yr/household
Description	Average household wood fuel consumption, including fuelwood and charcoal in the project area.
Source of data	Baseline Survey
Value applied	5.3297
Justification of choice of data or description of measurement methods and procedures applied	AMS-II.G. permits the results of a sampling survey conducted as per the latest version of "sampling and surveys for CDM project activities and programme of activities". The TAS surveyed beneficiaries on household wood fuel consumption in 2018. TRL's Programs Team conducted data validation after every round of data collection to ensure accuracy. Survey results are averaged.
Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Comments	The value is fixed ex-ante

Data / Parameter	$EF_{projected_fossilfuel}$
Data unit	† CO ₂ /TJ ₈
Description	Emission factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers.
Source of data	AMS-II.G. Default
Value applied	63.7
Justification of choice of data or description of measurement methods and procedures applied	Conversion factor is prescribed by AMS-II.G.

Purpose of Data	<ul style="list-style-type: none"> The value is fixed ex-ante
Comments	No additional comments.

Data / Parameter	NCV _{biomass}
Data unit	TJ/tonne
Description	Net calorific value of the non-renewable woody biomass, briquettes, or charcoal used in project devices
Source of data	IPCC default for wood fuel
Value applied	0.0156
Justification of choice of data or description of measurement methods and procedures applied	AMS-II.G. prescribes that the IPCC default for wood fuel, 0.0156 TJ/tonne, based on the gross weight of the wood that is 'air-dried' may be used if fuel used in project device is also woody biomass, as is the case for the project.
Purpose of Data	<ul style="list-style-type: none"> Calculation of baseline emissions
Comments	The value is fixed ex-ante.

Data / Parameter	MAI _{forest}
Data unit	tonnes/ha/yr
Description	Mean Annual Increment of woody biomass growth per hectare in subcategory i of forest areas.
Source of data	Global Forest Watch
Value applied	.9
Justification of choice of data or description of measurement methods and procedures applied	Global Forest Watch data are timely, accurate, and available by department within Guatemala. Data are specific to the Sololá Department. GFW data were chosen for rigor and advanced monitoring methodology that uses remote-sensing technology to gather near real-time information.

Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Comments	The value is fixed ex-ante.

Data / Parameter	MAI_{other}
Data unit	tonnes/ha/yr
Description	Mean Annual Increment of woody biomass growth per hectare in subcategory i of other wooded land areas
Source of data	Global Forest Watch
Value applied	.9
Justification of choice of data or description of measurement methods and procedures applied	Global Forest Watch data are timely, accurate, and available by department within Guatemala. Data are specific to the Sololá Department. GFW data were chosen for rigor and advanced monitoring methodology that uses remote-sensing technology to gather near real-time information.
Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Comments	The value is fixed ex-ante.

Data / Parameter	F_{forest, i}
Data unit	ha
Description	Extent of forest in sub-category i
Source of data	Global Forest Watch
Value applied	91100
Justification of choice of data or description of measurement methods and procedures applied	Global Forest Watch data are timely, accurate, and available by department within Guatemala. Data are specific to the Sololá Department. GFW data were chosen for rigor and advanced monitoring methodology

	that uses remote-sensing technology to gather near real-time information.
Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Comments	The value is fixed ex-ante.

Data / Parameter	$F_{\text{other}, i}$
Data unit	ha
Description	Extent of other wooded land in sub-category i
Source of data	Global Forest Watch
Value applied	13950
Justification of choice of data or description of measurement methods and procedures applied	Global Forest Watch data are timely, accurate, and available by department within Guatemala. Data are specific to the Sololá Department. GFW data were chosen for rigor and advanced monitoring methodology that uses remote-sensing technology to gather near real-time information.
Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Comments	The value is fixed ex-ante.

Data / Parameter	P_{forest}
Data unit	ha
Description	Extent of non-accessible area (e.g. protected area where extraction of wood is prohibited, geographically remote area) within forest areas.
Source of data	Global Forest Watch
Value applied	77684
Justification of choice of data or description of measurement methods and procedures applied	Global Forest Watch data are timely, accurate, and available by department within Guatemala. Data are specific to the Sololá Department. GFW data were chosen for rigor and advanced monitoring methodology

	that uses remote-sensing technology to gather near real-time information.
Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Comments	The value is fixed ex-ante.

Data / Parameter	P_{other}
Data unit	ha
Description	Extent of non-accessible area (e.g. protected area where extraction of wood is prohibited, geographically remote area) within other wooded land areas
Source of data	Global Forest Watch
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	Global Forest Watch data are timely, accurate, and available by department within Guatemala. Data are specific to the Sololá Department. GFW data were chosen for rigor and advanced monitoring methodology that uses remote-sensing technology to gather near real-time information.
Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Comments	The value is fixed ex-ante.

Data / Parameter	SC_{old}
Data unit	t fuel/unit output
Description	Specific fuel consumption of the pre-project devices.
Source of data	Using the controlled cooking test (CCT) procedure. CCT is conducted on a sample basis (see section 5.3).
Value applied	1132.3 g/kg
Justification of choice of data or description of measurement	Specific fuel consumption is to be determined using the CCT protocol carried out in accordance with international standards specified by Clean Cooking Alliance.

methods and procedures applied	3. When the CCT is conducted on a sample basis, the sampling requirements indicated in section 6.2 and guidance provided in the “Standard for sampling and surveys for CDM project activities and programme of activities” will be followed.
Purpose of Data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Comments	The value is fixed ex-ante.

5.2 Data and Parameters Monitored

Project Activity One: Introduction of high-efficiency, biomass fired project devices to replace the existing devices

Data / Parameter	$N_{y,i,j}$
Data unit	Number
Description	Number of project devices of type i and batch j operating during year y.
Source of data	Monitoring, inputs entered in beneficiary database that tracks installation and visit dates
Description of measurement methods and procedures to be applied	Number of new instances measured directly.
Frequency of monitoring/recording	365 days after installation and ongoing biennial monitoring. Beneficiary database is updated daily.
Value applied	120 (projected)
Monitoring equipment	Samsung Tablet, Kobo Toolbox
QA/QC procedures to be applied	TRL's Programs Team conducted data validation after every round of data collection to ensure accuracy.

Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Calculation method	Number of stoves marked as “operating” (see section 5.3)
Comments	No additional comments.

Data / Parameter	$B_{y=1,new,i,j,survey}$
Data unit	Tonnes
Description	Quantity of woody biomass used by project devices in tonnes per device of type i.
Source of data	Sample survey of end user. Inputs entered in beneficiary database that tracks installation and visit dates
Description of measurement methods and procedures to be applied	The TAS surveys beneficiaries on household wood fuel consumption 365 days post-installation.
Frequency of monitoring/recording	First year of installation.
Value applied	2.340181121
Monitoring equipment	Samsung Tablet, Kobo Toolbox
QA/QC procedures to be applied	TRL's Programs Team conducted data validation after every round of data collection to ensure accuracy.
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Calculation method	Survey results are averaged.
Comments	No additional comments.

Project Activity Two: Energy efficiency improvements in existing biomass fired cookstoves³⁶

Data / Parameter	$N_{y,i,j}$
Data unit	Number
Description	Number of project devices of type i and batch j operating during year y.
Source of data	Monitoring, inputs entered in beneficiary database that tracks installation and visit dates
Description of measurement methods and procedures to be applied	Number of new instances measured directly.
Frequency of monitoring/recording	365 days after installation and ongoing biennial monitoring. Beneficiary database is updated daily.
Value applied	100
Monitoring equipment	Samsung Tablet, Kobo Toolbox
QA/QC procedures to be applied	TRL's Programs Team conducted data validation after every round of data collection to ensure accuracy.
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Calculation method	Number of improved devices marked as "operating"
Comments	No additional comments
Data / Parameter	$SC_{new,i,j}$
Data unit	t fuel/unit output or t fuel/hour

³⁶ Uses several of the Data/Parameters necessary for Project Activity One. Section only lists additional Data / Parameters necessary for calculating ER of Project Activity Two.

Description	Specific fuel consumption or fuel consumption rate during year y of the device(s) of type i deployed as part of the project that is fuel consumption per quantity of item(s) processed (e.g. food cooked) or fuel consumption per hour respectively with the age a .
Source of data	Using the controlled cooking test (CCT) procedure. CCT is conducted on a sample basis (see section 5.3).
Description of measurement methods and procedures to be applied	The CCT is performed by the TAS, M&E Director, and Lead Technician. CCTs are performed per procedures specified by the Clean Cooking Alliance, in accordance with CDM AMS-IL.G. Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass, Version 10.0, Data / Parameter table 13.
Frequency of monitoring/recording	Annually
Value applied	590.6 g/kg ($j=0$)
Monitoring equipment	Scale, thermometer, timer/stopwatch.
QA/QC procedures to be applied	TRL's Programs Team conducted data validation after every CCT to ensure accuracy.
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions
Calculation method	Specific fuel consumption (SC) = Equivalent dry wood consumed (fd)/Total weight of food cooked (Wf) * 1000
Comments	See appendix 4 for CCT procedure

5.3 Monitoring Plan

The ICS project uses a results-based framework that allows TRL to track short-term and long-term success and make necessary changes to improve the project results. The ICS Project tracks client information and other indicators (see SD VISTA Project Description), $N_{y,i,j}$ and either $B_{y=1,new,i,j,survey}$ or $SC_{new,i,j}$, through the combination of the digital survey platform, KoBo Toolbox, and a cloud-based server. Using in-house designed surveys that account for

cultural nuances relevant to our beneficiary base, the Outreach Team gathers data in beneficiary homes (offline) using a tablet over the course of a multi-year visit follow-up schedule. Maintenance and educational services are also included on these visits, conducted entirely in the native language of the beneficiary. Once connected to wifi at the end of each day, an Outreach Team member will sync the tablet, uploading survey results to the cloud. TRL conducts data validation after every round of data collection to ensure accuracy. When non-conformances arise, the Outreach and Program Development team discuss the reasons for such and plan to ensure monitoring activities abide by the validated monitoring plan. The quality of data collected that coincides with non-conformances is internally evaluated, and excluded if incomplete or inaccurate. The principle of conservativeness is applied in these evaluations.³⁷

Project Activity One: Data / Parameter: $B_{y=1,new,i,j,survey}$			
Method	Stored	Time-Frame	Responsible Party
On the one-year visit, beneficiaries are surveyed on monthly wood use. Amounts are synced daily, uploaded and converted to appropriate units. The average value of batch data is used.	Cloud-based Server	365 days following installation	TAS, M&E Director

All clients are surveyed 365 days following installation.

Project Activity One: Data / Parameter: $N_{y,i,j}$			
Method	Stored	Time-Frame	Responsible Party
At the end of each visit, a survey question prompts the TAS to update	Cloud-based Server	365 days after installation and ongoing biennial monitoring for a representative sample	TAS, M&E Director

³⁷Per the VCS standard section 2.2.1

the stove status (figure 9).

Figure 9: The TAS chos between the options listed in the stove status questionnaire.

Project Activity Two: Data / Parameter: $N_{y,i,j}$			
Method	Stored	Time-Frame	Responsible Party
At the end of each visit, a survey question prompts the TAS to update the stove status.	Cloud-based Server	365 days after installation and ongoing biennial monitoring for a representative sample	TAS, M&E Director

We survey a representative sample of each batch, biennially, per CDM guidelines (95% confidence, $\pm 10\%$ target precision level).³⁸ This representative sample is visited one, three, five and seven years after installation.

Project Activity Two: Data / Parameter: $SC_{new,i,j}$			
Method	Stored	Time-Frame	Responsible Party
The Controlled Cooking Test	Cloud-based Spreadsheet	Ongoing annual monitoring for a	TAS, M&E Director, Technician

³⁸ Per AMS-II.G Section 6.2, "When biennial inspection is chosen a 95 percent confidence interval and a 10 percent margin of error shall be achieved for the sampling parameter."

(CCT),
administered per
international
guidelines.³⁹

representative
sample

We randomly sample three or more families each year from the first batch, with three tests per stove, for a total of at least nine tests, or until sufficient to reach 90% confidence, $\pm 10\%$ target precision level, per CDM guidelines.

³⁹ Procedures specified by the Clean Cooking Alliance.

APPENDICES

- (1) Código de Trabajo de Guatemala Decreto 1441-1961
- (2) Leyes Áreas Protegidas
- (3) TRL Official Government Certification of non-profit Status
- (4) Controlled Cooking Test Procedure