

InStove 60L Stove: Carbon Offset, Fuel Savings, and Energy Savings Calculation Methodology

Explanation of Methodology

These values are derived from a series of three standard Controlled Cooking Tests (CCT's) conducted in Nigeria with local cooks operating both the institutional stove and a traditional 3-stone fire. The CCT procedure was adapted from the Aprovecho Research Center testing protocol, available here:

http://www.aprovecho.org/lab/index.php?option=com_rubberdoc&view=doc&id=53&format=raw

For complete CCT results, email us at info@instove.org

Carbon offsets and energy savings are proportional to the amount of cooking done per year, so both higher and lower-use cooking applications have been considered. Currently, most InStove stoves are placed in Internally Displaced Persons (IDP) camps, where they are often used for 10-12 hours a day. In the future, we expect placements in lower-use applications, such as residential schools, to overtake IDP camp use. A straight average of the two applications has been provided as a conservative estimate of the expected savings per stove.

Also note that while CCT's were done with each pot only partially full of food, our experience indicates that pots are usually filled completely in real-world cooking, yielding about 50kg of cooked food per 60L pot. Test results have been scaled to a more realistic 50kg of food per pot for all calculations.

Understanding this Document

The first table on the following page summarizes the results of the CCT series. The second table explains estimated cooking frequency in different stove applications. Each of the subsequent sections use the information in these two tables to derive fuel, carbon, or energy savings.

Bolded entries highlight 60L stove savings compared to traditional cooking methods.

A summary of key values is provided at the end of this document.

Note that values may not sum exactly to totals shown due to rounding.

1. 60L Stove vs. Traditional Methods (3-Stone Fire):

Field Controlled Cooking Test (CCT) Series Results

<i>Average quantity of food cooked per pot (3-stone fire and 60L stove)</i>	28.25 kg
<i>Wood used per kg of food cooked (3-stone fire)</i>	0.808 kg
<i>Wood used per kg of food cooked (60L stove)</i>	0.096 kg
<i>Wood used per pot of food cooked (3-stone fire)</i>	22.84 kg
<i>Wood used per pot of food cooked (60L stove)</i>	2.72 kg
<i>Wood saved per meal</i>	20.12 kg
<i>Percent reduction in fuel use</i>	88%

2. Estimated Cooking Frequency and Total Mass of Food Cooked

<i>Application</i>	Residential school	Internally Displaced Persons (IDP) camp	Average
<i>Pots cooked per day</i>	3	6	4.5
<i>Days of cooking per week</i>	5	7	6
<i>Pots cooked per year</i>	782	2,190	1,486
<i>Food cooked per pot (kg)</i>	50	50	50
<i>Individual meals served per day*</i>	250-300	500-600	375-450
<i>Food cooked per year (kg)</i>	39,107	109,500	74,304

*Assumes a serving size of approximately 500-600g of prepared food, as recommended by the *World Food Program Basic Guide: School Feeding*, available here:

<http://www.schoolsandhealth.org/sites/ffe/Key%20Information/WFP%20Basic%20Tools%20-%20School%20Feeding/Basic%20Guide%20School%20Feeding.pdf>

In our experience, serving sizes may be smaller in some situations, while daily stove usage may be greater. We have received accounts of individual stoves serving up to 700 people per day.

3. Fuel Savings Calculations (60L Stove vs. 3-Stone Fire)

<i>Application</i>	Residential school	Internally Displaced Persons (IDP) camp	Average
<i>Fuel used per year (3-stone fire) (kg)</i>	31,606	88,496	60,051
<i>Fuel used per year (60L stove) (kg)</i>	3,760	10,529	7,145
<i>Fuel saved per year (60L stove vs. 3-stone fire) (kg)</i>	27,846	77,968	52,907
<i>Fuel saved per year (60L stove vs. 3-stone fire) (tons)</i>	30.7	85.9	58.3

4. CO₂ Offset Calculations (60L Stove vs. 3-Stone Fire)

<i>Application</i>	Residential school	Internally Displaced Persons (IDP) camp	Average
<i>CO₂ produced per year* (3-stone fire) (kg)</i>	47,409	132,745	90,077
<i>CO₂ produced per year* (60L stove) (kg)</i>	5,640	15,793	10,717
<i>CO₂ production offset per year (60L stove vs. 3-stone fire) (kg)</i>	41,768	116,951	79,360
<i>CO₂ production offset per year (60L stove vs. 3-stone fire) (tons)</i>	46.0	128.9	87.5

Note: CO₂ is only one part of the total climate-warming potential of an emission source. Research has shown that open fires create more products of incomplete combustion (PIC) per gram of fuel burned than comparable rocket stoves, such as InStove stoves. These include methane, carbon monoxide, and particulate matter (such as black carbon). Most PIC's have a much higher warming potential than CO₂, meaning that the overall reduction in climate-changing effects of an improved cookstove vs. a 3-stone fire can be significantly higher than is suggested by CO₂ production, alone.

See the Aprovecho Research Center "Laboratory Comparison of the Global-Warming Potential of Six Categories of Biomass Cooking Stoves" for justification of this information, available here:

http://www.scscertified.com/lcs/docs/Global_warming_full_9-6-07.pdf

5. Energy Savings Calculations (60L Stove vs. 3-Stone Fire)

<i>Application</i>	Residential school	Internally Displaced Persons (IDP) camp	Average
<i>Energy used per year** (3-stone fire) (MWh)</i>	129.6	362.8	246.2
<i>Energy used per year** (60L stove) (MWh)</i>	15.4	43.2	29.3
<i>Energy saved per year (60L stove vs. 3-stone fire) (MWh)</i>	114.2	319.7	216.9

6. Summary of Average InStove 60L Stove Savings vs. 3-Stone Fire

<i>Annual Wood Fuel Savings</i>	52,907 kg
	58.3 tons
<i>Annual CO₂ offset</i>	79,360 kg
	87.5 tons
<i>Annual Energy Savings</i>	216.9 MWh

*Assumes an average of 1.5kg of CO₂ is produced per 1kg of fuel wood burned.

**Based on an estimated average of 0.0041MWh of energy per 1kg of fuel wood with a 20% moisture content (percent wet basis).