Shell Foundation HEH Project Kitchen Performance Test: Data and Calculation Form
Shaded cells require user input; unshaded cells automatically display outputs

Name(s) of		GPS coordinates	
Enumerator(s)		Type of stove	
Family name/HH code		Start date of KPT	
Administative division		Time family is to be visited	
Region/province		Is fuel provided (Yes/No)	

Schedule of KPT

Day 0: Initial briefing of famliy, defining wood inventory area, and weighing of initial stock of wood.

Days 1 and 2: Visit family at roughly the same time, weigh fuel remaining in stockpile and weigh any wood added on that day.

Day 3: Final weighing and debriefing of family. If possible, tell them the outcome of the test and present them with appropriate compensation.

Describe the location of the household (list distinguishing features like water sources, trees, and other details of the landscape)…

		Daily fuel use (kg)			Fuel use per capita (kg/person)		
		Average	**SD**	**95% CI**	**Average**	**SD**	**95% CI**
Wood							
Other biomass							
Coal or charcoal							
Kerosene							
LPG							

		Daily energy use (MJ)			Energy use per capita (MJ/person)		
		Average	**SD**	**95% CI**	**Average**	**SD**	**95% CI**
Wood							
Other biomass							
Coal or charcoal							
Kerosene							
LPG							
Total							

KPT Daily Data Form: **Family name/HH code:**

Shaded cells require user input - unshaded cells automatically display outputs (see note on fuel moisture)

Day 0

Initial stock of wood in inventory area ☐ kg   *(Measure and enter the total amount of wood that the family has at the start of the testing*

Day 1		**Results - mass of fuel**	Day 1	Day 2	Day 3	Avg	SD
Fuel consumed between day 0 and day 1		No. of adult equivalents					
Fuel moisture (wet basis)*		**Wet** wood used (kg)					
Fuel in stock *(excluding new additions not weighed during previous visit)*	kg	**Wet** wood per cap (kg/cap)					
Fuel collected during past 24 hrs *(keep apart from previous day's fuel and add after weighing)*	kg	**Dry** wood (kg)					
		Dry wood per cap (kg/person)					
Fuel consumed in the past 24 hrs	kg						

Day 2		**Results - energy consumption**	Day 1	Day 2	Day 3	Avg	SD
Fuel consumed between day 0 and day 1		**Energy** used (MJ)					
Fuel moisture (wet basis)*		**Energy** per cap (MJ/cap)					
Fuel in stock *(excluding new additions not weighed during previous visit)*	kg						
Fuel collected during past 24 hrs *(kept apart from previous day's weighed fuel - add to stock after weighing)*	kg						
Fuel consumed in the past 24 hrs	kg						

Day 3

Fuel consumed between day 2 and day 3

Fuel moisture (wet basis)*

Fuel in stock *(excluding new additions not weighed during previous visit)* kg

Fuel collected during past 24 hrs *(kept apart from previous day's weighed fuel - add to stock after weighing)* kg

Fuel consumed in the past 24 hrs kg

> *** Fuel moisture**
> If you are using the Delmhorst J-2000 moisture analyzer (the recommended instrument for measuring fuel moisture in these field tests) you will be measuring fuel moisture on a **dry basis**. You can use the averaging function on the meter to or enter data in the "Fuel Mois-ture" worksheet (immeditely followng this worksheet). That work-sheet will calculate the average moisture content (both dry and wet basis). The wet-basis will be output automatically to this work-sheet. If you are using an alternate method to calculate fuel moisture, ignore the "Fuel Moisture" work-sheet and enter the fuel moisture values (**wet-basis**) directly into this work-sheet.

KPT Daily Data Form: **Family name/HH code:**

Shaded cells require user input - unshaded cells automatically display outputs (see note on fuel moisture)

Day 0

Initial stock of crop residues or dung in inventory area   [　　] kg   *(Measure and enter the total amount of fuel that the family has at the start of the testing period)*

Day 1

Fuel consumed between day 0 and day 1

Fuel moisture (wet basis)*   0%

Fuel in stock *(excluding new additions not weighed during previous visit)*   kg

Fuel collected during past 24 hrs *(keep apart from previous day's fuel and add after weighing)*   kg

Fuel consumed in the past 24 hrs   kg

Results - mass of fuel	Day 1	Day 2	Day 3	Avg	SD
No. of adult equivalents					
Wet fuel used (kg)					
Wet fuel per cap (kg/cap)					
Dry fuel (kg)					
Dry fuel per cap (kg/person)					

Day 2

Fuel consumed between day 0 and day 1

Fuel moisture (wet basis)*   0%

Fuel in stock *(excluding new additions not weighed during previous visit)*   kg

Fuel collected during past 24 hrs *(kept apart from previous day's weighed fuel - add to stock after weighing)*   kg

Fuel consumed in the past 24 hrs   kg

Results - energy consumption	Day 1	Day 2	Day 3	Avg	SD
Energy used (MJ)					
Energy per cap (MJ/cap)					

Day 3

Fuel consumed between day 2 and day 3

Fuel moisture (wet basis)*   0%

Fuel in stock *(excluding new additions not weighed during previous visit)*   kg

Fuel collected during past 24 hrs *(kept apart from previous day's weighed fuel - add to stock after weighing)*   kg

Fuel consumed in the past 24 hrs   kg

> *** Fuel moisture**
> The Delmhorst J-2000 moisture analyzer is not designed to measure the moisture content of non-woody biomass. You should use an alternate technique described in the accompanying document and enter in the "non-woody fuel moisture worksheet"

KPT Daily Data Form: **Family name/HH code:**

Shaded cells require user input - unshaded cells automatically display outputs (see note on fuel moisture)

Day 0

Initial stock of coal or charcoal in inventory
area   kg   *(Measure and enter the total amount of fuel that the family has at the start of the testing period)*

Day 1

Fuel consumed between day 0 and day 1

Fuel moisture (wet basis)*   3%

Fuel in stock *(excluding new additions not weighed during previous visit)*   kg

Fuel collected during past 24 hrs *(keep apart from previous day's fuel and add after weighing)*   kg

Fuel consumed in the past 24 hrs   kg

Results - mass of fuel	Day 1	Day 2	Day 3	Avg	SD
No. of adult equivalents					
Dry fuel (kg)					
Dry fuel per cap (kg/person)					

Day 2

Fuel consumed between day 0 and day 1

Fuel moisture (wet basis)*   3%

Fuel in stock *(excluding new additions not weighed during previous visit)*   kg

Fuel collected during past 24 hrs *(kept apart from previous day's weighed fuel - add to stock after weighing)*   kg

Fuel consumed in the past 24 hrs   kg

Results - energy consumption	Day 1	Day 2	Day 3	Avg	SD
Energy used (MJ)					
Energy per cap (MJ/cap)					

> *** Fuel moisture**
> Coal and charcoal tend to have low moisture contents (1-5%). If possible, test gravimetrically. If not, assume 3% moisture (wet) for these fuels.

Day 3

Fuel consumed between day 2 and day 3

Fuel moisture (wet basis)*   3%

Fuel in stock *(excluding new additions not weighed during previous visit)*   kg

Fuel collected during past 24 hrs *(kept apart from previous day's weighed fuel - add to stock after weighing)*   kg

Fuel consumed in the past 24 hrs   kg

Shaded cells require user input - unshaded cells automatically display outputs (see note on fuel moisture)

Day 0

Initial mass of kerosene   kg   *(Measure and enter the total amount of kerosene that the family has at the start of the testing period)*

Day 1

Kerosene consumed between day 0 and day 1

Kerosene in stock *(excluding additions not weighed during previous visit)*   kg

Kerosene purchased during past 24 hrs (keep apart from previous day's fuel and add after weighing)   kg

Kerosene consumed in the past 24 hrs   kg

Results - mass of fuel	Day 1	Day 2	Day 3	Avg	SD
No. of adult equivalents					
Kerosene used (kg)					
Kerosene per cap (kg/cap)					

Day 2

Kerosene consumed between day 0 and day 1

Kerosene in stock *(excluding additions not weighed during previous visit)*   kg

Kerosene purchased during past 24 hrs (keep apart from previous day's fuel and add after weighing)   kg

Kerosene consumed in the past 24 hrs   kg

Results - energy consumption	Day 1	Day 2	Day 3	Avg	SD
Energy used (MJ)					
Energy per cap (MJ/cap)					

Day 3

Kerosene consumed between day 2 and day 3

Kerosene in stock *(excluding additions not weighed during previous visit)*   kg

Kerosene collected during past 24 hrs (keep apart from previous day's kerosene and add after weighing)   kg

Kerosene consumed in the past 24 hrs   kg

KPT Daily Data Form:　　　　　**Family name/HH code:**

Shaded cells require user input - unshaded cells automatically display outputs (see note on fuel moisture)

Day 0

Initial mass of LPG (weigh tank)　　　　　[　　] kg　　*(Measure and enter the LPG tank that the family has at the start of the testing period)*

Day 1

LPG consumed between day 0 and day 1

Results - mass of fuel	Day 1	Day 2	Day 3	Avg	SD
No. of adult equivalents					
LPG used (kg)					
LPG per cap (kg/cap)					

LPG in stock **(excluding additions not weighed during previous visit)**　　[　　] kg

LPG purchased during past 24 hrs (keep apart from previous day's fuel and add after weighing)　　[　　] kg

LPG consumed in the past 24 hrs　　[　　] kg

Day 2

LPG consumed between day 0 and day 1

Results - energy consumption	Day 1	Day 2	Day 3	Avg	SD
Energy used (MJ)					
Energy per cap (MJ/cap)					

LPG in stock (excluding additions not weighed during previous visit)　　[　　] kg

LPG purchased during past 24 hrs (keep apart from previous day's fuel and add after weighing)　　[　　] kg

LPG consumed in the past 24 hrs　　[　　] kg

Day 3

LPG consumed between day 2 and day 3

LPG in stock (excluding additions not weighed during previous visit)　　[　　] kg

LPG collected during past 24 hrs (keep apart from previous day's LPG and add after weighing)　　[　　] kg

LPG consumed in the past 24 hrs　　[　　] kg

KPT Daily Data Form: **Family name/HH code:**

Shaded cells require user input - unshaded cells automatically display outputs (see note on fuel moisture)

Gender and age	Child: 0-14	Female: over 14	Male: 15-59	Male: over 59
Adult equivalent	0.5	0.8	1.0	0.8

Day 1

People present for meals during the last 24 hour period

Children: 0-14

Females: > 14

Males: 15 - 59

Males: > 59

Total Adult Equivalent

Day 2

People present for meals during the last 24 hour period

Children: 0-14

Females: > 14

Males: 15 - 59

Males: > 59

Total Adult Equivalent

Day 3

People present for meals during the last 24 hour period

Children: 0-14

Females: > 14

Males: 15 - 59

Males: > 59

Total Adult Equivalent

Moisture should be read the day before from the stock of fuel that is going to be used during the next 24 hour period. For each day, randomly draw 3 pieces of the fuel and measure its moisture in three positions as instructed for the WBT

Family name/HH code:

Day 0   Instrument reading (% dry basis)

	1	2	3
Piece 1			
Piece 2			
Piece 3			

Average moisture content (%)

dry-basis [   ]   wet-basis [   ]

Day 1   Instrument reading (% dry basis)

	1	2	3
Piece 1			
Piece 2			
Piece 3			

Average moisture content (%)

dry-basis [   ]   wet-basis [   ]

Day 2   Instrument reading (% dry basis)

	1	2	3
Piece 1			
Piece 2			
Piece 3			

Average moisture content (%)

dry-basis [   ]   wet-basis [   ]

The Delmhorst J-2000 moisture analyzer measures fuel moisture on a dry basis. To find moisture on a wet basis, simply use the following calculation:

$$MC_{wet} = \frac{MC_{dry}}{1 + MC_{dry}}$$

This spreadsheet does this calculation automatically. Output from the HH data and results worksheet requires moisture content on a wet basis, so the conversion is very important.

Page 3: Fuel moisture content worksheet

Moisture content for non-woody biomass should be determined by taking a sample of the household's fuel and doing a gravimetric measurement as descibed in the accompanying text

Family name/HH code:

Type of fuel

Take a small sample (200-300 g) of the fuel randomly from the stock of fuel to be used for the tests. Weigh the sample and record the mass. Dry the sample an oven at a few degrees over 100 °C and weigh it again. This may be done at the testing site if an oven is available, or the wet sample may be weighed on-site and then stored carefully and dried later, when an oven is available.

To dry the sample, put it in an oven and then remove it and weigh the sample every two hours on a sensitive scale (±1 g accuracy) until the mass no longer decreases. The oven temperature should be carefully controlled so that it doesn't exceed 110°C (230°F). If the wood is exposed to temperatures near 200°C (390°F), it will thermally break down and lose matter that is not water, causing an inaccurate measurement of moisture content.

Fuel moisture content (% wet basis)

Fuel calorific values

If possible, use calorific values derived from samples of the actual fuels used in the households being evaluated. If this is not possible use the default values given in the accompanying document.

Fuel	Value	Unit
Wood	18.0	MJ/kg
Crop residues or dung	15.0	MJ/kg
Coal or charcoal	28.0	MJ/kg
Kerosene	44.0	MJ/kg
LPG	48.0	MJ/kg

Reference values:

Fuel	Calorific value (MJ/kg)	MC at which the cal value was measured	Source
Charcoal	25.7	1.7 % (wet)	(Smith et al., 2000)
	27.6-31.5	~5 % (wet)	(Pennise et al., 2001)
Maize stalks	16.1	9.1 % (wet)	(Zhang et al., 2000)
	15.4	5.0 % (wet)	(FAO, 1993)
Wheat stalks	14	7.3 % (wet)	(Zhang et al., 2000)
	15.4	5.0 % (wet) t	(FAO, 1993)
Rice stalks	13	8.8 % (wet)	(Smith et al., 2000)
	14.2	5.0 % (wet)	(FAO, 1993)
Dung	11.8	7.3 % (wet)	(Smith et al., 2000)
	15.4	5.0 % (wet)	(FAO, 1993)
Coal			
China	22.5		(IEA, 2005)
China	27.3	2.1 % (wet)	(Zhang et al., 2000)
China (washed)	30.1	4.7 % (wet)	(Zhang et al., 2000)
US	26.2		(IEA, 2005)
India	18.4		(IEA, 2005)
South Africa	23.5		(IEA, 2005)
Kerosene	43.3		(Zhang et al., 2000)
	43.6		(IEA, 2005)
	43.1		(Smith et al., 2000)
LPG	49		(Zhang et al., 2000)
	47.1		(IEA, 2005)
	45.8		(Smith et al., 2000)
Natural gas	51.3		(Zhang et al., 2000)
Biogas	17.7		(Smith et al., 2000)