

Mini TLUD Stoves: 2-page Brief Introduction (Version --- 2017-10-20)

(Updated versions and more complete mini TLUD documents are placed, as they become available, at www.drtilud.com/resources)

Paul S. Anderson, Miles Franklin, Matthew Zell, and Carlos Urmeneta

(Send correspondence to: psanders@ilstu.edu . The authors/developers welcome collaboration for further efforts.)

Basic Terminology and Characteristics of “Mini” Cooking

“Mini” means “of a small or reduced size in comparison with others of its kind”; or “limited in scope, intensity, or duration.” It is from a shortening of “miniature, minimal, or minimum.” It is sometimes written as a hyphenated prefix (mini-something), or joined to make a new word (miniskirt), or as a separate adjective (mini recession).

To apply that prefix or adjective to cooking refers to the use of heat for the preparation of very small quantities of food, as in mini-cooking, or mini cooking. Examples include frying 2 eggs, boiling water for 1 to 3 cups of tea or coffee, toasting a piece of bread, or roasting a marshmallow to make a “s’more”. The general amount of thermal energy needed for mini cooking is typically less than 1 MJ (MegaJoule) or 280 Wh (Watts-hour), the energy in approximately 100 grams (3.5 ounces) of wood. Even double or triple that energy is still quite minimal, or mini.

Note that the small amount of food cooked and/or the low amount of thermal energy utilized do not specify the size of the fire or stove. The heat source for mini cooking could range from a blazing campfire (for a hot dog or s’more), a modern gas or electric multi-burner stove, a simple electric toaster, a backpacker’s stove, or even an alcohol-gel chafing dish. Therefore, there is a distinction between mini cooking (of small quantities of food regardless of the size of the heat source) and mini stoves (referring to the wide variety of mini cooking devices intended to provide small amounts of heat). For example, what is called “backpacker”-sized cooking is a very specific and considerably developed sub-set of mini cooking. Mini cooking can be done on large stoves, but mini stoves (cooking devices) are generally dedicated to preparing small quantities. [Exceptions are when a very small stove (mini) is used for extended periods of time or is combined with other mini stoves to make sufficient heat for cooking substantially more food.]

There is no required correlation between stove sizes and meal sizes, especially when influenced by factors including availability of food, fuel supply, fuel types, cultural traditions, and household financial conditions.

Mini Cooking and Devices in Affluent Households

All residents in affluent (“advanced”) societies know and utilize mini cooking when appropriate and available. In general, mini cooking is quick and fast, and uses surprisingly little energy. Affluent households can have a dozen mini stoves/devices; consider a waffle iron, microwave oven, or crock-pot. If a large stove is used, it is only a single heating element (a front burner) that is turned on and then off in a few minutes.

Mini cooking is also very popular with individuals eating alone and with two-person families. Modern societies facilitate mini cooking, especially when a single or small serving of food comes pre-packaged, maybe even frozen. Heat it and eat it. No muss; no fuss. Convenience in the kitchen. Dedicated purpose. Energy savings. Modern living.

Mini Cooking and Devices in Impoverished Households

“Impoverished” is a relative term. At one extreme are people in zones impacted by famines, wars, refugee movements, natural disasters, and chronic poverty. When food is scarce, household cooking will be in small quantities because that is all that the people have. In such situations, the availability of mini TLUD stoves might be highly appropriate for using little fuel, fast cooking, portability, and low cost.

At the other end of “impoverished” are the households on the verge of transition into the lower middle class. Transition can be gradual and incremental, such as acquiring a better or additional cooking device while still mainly using “traditional” stoves. Between the extremes is a spectrum of subsistence-level, low-earning rural and urban households that generally lack multiple appliances and alternative sources of thermal energy.

In today’s world, about 500 million households with approximately 3 billion people (about 40% of the world’s population) do their daily cooking with solid fuels such as wood, dung, agro-refuse, and in some places, coal. Usually their cooking fires are slow to start, their fuel might be inconveniently sized, and their stove configurations often include lingering, sometimes smoky, smoldering fires that are stoked up to significant heat when needed, even if only for some tea or coffee water in the mid-afternoon. These are not efficient cooking devices for mini cooking. They are for larger pots and griddles (planchas). There are some exceptions, such as Chinese high-heat wok cooking, with high-intensity fire for a relatively short period, but that is generally not mini cooking.

The discussion here is about how mini cooking on mini stoves can be accomplished in impoverished, developing societies, resulting in greater personal convenience, time-saving speed, important energy efficiency, fuel savings, and reduction of CO2 emissions.

There is a noteworthy absence of mini cooking devices (mini stoves) that use the abundant and (generally) lower cost solid fuels of wood and dung and agro-wastes. The reasons include slow ignition, lack of sufficient flame control, inconvenience of extinguishing after short times of usage, and, most importantly, issues of smoke in the kitchen; these are all issues with traditional and “improved” cookstoves (ICS) wood-burning stoves. Only now in the 21st century, has the advent of micro-gasifier stoves (“Woodgas stoves”) added new options with clean burning of wood and other dry biomass solid fuels. Gasifier stove technology provides prospects for mini cooking with abundant, low cost local fuels in mini stoves.

Top-Lit UpDraft (TLUD = tee-lud) Micro-gasification

The full spectrum of cookstoves is summarized in the useful “Classification of Stoves” (<http://www.drtilud.com/2017/04/11/classification-stove-technologies-fuels/>). Readers who are not well informed about micro-gasification and woodgas as a cooking fuel are referred to the full technical discussions of TLUD technology and regular-size TLUD stoves available at www.drtilud.com , and in particular “Micro-gasification: What It Is and Why It Works” at <http://www.drtilud.com/wp-content/uploads/2012/08/BP53-Anderson-14.pdf> .

Quick View of Early Work (August to October 2017) on Mini TLUD Cookstoves

A mini TLUD stove is specifically designed to use micro-gasification technology to accomplish mini cooking. Basically, it produces appropriately small amounts of heat for convenient, fast, clean, controlled cooking.

1. Combustion device (also called “reactor” or fuel chamber or TLUD body): (see photos section)

- Fuel container: The prime example is a stainless steel drinking cup, 0.4-liter (14 – 15 fl. oz.), with holes for primary and secondary air;
- Outer cylinder: a metal can, size of 1 gallon (4 to 5 L) or #10 food tin can. Optional to be open at one end. Many other sizes of cans can be used, but uniform height is advantageous for usage, that is, the proper placement of the cooking vessel.
- Arrangements for handle.
- Air control options: There are two major types, ND and FA, with significant differences in the numbers of primary versus secondary air holes. If natural draft (ND-TLUD), a controller for primary air entry is desirable, and a riser to increase draft is part of the stove structure or is simply placed above the fuel container. If forced air, the reactor is placed upon a fan-assisted air base (“FAAB”). See separate FAAB documents.

2. Application (also called “stove structure”): Note that the pot (or cooking application) is supported by the stove structure, not by the gasifier itself. This is highly recommended for 1) safety (stability) and several other reasons:

- Appropriate support of whatever size pot or other stove usage utensil.
- Ability to easily insert and remove the mini TLUD under the cooking vessel.
- The relatively short duration of a batch of fuel in a mini TLUD can result in frequent refilling of the fuel chamber if used for larger portions of food.
- Potential ability to place more than one mini TLUD under the cooking vessel, thereby accomplishing larger cooking tasks without needing a larger combustion device.
- Ability to have different sizes and designs of mini TLUDs under one pot at different times, without the need to move the pot.
- The flexibility to use the same mini TLUD to provide heat to different stove structures, such as when there is both an indoor and outdoor kitchen (common in some tropical regions).

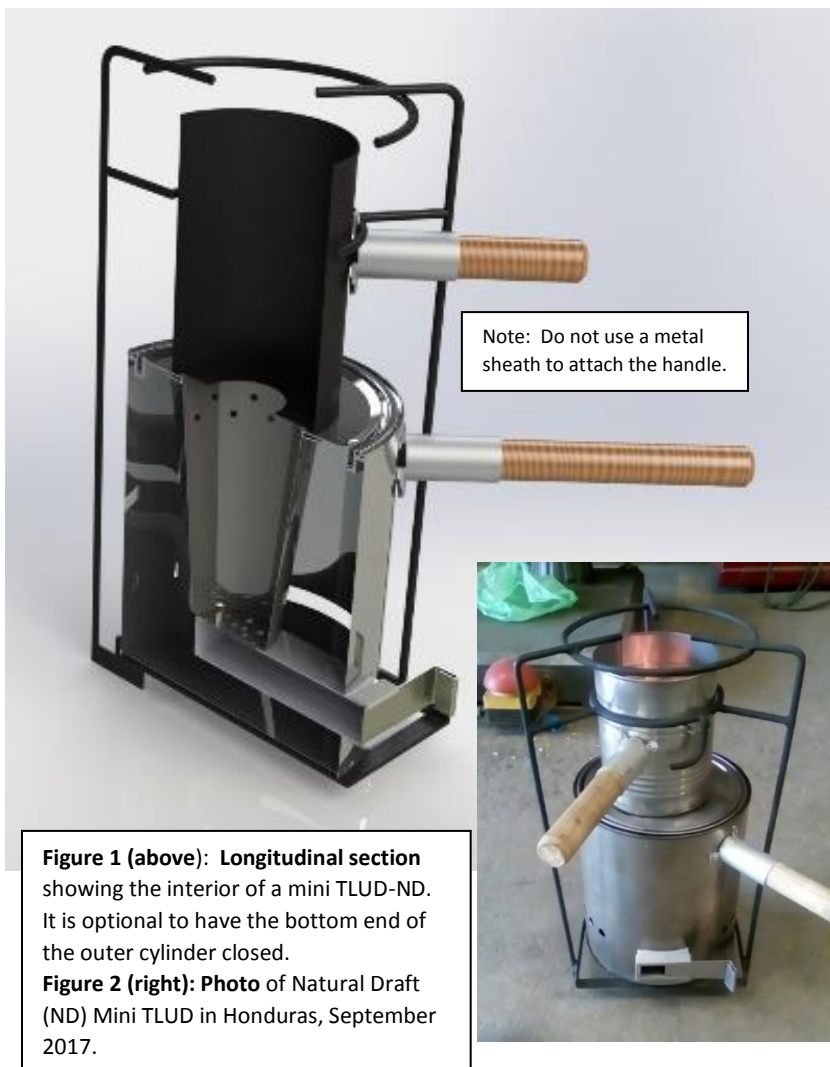


Figure 3 (above): A fan assisted air base (FAAB) for a mini TLUD-FAAB gasifier stove. This minimal TLUD-FAAB stove consists of a SS drinking cup (not shown) inside a tin can with a handle, in operation upon a base plate with a recycled computer fan attached, all supported by two horizontal rods.

The base configuration, fan and electronics should be considered part of the stove structure, not part of the gasifier itself. Although the base and the gasifier / reactor function together, only the gasifier is designed to be moved in and out of the overall stove structure. Additional documentation about FAAB stoves is being prepared and will have content relating to the mini TLUD stoves.