



Standard Stove Performance Testing

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Introduction

Monitoring and evaluation of improved cookstove performance is a critical factor in cookstove program development; however, there is mounting evidence that water boiling tests are not representative of stove performance during daily cooking activities. Since emissions from biomass cooking contributes heavily to regional estimates of greenhouse gas production and given the current importance of stove performance tests as a basis for global climate prediction models and IPCC inventories, improvements in performance testing are critical to derive more representative estimates (1).

Standard types of stove performance testing

The Water Boiling Test (WBT) is a laboratory test that evaluates stove performance while completing a standard task in a controlled environment (boiling and simmering water) to investigate the heat transfer and combustion efficiency of the stove. They are the easiest, quickest, and cheapest to conduct, but reveal the technical performance of a stove only under the particular case of water-boiling conditions, and not necessarily under real cooking conditions in households. They are conducted under controlled conditions by trained technicians, rather than local cooks, and therefore cannot provide insight into how the stove performs when cooking real foods under realistic conditions. The method starts with a high-power boiling phase followed by a low-power simmering phase (1, 2).

- Strengths: simplicity, replicability, speed, and cost to conduct. It can provide preliminary understanding of stove performance and therefore inform the design process.
- Weaknesses: only a rough approximation of actual cooking. Recent studies have shown that WBT are not good predictors of actual fuel use when compared to measurements in fuel use in households (1, 3, 4).

The Controlled Cooking Test (CCT) is a laboratory or field test that measures stove performance in comparison to traditional cooking methods when a cook prepares a local meal. The CCT is designed to assess stove performance in a controlled setting using a standard task chosen to emulate local practices. It reveals what is possible in households under ideal conditions but not necessarily what is actually achieved by households during daily use. It should be done by a person who is familiar with the meal being cooked, the traditional cooking methods, and the operation of the stove being tested (2).

- Strengths: relative simplicity, replicability, speed, and cost to conduct. It can provide preliminary understanding of stove performance for local cooking and therefore can be helpful through the design and dissemination process.
- Weaknesses: controlled conditions (including fuel, food procurement and training) still do not reflect uncontrolled usage that is sensitive to operator behavior differences or fuels that vary in composition, moisture, and size (3).

The Kitchen Performance Test (KPT) is the principal field test used to evaluate stove performance in real-world settings. It is used in the homes of stove users and is designed to assess actual impacts on household fuel consumption. KPTs are typically conducted in the course of a dissemination effort with local populations cooking normally, and give the best indication of real world changes. They are often conducted over several days (2).

- Strengths: allows the best understanding of stove performance in the field, including stove impacts on both fuel use and on general household behavior with regards to the stoves.
- Weaknesses: labor intensive, intrusive on people's daily activities, more variability in results due to the less controlled testing situation, more sensitive to survey/study design and bias in choice of included households.

Conclusions

Improved cookstove performance tests require trade-offs between logistical complexities and a realistic reflection of cookstove performance outcome in the field. Despite well-documented problems associated with the use of the three different stove performance tests (WBT, CCT, KPT), little research has been conducted to improve these testing methods ((1) and references therein). The most salient issue is the inability to correlate the results of the three tests in a consistent manner, and evidence that the overall efficiencies during daily cooking activities in the KPTs have been highly misrepresented by the water boiling tests (1, 3, 4). Controlled laboratory tests do not capture the complexity of real household conditions and behaviors, and thus there may be no direct correlation between performance in laboratory tests and performance in actual households (3, 4). We thus recommend a two-pronged approach to testing: laboratory testing using local food preparation within the controlled laboratory environment, and controlled cooking cycles in the field for verification, using local users, in their households, all of whom prepare the same meals in order to reduce variability in stove performance testing results due to differences in number or types of meals.

References

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