Round Robin Builds Testing Capacity

Nine labs across eight countries conducted comparative testing of three stoves and created a community of practice

Background and Scope

International standards provide a single, validated source for testing methods and performance indicators; facilitate coordination among diverse stakeholders with varied priorities, approaches, and goals; and form the basis of governmental and organizational policies and programs, as well as a means of tracking progress toward policy objectives and outcomes.

CCA is proud to have been a leader in the development, dissemination, and implementation of the International Organization for Standardization (ISO) clean cooking standards since CCA's inception. The ISO standards allow for the identification of the best available (i.e., cleanest and most efficient) technologies and fuels, which are specific to each context. Being able to systematically assess the performance of a range of clean cooking solutions allows countries, implementers, and donors to strive for continuous measured improvement over time.

Figure 1: LEMS equipment at CSIR-IIR (Ghana)

Specifically, these standards include:

- ISO 19867-1:2018; Harmonized Laboratory Test Protocols; Part 1: Standard test sequence for emissions and performance, safety and durability (which provides guidance on how to test cooking stoves); and
- ISO/TR 19867-3:2018; Harmonized Laboratory Test Protocols; Part 3: Voluntary performance targets for cookstoves based on laboratory testing (which outlines a 6-tier rating framework for reporting test results across 5 parameters).

Key to successful implementation of the ISO standards is the ability of testing labs to confidently and accurately test and report against the new protocol and reporting framework. To that end, CCA launched a round robin testing program in 2021 to deepen the capacity of testing centers and to ensure they are harmonized in their abilities, so that stakeholders receive similar results no matter where in the world they send their stove to be tested.

Round Robin Testing Program (2021-2023)

Through direct contracts with nine labs in eight countries, CCA commissioned stove testing to generate testing and reporting practice, and to establish a community of practice to compare results, identify inconsistencies, discuss challenges, and fill gaps in knowledge or practice. As these labs act as hubs in each of their regions, this work built regional testing capacity in addition to national capacity in the 8 countries. The testing also provided a much-needed increase in available testing data on clean cooking stoves and fuels in use in the sector.

The participating testing labs in the 2022-2023 Round Robin cohort included:

- Aprovecho Research Center, Cottage Grove, Oregon, USA
- Centre d'Études et de Recherches sur les Énergies Renouvelables (CERER), Dakar, Senegal
- Centre d'Études et des Recherches sur les Énergies Renouvelables Kitsisa-Khonde – Institut Supérieur de Techniques Appliquées de Kinshasa (CERERK), Kinshasa, Democratic Republic of the Congo
- Centre for Research in Energy and Energy Conservation (CREEC), Kampala, Uganda
- Centro de Pruebas de Cocinas (CPC) del Instituto de Investigación y Desarrollo de Procesos Químicos (IIDEPROQ), La Paz, Bolivia
- Colorado State University (CSU), Fort Collins, Colorado, USA
- Council for Scientific and Industrial Research – Institute of Industrial Research (CSIR-IIR), Accra, Ghana
- Kenya Industrial Research and Development Institute (KIRDI), Nairobi, Kenya
- Laboratorio de Innovación y Evaluación en Bioenergía (LINEB), UNAM, Mexico City, Mexico

Jim Jetter, from the U.S. Environmental Protection Agency (EPA) Office of Research and Development, and director of EPA's cookstove testing program and lab, provided expert advice and guidance throughout the program.

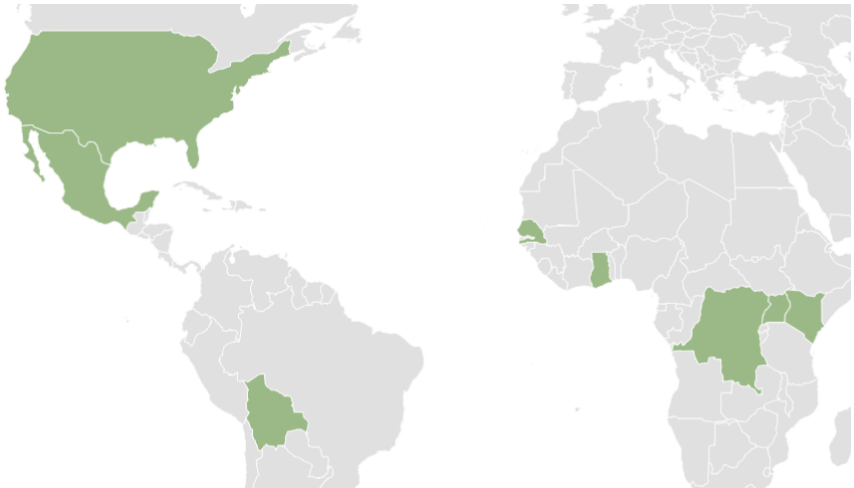

Figure 2: Map of round robin testing lab country representation

The Round Robin (RR) program was structured around each lab completing three synchronized rounds of testing over 12 months. For each round, labs tested the same stove and fuel combination, with identical pots, using the ISO 19867-1 protocol and reported the results using the ISO/TR 19867-3 reporting framework for emissions (carbon monoxide and particulate matter), efficiency, and safety.

The three stoves tested were a top-fed forced draft stove tested with pellets, a side-fed rocket-style stove tested with wood, and a top-fed charcoal stove.

The labs attended three cohort-wide virtual calls of 60-90 minutes each per round. For each round, upon receipt of the stove, labs performed practice tests using locally available fuel. During the first cohort-wide call for each round, the group discussed and decided on harmonized stove operation for that particular stove based on both the ISO protocol and stove manufacturer's operating instructions, as well as their own practice tests. This included the best approach to light the fire and load or meter fuel. Based on those decisions, and using the round robin-provided fuel, labs performed and submitted their first testing replicate (a full ISO test includes five replicates).

During each second cohort-wide call the group reviewed, compared and discussed the first replicate results. The group explored any anomalous findings, with relevant labs explaining their procedure and any challenges they had. Once inconsistencies were resolved, the cohort went on to perform the remaining test replicates, retesting the first replicate where needed.

A third discussion for each round focused on the full suite of testing data, after which each lab submitted a final testing report to CCA.

Program Outcomes

The RR program provided key experiences and support to participating laboratories allowing them to improve their execution of the ISO protocol. The results also helped to generate data on stove performance with the ISO protocol, which is critically needed, given the protocol has only been available since 2018. The RR program also helped build communications and relationships across testing laboratories, which fostered peer-to-peer learning and strengthened connections in the testing community. The participating laboratories were engaged and enthusiastic, and reported the process to be well-organized. The results provide key insights into how the protocol is implemented and the corresponding implications for results.

Despite well-coordinated efforts, there was variation among laboratories on key operational conditions. The variability in performance metrics between laboratories was likely in due in part to the differences in operational firepower. However, the results did not show clear or expected relationships between firepower and thermal efficiency and/or emissions. Encouragingly, despite the need for further alignment in operating procedures, tier performance was generally within one tier level between the laboratories. Given the importance of firepower as an operational parameter in the ISO protocol, this variability suggests that further guidance or prescriptive measures may be needed to increase consistency across laboratories.

Of note, it was not clear that results from the US laboratories were more reliable or consistent than the labs in global South. Variability within tests was generally lower at the US testing centers, but the difference in performance metrics among the US laboratories was similar to the non-US centers, suggesting care should be taken in considering their results a “gold standard”.

Figure 3: CPC (Boliva) Staff with Jim Jetter, USEPA

Importantly, the community of practice created through the round robin program is continuing to deepen our technical testing knowledge, which is a welcome development for the sector. Because an automatic review of ISO standards happens every 5 years, the ISO 19867-1:2018 review process will launch in the fall of 2023. As graduates of the RR program, the nine labs are now well positioned to contribute valuable feedback to this review, highlighting points of confusion and making recommendations for improvements in guidance or clarity based on their RR experience, many of which were identified through the course of the program. For example, one lab manager has noted inconsistencies across different sections of the testing protocol in the requirements for how stove safety metrics are reported. A technician in another lab noted that the protocol does not sufficiently emphasize safety and durability, and more attention should be paid to quality assurance and quality control measures.

Next steps

Based on the success of the first-round robin cohort, CCA is planning to launch a second round robin program for labs not already involved in the first cohort. Because this second round will target testing labs starting out at lower capacity than the first round did, it will commence with an in-person training on how to conduct the ISO test protocol.

CCA hopes to take advantage of this event to include an in-person refresher training for first cohort participants, which will allow them to review the ISO test sequence more fully than was possible virtually.

As the second RR program rolls-out, CCA will build on lessons learned from the first round to encourage participating labs to take leadership roles for different stages of the RR process. For example, different RTKCs will lead and coordinate communications for a given stove. Further, feedback and conversation during the virtual calls will be structured so that each RTKC contributes input. These suggestions were all provided by first cohort participants to CCA following their completion, and CCA is grateful for their participation and feedback.

By encouraging engagement and input from all labs throughout the program, the investment made in the RR testing program will continue to return dividends in terms of stove testing quality and consistency to support the scale up of clean cooking fuels and technologies across the global South.

This report was co-authored by the Clean Cooking Alliance and Berkeley Air Monitoring Group.