

Nepal Interim Benchmark for solid biomass Cookstoves

(NIBC, 2014)



Government of Nepal

Ministry of Science, Technology and Environment

Alternative Energy Promotion Center

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List of Abbreviation

AEPC	Alternative Energy Promotion Center
NRREP	National Rural and Renewable Energy Programme
NAST	Nepal Academy of Science and Technology
RETS	Renewable Energy Test Station
ISO	International Organization for Standardization
IWA	International Workshop Agreement
BIS	Bureau of Indian Standards
CDM	Clean Development Mechanism
ICS	Improved Cooking Stoves
NACC	Nepal Alliance for Clean Cookstoves
NIBC	Nepal Interim Benchmark for solid biomass Cookstoves
PM	Particulate Matter
CO	Carbon Monoxide
MJ	Megajoule
MJ _d	Megajoule delivered to the pot
L	Liter
g	Gram
mg	Milligram
min	Minute

Background

Alternative Energy Promotion Center (AEPC) is the focal agency of Government of Nepal (GoN) under the Ministry of Science, Technology and Environment (MoSTE). With the mandates of policy and plan formulation, programme/project execution, technology dissemination, resource mobilization and coordination and quality assurance, the mission of AEPC is to make renewable energy a mainstream resource through increased access thereby, contributing for the improved living conditions of people in Nepal.

AEPC has been disseminating different models of Improved Cooking Stove (ICS) right from its inception, under different programs supported by various external development partners. Recently conducted 'National Living Standard Survey' has shown that still more than 3 million households of the country qualify for improving their traditional stoves to improved cooking stoves.

AEPC is implementing National Rural and Renewable Energy Programme (NRREP) with support from a number of external development partners in a single programme modality for the promotion and dissemination of renewable energy technologies under various sub/components and units from mid-July 2012 to mid-July 2017. "Biomass Energy Sub-Component" (BESC) of NRREP aims to improve living standards of rural people, increase employment through introduction of affordable, efficient and appropriate biomass technologies.

AEPC/NRREP has targeted to disseminate about 475,000 stoves under its project period including both mud and metal ICS and the programme has envisioned for dissemination of quality stoves in terms of technical performance and user acceptability.

Output 2.3 of NRREP states that "Scaled up implementation network for ICS is in place and tested and certified stoves with defined quality criteria are operational". The development of interim benchmark for solid biomass burning cookstoves is aimed to recognise and certify stoves that have optimized performance in terms of efficiency, total emissions, indoor emissions and user safety. Further, the recognized stoves can qualify for participation in government subsidies, CDM or other carbon market schemes.

This Nepal Interim Benchmark for solid biomass Cookstoves (NIBC, 2014) document is the outcome of rigorous interactions and consultative meetings with the NACC members during Annual Day of NACC (10 July 2014), national and international experts during ICS Regional Workshop (18-20 August 2014) and the Stakeholders' Meeting for Benchmark Setting on Biomass Cookstoves on 24 September 2014 at AEPC.

The reviews and update of this document will be done following similar interaction and consultative meeting as per the requirement in the future.

1. Terms and Definition

For the purposes of this document, the terms and definitions given in the following apply.

Biomass cookstove

A device which is used to cook food and/or provide warmth and/or boil water through the conversion of biomass, typically through combustion.

Batch type stove

A stove in which fuel is loaded one time per burn cycle.

Continuous type stove

A stove in which fuel is loaded continuously over its burn cycle.

Cooking and heating stove

A stove which is used to cook food as well as heat the space of its surrounding area.

High-power

Operation of a stove at maximum (or nearly maximum) rate of energy use.

Low-Power

Operation of a stove at minimum (or nearly minimum) rate of energy use.

Water boiling test

A test in which the performance of a stove is evaluated through the heating of a known quantity of water across a specified range of temperature following a defined protocol.

Natural draft stove

The stove in which flow of exhaust gas occur naturally due to difference in pressure created by temperature difference between inside of the stove and outside environment.

Force draft stove

The stoves where fan is used to assist in flow of exhaust gas.

Chimney stove

The stove in which chimney is used to assist in creating positive draft for flow of the exhaust gas from inside of the stove body to the outside environment.

Chimneyless stove

The stove in which chimney is not used to assist in flow of exhaust gas from inside of the stove body to the outside environment.

2. Testing Protocol/methods

ISO-IWA recommended Water Boiling Test Version 4.2.2 and above shall be followed for testing the biomass cookstoves (excluding batch feeding type cookstoves and charcoal, briquette burning stoves). The stoves shall be tested under high power and low power phases.

BIS recommended IS 13152 standard testing procedure shall be followed for Thermal Efficiency test of batch fuel feeding type biomass cookstove (including charcoal stoves, briquette burning cookstoves and gasifiers).

Biomass Stove Safety Protocol - Version 1.1 (developed at Iowa State University and recommended by ISO-IWA) shall be followed for safety performance measurement.

3. Minimum requirements for testing facilities

The following minimum equipment is required for certified testing of emissions, performance, and indoor emissions:

- a. For carbon monoxide emissions or room measurement: non-dispersive infrared or electrochemical cell.
- b. For particulate matter emission or indoor air quality measurement:
 - a. real-time measurement of a particulate matter proxy via light scattering, and
 - b. PM 2.5 gravimetric measurement
- c. For emissions exhaust gas flow: constant volume pump or flow grid both with real time temperature and pressure correction.
- d. For temperature measurement: Type K thermocouple or equivalent.
- e. Computer data logging of all measurements with a minimum time resolution of one measurement per ten seconds.
- f. For measuring fuel and water masses, a calibrated digital scale with 1 gram resolution or better.
- g. For BIS standard, measurement parameter unit equivalence to those used in the IWA-ISO has to be developed using emission hood and aforementioned testing methods.

4. Minimum technical standard for performance of solid biomass cookstoves

4.1 Thermal Efficiency and fuel use

Types of stove	Chimney Stove (Natural Draft)	Chimneyless Stove (Natural Draft)	Forced Draft Stove (Fan stove)
High Power Thermal Efficiency(%)	≥20	≥25	≥30
Specific Fuel Consumption (MJ/min/L)*	≤0.045	≤ 0.039	≤0.034

*The high power values are mandatory values and low power values are preferred values only.

4.2 Total Emission

Types of stove		Chimney Stove (Natural Draft)	Chimneyless Stove (Natural Draft)	Forced Draft Stove (Fan stove)
PM 2.5 Emissions	High Power (mg/MJ _d)	≤979	≤386	≤277
	Low Power (g/min/L)*	≤8	≤4	≤ 3
CO Emissions	High Power (g/MJ _d)	≤16	≤11	≤10
	Low Power (g/min/L)*	≤0.20	≤0.13	≤ 0.12

*The high power values are mandatory values and low power values are preferred values only.

4.3 Indoor emission

Types of stove	Chimney Stove (Natural Draft)	Chimneyless Stove (Natural Draft)	Forced Draft Stove (Fan stove)
CO (g/min)	≤0.42**	≤0.62	≤0.56
PM2.5 (mg/min)	≤2**	≤17	≤13

**Fugitive emission value only, excluding emission from the chimney outlet.

4.4 Safety performance

Stove category	Metallic body cooking and heating stove	Metallic body cooking stove	Mud/ composite body cooking stove
Safety assessment calculation	≥45	≥75	≥88

5. Validity of Document

This interim benchmark will be applicable for all the solid biomass cookstoves disseminated under government subsidy policy. This document will be effective from 1st December 2014 and will remain valid until a new version or National Benchmark for Solid Biomass Cookstoves formally replaces it.

Note –

1. Testing of cookstoves could be done from any laboratory which fulfills minimum equipment and process requirement mentioned in Section 3 of this document.
2. Third party certificate verification (national and international laboratories) and Certification of cookstoves, as per this benchmark, has to be from Renewable Energy Test Station (RETS) under Nepal Academy of Science and Technology (NAST).