A Comprehensive Review on Biomass Cook-Stove

Maneesh Singh¹ Devesh Kumar²
¹M. Tech Student ²Assistant Professor
¹,²Department of Mechanical Engineering
¹,²M. M. M. U. T., Gorakhpur

Abstract— The of biomass cook-stoves popularity all over world but the basic need to discuss about the biomass cook-stove application in India. In this paper I would like to focus on the biomass cook-stove history, how it can be useful for rules area as well as urban area because India is country where consumption of petroleum is more than enough so in this our purpose is to discuss the awareness of biomass cook-stove. This paper gives the historical overview of cook-stove.

Key words: biomass cook-stoves, emission efficient ICSs, three stone fire (TSF)

I. INTRODUCTION

In the present time the advancement in India is called digital era and living standardization has been changed but at these time most of the approx. 70% population of India live in rural area [1] or belong to Indian village and in the villages there is a easily available resources is biomass in the form of wood, rice, wheat, cow, and many more and these resources help to people in cooking system in traditional chulaha(stove) which causes a lot of smoke and pollution which very harmful for that person who involve in cooking and we find the solution of that problem in the new cook-stove which very chip and depend upon natural resources.

But these time trend has been changed modernization is affect the rural areas and people are so conscious about their health so we have to need biomass gasifier. Our purposes is access to clean cooking facilities.

In the era of spacecraft’s, computers, and electronic gadgets, about 2.6 billion people do not have access to clean cooking facilities; and if predictions are believed the approximately same number will still be so in 2030 [1]. About 1.6 million people die prematurely per year; from indoor air pollution, resulting from solid-fuel cooking; causing more than 2% of the whole world diseases (4% in the poorest nations) [2]. Cooking with solid biofuels also has a significant global impact on, greenhouse gas and black carbon emissions, accounting for 1–3% of all human generated global warming [3]. Venkataraman et al. concludes that, the solid biofuel combustion is the dominant source of global black carbon emissions, with as much as 42% of total black carbon emissions in India [4]. The heavy dependence on biomass resources and their inefficient utilization can be a significant source of deforestation and resulting climate change, as observed in studies conducted independently, in six Tanzanian cities [5] and three urban regions of Ethiopia [6].

As a solution to these global problems, energy and emission efficient ICSs (Improved cook-stoves) can reduce: diseases, by decreasing indoor air pollution (IAP); time and cost of obtaining fuel; risk of violence against women and children gathering fuel in conflict areas; consequent climate change and deforestation. Hence, in the “Biomass Cook-stoves Technical Meeting” held on January 2011, the expert team on cook-stove technologies set new benchmarks for ICS: “at least 90% emissions reductions and 50% fuel savings over baseline technology (three-stone fire)” [7]. Currently more than 160 cook stove programmes are running in the world, across different nations [8]. Since 1970s, the laboratory, the field, and the policy aspects of biomass cook-stoves have been studied under ICS projects by many renowned researchers like Samuel Baldwin [9], Barnes, Smith [10,11], Prasad [12], and Bryden [13]. Numerous studies conducted by such researchers, helped build a database regarding various issues related to cook-stoves such as design, development, testing, materials, dissemination and field performance. Unfortunately, much of the literature is widely spread, and it is hard to get a good outline of the subject. This review paper is an effort to address the need for concise and simplified discourse; on scientific knowledge related to biomass cook-stoves.

A. Biomass Cook-Stoves:

“Biomass cook-stove” is a physical structure that contains air-fuel combustion for heat release, and subsequently, directs the heat of combustion towards a cooking target (pot/pan/griddle). Besides cooking, stoves provide useful energy for space/water heating, in-house lighting, fish/meat smoking, and grain/flour roasting. The same device in many cultures, serves more than one of these functions. Modern cook-stoves guarantee more than a plain fire; features such as high efficiency, low emissions, and safety of the user. According to the wide range of food habits, socio-cultural factors, and fuel type available; there exist, no of cook-stove designs across the world whether traditional or improved.

B. Historic Overview of Biomass Cook-Stoves

Cook-stoves are as old as the human history. They have evolved in numerous shapes and sizes, made up of varied materials, and adapted to different cultures and cuisines, with the advent of time.

C. Early History (Time Immemorial—1950)

Evidence is present, for the biomass fuel use within the caves of Peking man as early as 500,000 years ago [14]. From ancient times, while styles and methods of cooking have developed, the “archetypal” stove, which is today’s “traditional stove” or the “three stone fire (TSF)” has been as it was formed, for around 12,000 years now [15]. The “archetypal” stove remains predominant in the entire world up to the 18th century, and in the rural areas of many developing countries even to date. It was by the Industrial Revolution of the 18th and 19th centuries that the modern cooking technologies began. A book published in 1802 (London): “Essays, Political, Economical, and Philosophical” by Count Rumford, has descriptions of research on fireplaces, ovens and boilers [16].
D. The Recent Past (1950–2000)
In 1950s, the Gandhian organizations in India initiate the process of biomass cook-stove development, labelled the “classic phase” by Kirk Smith; focusing mainly on the reduction of the smoke exposure in kitchens, with the introduction of chimney stoves [16,17]. However, no scientific research and development of the ICS took place until the late 1970s or the early 1980s.

It was the 1970s’ oil crisis, which made the world pay attention to the energy issues; and as an answer to the fuel wood crisis and consequent deforestation, ICS received attention. Westhoff [15] identifies the period between the 1970 and the 1980 as marking the “first wave” of improved stove development. Then predictions to the effect that, high biofuel use will cause deforestation and escalated poverty; motivated the “first wave” or “energy phase” or “first phase” of stove development. The focus of designers in “energy phase” was on achieving fuel savings, through increased efficiencies, with smoke reduction being a secondary issue [9, 17]. It was during this period, that improved cook-stove movement began in the Africa at Sahel, after the severe drought of the late 1970s. The Guatemala earthquake of 1976 in Central America introduced the ICSs to the region, especially, the “Lorena stove” [15]. The famous Aprovecho Research Center (ARC) came to existence in 1976 with the aim of facilitating the research, development, and dissemination of the clean cook-stove technologies.

During 1980–1990, when the issues associated with the use of traditional stoves such as women-empowerment, enhancement of livelihoods, and natural resource conservation gained international recognition, “phoenix” period or “second phase” of stove development started [17]. Superior stove designs based on scientific studies; steadily evolved during the mid-1980s. During this phase, a strong technical base for the cook-stoves was laid because of heat transfer and fluid mechanics studies [9,12]; systematic testing and design procedures were also gradually established [18,19]. A large number of ICS models were developed and disseminated during this phase; with stove programmes in India and China being two major events. However Barnes et al. [10] conclude that the stove programmes executed between the 1980s and the early 1990s, were not much successful.

The “third phase”, of stove development, which began at the start of 1990s, shifted researchers’ focus on the consumer needs, such as smoke reduction in kitchens, user’s safety, and convenience in the stove use. The “third phase” combines additional environmental issues with the previous motivations of fuel savings. Single pot stoves without chimney or artisan made metal stoves, were the major stove types developed and disseminated during this period.

Amongst important events during the recent past was the “Indian National Programme on Improved Chulhas” (NPIC), first as a demonstration programme from 1983 to 1984, then on a full-fledged scale in 1985 [20,21]. It resulted in the development of more than 60 stove designs and Over 35 million stoves dissemination [22, 23]. Another impact programme during this period was “The Chinese National Improved Stoves Programme” (NISP), which has been addressed as the “World's largest publicly financed initiative to improve stoves” [24]. Between 1982 and 1992, the NISP introduced some 129 million improved biomass and coal stoves, in rural areas [25]. With more than 100 million cook-stoves still used, NISP is one of the successful stove programmes [26].

E. The New Millennium (2000—To Date)
In 2002, Ministry of New and Renewable Energy (MNRE) India deemed NPIC a failure, stopping funding to the programme, and passing the responsibility to the states [20, 23]. However, after more than a decade of decline, the interest in household energy (and hence ICS) emerged again at the international level. In 2002, at the “World Summit on Sustainable Development” held in Johannesburg, the “U.S. Environmental Protection Agency” (EPA) launched the “Partnership for Clean Indoor Air”, to address the environmental health risk faced by people using traditional biomass fuels indoors. In another favourable development, the “Clean Development Mechanism” (CDM), in February 2008, included cook-stove programmes in their agenda under “smaller decentralized projects”, by revising the programmatic guidelines [27]. Because of this, about 14 cook-stove projects are registered as “Programmes of Activities” with CDM as on May 2013 [28]. In December 2009, rejuvenating the efforts of providing clean cooking services to its people, the Government of India launched, “The National Biomass Cook stove Initiative” (NBCI) with the goal “Our aim is to achieve the quality of energy services from cook-stoves comparable to that from other clean energy sources such as LPG” [22]. In September 2010, the U.S. Department of State and EPA helped launch “The Global Alliance for Clean Cook-stoves” at New York. United Nations Foundation, comprising over 600 partners, is leading the alliance with the goal of creating the global market for energy and emissions efficiency cook-stoves, to solve multiple issues associated with the cook-stove use. The Alliance’s goal calls for 100 million homes to adopt “clean and efficient stoves and fuels by 2020”.

Health and environmental concerns, in addition to fuel efficiency are the main motivations of present day stove programmes. However, as with the earlier phases, the majority of these have been unable to scale up significantly [29]. Even today, only 40% of the people in developing countries have access to modern fuels for cooking [30]. Out of the people relying on solid-fuels for cooking in developing countries, only 30% have access to ICSs [30]. Most of these nations, access to ICSs is available to less than one-fourth of the people using solid-fuels. However, access is much higher in some countries such as China, Thailand, and Brazil [30]. Instead of mixed results obtained so far; some 166 million ICSs are still in use, as an inheritance of the efforts of all cook-stove initiatives of the past [26].

REFERENCES


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