Urban Pathways

Factsheet on biomass – Improved cooking energy Case Study Kenya: Solar Cook Stoves 2018

Source: (Global Alliance for Clean Cookstoves, 2018)

Wuppertal Institut

UN HABITAT FOR A BETTER URBAN FUTURE

UN environment

Authors/Contributors:
Mahendra Shunmoogam-Grabosch

Editor: Stefan Werland,
Kain Glensor
Layout/Design: Barbara Lah

Citation:
Grabosch, M. Factsheet on biomass – Improved cooking energy Case Study Kenya: Solar Cook Stoves . Urban Pathways 2018.

Supported by:

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

based on a decision of the German Bundestag

UN HABITAT
FOR A BETTER URBAN FUTURE

UN environment

Wuppertal Institut

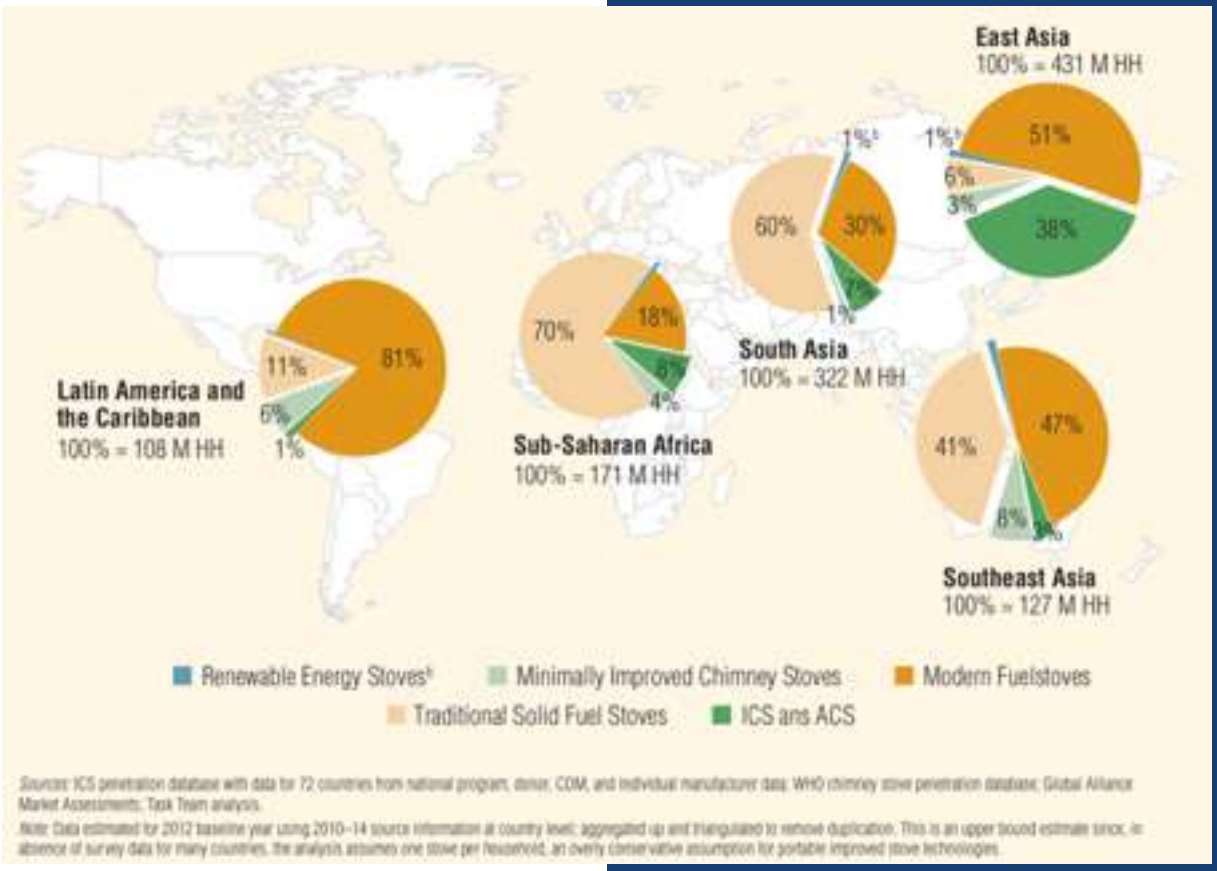
Background

Biomass is any organic matter that may and can be used as an energy source - these include wood, crops, yard and animal waste products. Easily available in the natural environment, biomass has aided human civilisation as total primary energy (TPE) since humanity's origins. Populations in rural areas, especially in developing countries, continue to rely on biomass for TPE – mostly for cooking and heating purposes. An estimated 2.7 billion people globally - 40% of the world's population - depend on traditional biomass, such as fuel wood, charcoal or crop residues, for cooking, heating and other purposes. Worldwide, an estimated 1.06 billion people do not have access to electricity, and 3.04 billion people still rely on solid fuels and kerosene for cooking and heating (World Bank, 2017). An estimated 530 million people in sub-Saharan Africa will still not have access to electricity by 2040. Moreover, people living in sub-Saharan Africa and South Asia spend a large part of their productive hours collecting biomass, and less time on education or other developmental priorities (World Bank, 2017). Population growth and the non-existence of proactive policies could see a global rise of people relying on biomass, which would contribute to increases in several negative health effects, especially in women and children and adversely contribute to environmental change. Smoke and its related toxic components from the burning of biomass used in cookstoves, especially in the developing world, is inhaled by people – which directly cause a range of chronic and acute health effects. These range from and include pneumonia, lung cancer, chronic obstructive pulmonary disease, heart disease, and low birth weights in children born to mothers whose pregnancies are spent breathing toxic fumes from open fires (Kaur, Sharma, Kaur, & John, 2016).

Clean cooking, increasing access to electricity, renewable energy and energy efficiency form part of the sustainable development goal number 7. Clean cooking refers to improved cookstoves that offer safer and healthier cooking options for households – moving households away from the toxic fumes inhaled from the use of biomass fuels used in traditional cookstoves. Its use positively impacts on families by reducing indoor air pollution and relies on alternative fuel sources. Clean Energy technologies/solutions in the form of improved cook Stoves (ICS) which allow biomass (wood fuels, charcoal etc.) to be burnt more efficiently and of solar powered lanterns, which are not dependent on fossil fuels, help to address and improve socio-economic challenges and health issues

Greenhouse gas (GHG) emissions from biomass such as wood fuels, for example, amount to a Gigaton of CO2 per year, an estimated 1.9 to 2.3% of global emissions (World Bank, 2017). Addressing this sector's effect on GHG could significantly contribute to the UNFCCC's (United Nations Framework Convention on Climate Change) mitigation efforts. After carbon dioxide, black carbon has the second highest impact on climate change. Since black carbon remains in the atmosphere for days to weeks and returns to earth's surface through rain or air deposition it has 3000 times the global warming potential of carbon dioxide. (Global Green Freight Project, 2017). Recently, global interest in clean bio-energy has been developing, sparked by higher oil prices, instability in oil-producing regions, the shift of financial investments into commodities and oil in 2007-08, extreme weather events and surging energy demand especially in developing countries. Moreover, domestic agricultural support programmes, demand for self-supplying energy commodities, and mitigating climate change have fuelled global interest in clean bioenergy. Traditional biomass is still, and will continue to be, a significant source of energy in developing countries. Continued use of bioenergy places a burden on land use, the environmental concerns related to biofuel expansion related to deforestation and land clearing (Cushion, Whiteman, & Dieterle, 2010).

Photo by Joshua Anand (World Bank, 2017)



The diagram above displays the limited penetration of clean fuels and improved cookstoves globally.

Biomass fuel and cookstove impact on the world (ESMAP, 2015)

Economic
USD 38-40 billion annually on solid fuels for cooking and heating – 140 million potentially productive person years annually wasted on biomass fuel collection and avoidable cooking time.

Health
4.3 million premature deaths annually and 110 million disability adjusted life years resulting from household air pollution (HAP).

Environment
Emissions from solid fuel use and charcoal production of 0.5-1.2 billion MT carbon dioxide (CO2) – up to 3% of annual global CO2 emissions, 25% global black carbon emissions, consumption of ~1.36 billion tons of wood fuel across the developing world, with contribution to forest degradation and deforestation most likely from charcoal production in Africa and Asia.

Gender equity & social Impacts
Disproportionate risks of negative HAP-linked health outcomes and physical injury for women and girls, given their proximity to cooking fires and primary responsibility for firewood collection in many cultures; decreased educational opportunities for children involved in fuel collection; impaired nutrition because of the diversion of resources to fuel purchases; and home environments damaged by smoke and soot.

Other social Effects
Reduced access to education due to impaired child health and time spent on fuel collection. Negative aesthetic effect in homes due to soot darkening the home environment.
Poor nutrition due to partly prepared food or reduced food budgets.
Increase poverty due to diversion of resource to pay for fuels.

Traditional burning cook-stoves

An estimated 3 million people – over 60 % of the developing world and 40% of the global population – rely on traditional cook stoves for cooking and heating their homes. These stoves rely on wood, charcoal, coal, animal dung or crop waste for fuel. The estimated health, environmental and economic cost of the use of solid fuels amounts to approximately USD 123 billion per year (World Bank, 2017). Women and children are more likely to be affected by the adverse health impacts of using biomass fuels. Black carbon (soot) is estimated to have the second largest global warming impact after CO2, and approximately 25% of global black carbon (BC) emissions are from domestic solid fuel combustion (Wathore, Motimer, & Grieshop, 2017), and 84% of these BC emissions are from households in developing countries (Global Alliance for Clean Cookstoves, 2018). Black carbon are small, dark particles produced from the incomplete combustion of biomass and fossil fuels. Moreover, estimated global patterns in population growth, urbanisation and historical fuel use suggest that the number of people relying on solid fuels for cooking and heating will continue to grow to a level of over 3 billion by 2020 – with populations in the developing world continuing to use wood, charcoal, and coal as a secondary cooking energy source (Putti, Tsan, & Kammila, 2015).

Clean biofuel cooking sector and stakeholder overview

Clean cook stoves and appliances have seen a growing interest in recent years, with a rapidly evolving and diverse group of stakeholders becoming involved in the sector. Research institutions, testing centers, fuel and stove suppliers, providers of finance, government agencies/programmes, donors, NGOs and coordinating platforms and initiatives make up the categories of the major players in the clean stove sector. The diagram below further elaborates on this point:

Source: World Bank, 2015

In 2010, over 100 active national-level clean cook stove programmes were recorded globally (Gifford, 2010). The UN foundation's Global Alliance for Clean Cookstoves is a major player in the sector – mobilising support from public, private, and non-profit stakeholders to address the production, deployment and use of clean cookstoves in the developing world. The UN's Sustainable Energy for All (SE4ALL) is another global player, mobilising global resources for clean cooking solutions and supporting the creation of an enabling environment. The World Bank's Biomass Energy Initiative for Africa (BEIA) has also been co-financing multiple pilots to test early-stage improved biomass stoves – the World Bank has also launched regional cooking market transformation programmes in Africa, Central America, India and Asia. National governments, such as Australia, Germany, the Netherlands, Norway, Switzerland and the UK have also support organisations and programmes related to clean biomass energy and cookstoves.

Policy Landscape

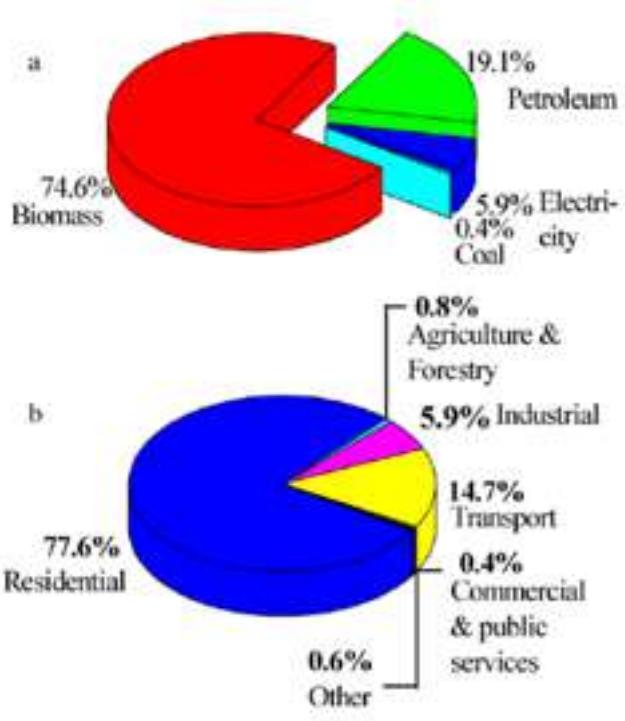
Robust testing mechanisms and standardised benchmarks for tests are critical to ensuring cookstove performance and product impact. Several testing protocols exist, but no single standard for governing cookstove performance has yet been implemented or adopted globally. A five-tier ISO IWA standards process led by the Global Alliance partners currently serves as the closest to a universal rating and test system for cookstove performance – adoption of this as a standard test is still at an early stage and in development. National governments retain the responsibility for cookstoves and market regulation governance. (Putti, Tsan, & Kammila, 2015). The Global Alliance for Clean Cookstoves have also been motivating and working with national governments to help create a labelling programme for clean cooking technologies – one of the aim of the labelling programme is to help consumers make an informed decision when making purchases. Biomass policy, institutions of favourable tax regimes for managed forests have been proven effective at promoting and sustaining responsible biomass fuel production (World Bank, 2017).

Case Study: Kenya

Source: Embassy of Kenya 2016

Country Statistics (World Bank, 2017)

- Population (2014): 45million
- Capital: Nairobi
- Area: 582, 000Km2
- Major Languages: Swahili, English
- Major Towns: Mombasa, Kisumu, Nakuru, Eldoret, Nyeri
- Population using solid fuels for cooking: 80%
- Number of people affected by Household Air Pollution (HAP): 38,800,00
- Number of deaths per year from HAP: 16,600



Energy supply in Kenya by type (a) and energy consumption sector (b)
Source Kiplagat, Wang, and Li, 2011

Biomass resource use in Kenya

Biomass is one of three main sources of energy in Kenya (the other two being petroleum and electricity) accounting for 74.6% of the country's total energy consumption of XX annually. In Kenya, like most developing countries, biomass plays a large role, especially for domestic and residential consumption. Most of the biomass resources used in Kenya are from closed forests, woodlands, bush lands, farmlands, plantations and agricultural and industrial residues. Wood fuel is the most-used form of primary energy consumed in Kenya, accounting for 74% of the total national primary energy supply. In 2000, wood fuel demand in Kenya reached a staggering 34.3 million tonnes compared to an estimated sustainable supply of only 15 million, and the demand is estimated to have reached 37.5 million tonnes in 2011 (Kiplagat, Wang, & Li, 2011). The increased use of wood fuel consumption and demand in Kenya is due to population growth, lack of access to biomass-energy substitutions and the growing incidence of poverty among the population – exerting pressures on the remaining forest and vegetation stock in Kenya. Charcoal use in Kenya is also considerably high, with 47% of the urban household population and 34% of rural households making use of it for energy. Urban charcoal usage in 2000 was 156 and 152 kg per capita for rural and urban dwellers respectively. The estimate for 2005 was 2.4 million tonnes (or 67 million bags of 36 kg each). The Kenya Demographic and Healthy survey (KDHS) in 2014 reported that 56% of Kenyans depend of wood fuel and 17% on charcoal as an energy source (Nyeri, 2018). In late 2017, Kenya's energy regulator issued a statement indicating that it aims to reduce biomass fuel use in the country (Sun News, 2017).

Clean cook stoves developments in Kenya

- NGOs, such as the Global Alliance for clean cookstoves, have been working with the Kenyan government to remove or reduce taxes and tariffs that impede the growth of the clean cooking sector.
- The Kenyan administration has prioritised clean cooking as a key intervention for meeting its obligations under the Paris Agreement to reduce emissions.
- The 2016-2017 Kenya national government budget announced the removal of the 16% value added tax (VAT) on LPG.
- A reduction in import duties on efficient cookstoves from 25% to 10% - placing a zero-rating VAT on clean cookstoves, raw materials and their accessories in an effort to make the cooking technologies more affordable.

Kenya's Nationally Appropriate Mitigation Actions and Improved Cooking Energy

Kenya submitted its INDC to the UNFCCC in July 2015 and has set its emission reduction target of 30 per cent by 2030 compared with its Business-as-usual scenario. Kenya has committed to creating a market-based environment for the manufacture and distribution of clean energy technologies which include PV lanterns and improved cookstoves. Policy intervention and coordinated efforts of the national and local levels have seen an increase of improved cookstoves in Kenya. The Global Village Energy Partnership (GVEP) international estimates that between 2.5 and 3 million Kenyan households have move towards using improved cookstoves. Although, less than 37 households in Kenya have switched to improved cookstoves in 2012, and the rest use cooking devices with low thermal energy efficiency ratios and high negative health impacts.

Bibliography

Cushion, E., Whiteman, A., & Dieterle, G. (2010). Bioenergy Development . Retrieved 05 03, 2018, from World Bank: http://siteresources.worldbank.org/INTARD/Resources/Bioenergy.pdf

ESMAP. (2015). State of the Global Clean and Improved cooking sector . Washington, DC: World Bank.

Gifford, M. (2010, 11 05). Global Reivew of Improved Cookstove Programs. Retrieved 05 05, 2018, from Freie Uni-Berlin: http://www.polsoz.fu-berlin.de/polwiss/forschung/systeme/ffu/veranstaltungen/termine/downloads/10_salzburg/gifford.pdf

Global Alliance for Clean Cookstoves. (2018, 05 03). Cooking and Climate Change. Retrieved 05 03, 2018, from Carbon Finance for Cook Stoves: http://carbonfinanceforcookstoves.org/about-cookstoves/cooking-and-climate-change/

Global Green Freight Project. (2017). Black Carbon Methodology for the Logistics Sector. Amsterdam: Smart Freight Centre.

Kaur, A., Sharma, P., Kaur, M., & John, S. (2016, Jan). Experimental Study of Traditional Cook Stoves and Various Improved Cook stoves using Biomass. International Journal of Advances in Science, Engineering and Technology, 1(4), pp. 121-124.

Kiplagat, J., Wang, R., & Li, T. X. (2011). renew

exploitation . Renewable and Sustainable Energy Reviews, 2960-2973.
Nyeri, M. M. (2018, April 02). Improved cook stoves-solution to skyrocketing charcoal prices. Nairobi, Nairobi, Kenya.
Putti, V. R., Tsan, M., & Kammila, S. (2015). The State of the Global Clean and improved Cooking Sector. Technical Report, World Bank: Energy Sector Management Assistance Programme , Energy, Washington, DC.
Sun News. (2017, 12 14). Kenya aims to end use of biomass fuel. Nairobi, Nairobi, Kenya.
Wathore, R., Motimer, K., & Grieshop, A. (2017, 02 07). In-use Emissions and Estimated Impacts of Traditional, Natural and Forced draft cookstoves in RUral Malawi. Environmental Science and Technology , 3(51), 1929-1938.
World Bank. (2017, 12 21). Putting Clean Cooking on the Front Burner. Retrieved 05 03, 2018, from World Bank: http://www.worldbank.org/en/news/feature/2017/12/21/putting-clean-cooking-on-the-front-burner
World Bank. (2017, 12 02). State of Electricity Access Report 2017. Washington, DC : World Bank. Retrieved from World Bank: http://documents.worldbank.org/curated/en/364571494517675149/pdf/114841-REVISED-JUNE12-FINAL-SEAR-web-REV-optimized.pdf

Urban Pathways

Supported by:

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

based on a decision of the German Bundestag

UN HABITAT
FOR A BETTER URBAN FUTURE

Wuppertal Institut

UN environment