

Improved biomass cookstoves: should they receive climate finance?

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Introduction and Summary:

Clean and efficient biomass¹ cookstoves have been attracting multilateral and bilateral development and, more recently, climate finance for several decades. The German government supports projects involving improved cookstoves both directly, through bilateral project finance, and indirectly, via funding for the Green Environment Facility, the Global Climate Fund and others.

Improved biomass cookstoves aim to reduce the amount of wood burned for household cooking in the Global South, and, at the same time, to reduce household air pollution to protect the health of women and young children in particular. The problems which improved cookstoves projects seek to address are very real and urgent ones.

Unfortunately, the results from peer-reviewed studies which look at the health impacts of improved biomass give little grounds for optimism: there appears to be no evidence of positive impacts on child health, nor on the incidence of the ultimately fatal respiratory illness, Chronic Obstructive Pulmonary Disease (COPD), which is associated with exposure to air pollution. At best, women's health is marginally improved, i.e. they experience fewer coughs and/or less phlegm and/or less eye irritation, with blood pressure readings showing improvements in one trial. However, in the largest and most long-term study to date, one which replicates the most common approach in climate finance projects (the mass delivery of stoves without follow-up repairs and maintenance), no positive outcomes were detected. Where marginal benefits are found, they appear to be linked to better ventilation, greater outdoor cooking and, in one case, a switch to charcoal- which is not good news for forests (since the total wood use is greater).

Furthermore, there is so far no evidence of any successful biomass stove projects which have reduced pollution levels to within the World Health Organisation's guidelines for indoor air quality.²

Clearly, the ideal outcome would be for all women to have access to clean cooking, using low-carbon renewable electricity, biogas or solar stoves.

Sadly, this is not a likely scenario in the foreseeable future. Communities affected by energy poverty, especially in rural areas in the Global South, will continue to rely on whichever measures help them to reduce the harm from biomass burning. There will continue to be a need for organisations working with such communities to help identify ways of reducing indoor air pollution from biomass, e.g. by helping to install stoves with chimneys, or by providing stoves that allow more of the cooking to take place outdoors.

¹ Note that the term 'biomass' here refers to solid biomass only. Biogas stoves, while far less common, are associated with significantly lower pollution than biomass stoves.

² Health and Household Air Pollution from Solid Fuel Use: The Need for Improved Exposure Assessment
Maggie L. Clark et.al., Environmental Health Perspectives, October 2013

However, the inclusion of biomass cookstoves into climate finance is highly problematic for three reasons:

a) Although fuelwood demand for cooking contributes to forest degradation in several regions, claiming potential greenhouse gas savings from reduced biomass use in the Global South is unjust and illogical when, at the same time, the EU and other countries in the Global North are allowed to (misleadingly) claim greenhouse gas reductions from burning more wood for heat and electricity.

b) The purpose of climate finance is to mobilise significant additional funding for implementing solutions that reduce greenhouse gas emissions and help vulnerable communities adapt to the already unavoidable level of climate change. Improved biomass cookstoves do not represent such a solution. The very best projects may to some extent reduce the harm caused by indoor air pollution as well as the amount of wood burned. Climate finance should go towards genuine solutions even if they are more expensive, i.e. solar stoves, renewable electricity or biogas made from local waste and residues.

c) As shown below, claims about fuel-use savings from improved biomass stoves are based on laboratory tests under idealised conditions. Studies invariably show that one cannot extrapolate from laboratory tests to the real-world use of stoves. Stoves that are clean and efficient in a laboratory may be much less so, if at all, when used to cook meals. Furthermore, households very commonly use new stoves in addition to their traditional ones, rather than as replacements.³

d) Arguably the most serious impacts of biomass stoves are those on the health of women and children. Climate finance projects may class reduced indoor air pollution as a secondary benefit, but they are not designed as public health measures.

This report looks at the evidence regarding the public health impacts of improved biomass stoves, at the controversial accounting for greenhouse gas savings from such stoves and, finally, at three climate finance projects involving the large-scale dissemination of stoves. A closer look at the three projects shows that they favour the dissemination of large quantities of stoves with little or no quality control.

Biomass cooking and public health:

According to the World Health Organisation, 3.8 million people – most of them women and young children – die every year as a result of breathing in small particulates and other pollutants from cooking with open fires or smoky stoves.⁴ Pollution from cooking kills more people annually than malaria, tuberculosis and HIV/AIDS combined.⁵ Far greater still is the number of people suffering chronic and acute illnesses that could be avoided with clean cooking methods.

³ See for example Assessment of cookstove stacking in Northern Ghana using surveys and stove use monitors

Author links open overlay panel, Ricardo Piedrahita et.al., Energy for Sustainable Development, October 2016

⁴ <https://www.who.int/airpollution/en/>

⁵ <https://www.nature.com/news/global-health-deadly-dinners-1.15286#/ref-link-2>

In theory, cleaner biomass cookstoves should reduce illnesses and death rates amongst women and young children, who are most exposed to household air pollution from cooking. This chapter looks in detail at the evidence contained in 53 relevant studies included in a systematic review and meta-analysis published in June 2018.⁶

No evidence that improved biomass stoves can benefit children's health in any way:

According to the authors of the systematic review and meta-analysis, "*improved biomass cookstoves had no demonstrable impact on child health*". This was the authors' conclusion from all relevant studies which looked at health impacts on children. The same negative result was found for impacts on pregnancy outcomes.

Two large studies included in this systematic review were carried out in Malawi and Guatemala respectively.

In rural Malawi, researchers studied the health impacts of cleaner-burning biomass stoves on pneumonia rates over a period of two years.⁷ This was a Randomised Control Trial involving 10,750 children from 8,626 households, using biomass stoves which, according to laboratory tests, could reduce key pollutants by 90% when compared to traditional open fires, which means that the stoves were cleaner than most improved biomass cookstoves. Furthermore, they were repaired and replaced whenever needed throughout the study period, something that does not happen with most stove intervention programmes. The authors suggested that the lack of health benefits could have been due to other sources of air pollution to which young children were exposed, and that the stoves may not have reduced emissions enough to have any effect.

In Guatemala, researchers conducted a randomised control trial involving 534 households with a pregnant woman or young child, looking at the impact of a less clean but more affordable improved stove than the one tested in Malawi.⁸ The stove reduced smoke exposure by 50% because it vented it outside. Again, there was no statistically significant impact on the rate of diagnosed pneumonia in young children, although some differences in the rate of different types of pneumonia were found between children in houses with the new stoves and those with traditional fires. Again, the authors suggested that smoke reductions may simply not have been large enough to clearly benefit children.

Evidence of even marginal health benefits to women is limited, and some of it comes from studies with questionable methodologies, with the largest study showing no benefit. Robust evidence of health benefits seems to be limited to improved ventilation/outdoor cooking

⁶ Impact of improved cookstoves on women's and child health in low and middle income countries: a systematic review and meta-analysis, Megha Thaku et.al., Thorax, 2018

⁷ A cleaner burning biomass-fuelled cookstove intervention to prevent pneumonia in children under 5 years old in rural Malawi (the Cooking and Pneumonia Study): a cluster randomised controlled trial, Kevin Mortimer et.al., Lancet, Volume 389, Issue 10065, January 14, 2017

⁸ Effect of reduction in household air pollution on childhood pneumonia in Guatemala (RESPIRE): a randomised controlled trial, Smith KR et.al., Lancet, 12th November 2011

and, in one case, a switch from wood to charcoal which would require even greater overall wood use.

According to the systematic review and meta-analysis mentioned above, 15 peer-reviewed studies based on different trials provide evidence that improved biomass stoves may reduce respiratory and eye problems in women, and three of those studies show the improved stoves may reduce the incidence of the progressive and ultimately fatal lung disease COPD (Chronic Obstructive Pulmonary Disorder).

However, a closer look at each of the 15 studies cited reveals this conclusion to be overly optimistic – and, in several cases, based on studies being misrepresented.

Impacts on Chronic Obstructive Pulmonary Disorder (COPD)

COPD is a progressive and ultimately fatal disease in which the lungs become inflamed and damaged. Polluting biomass stoves significantly increase women's risk of developing COPD. Two studies were cited as finding that improved biomass stoves have a positive impact on the rate of COPD in women. In fact, neither of the two studies looked at improved biomass cookstoves.

- One of the studies found positive effects when biomass was replaced with biogas stoves and ventilation was improved.⁹ Biogas is well known to burn much more cleanly than solid biomass.
- Two studies looked at interventions related to coal stoves, not biomass stoves, and one of these studies looked at lung cancer rather than COPD risks.¹⁰

This means that – based on the literature search carried out for the systematic review considered – there is **no evidence of improved biomass stoves reducing the risk of COPD.**

Impacts on other respiratory illnesses:

Household air pollution is linked to a reduced lung volume (which may or may not be a sign of COPD), acute and chronic cough, phlegm and wheezing. Reducing women's exposure to air pollution should reduce the incidence of respiratory problems. According to the authors of the systematic review, all 16 trials resulting in 'positive outcomes' showed improvements in women's respiratory health. These include the three studies referred to above which did not consider the impacts of improved biomass stoves at all.

Another study looked at the health impacts on children rather than women and did not identify any positive health impacts. Two further studies which did look at the health impacts on women did not show positive findings. Those three studies falsely cited in the systematic review are listed and discussed in Appendix 1. One

⁹ Lung function and incidence of chronic obstructive pulmonary disease after improved cooking fuels and kitchen ventilation: a 9-year prospective cohort study, Y. Zhou et.al., PLoS Med., March 2014

¹⁰ Improvement in household stoves and risk of chronic obstructive pulmonary disease in Xuanwei, China: retrospective cohort study, Aaron Blair et.al., BMJ, December 2005 AND Hosgood HD, Chapman R, Shen M, et al. Portable stove use is associated with lower lung cancer mortality risk in lifetime smoky coal users, HD Hosgood et.al., British Journal of Cancer, November 2008

of those two studies is the largest and longest improved biomass cookstove trial to date, one which replicates the approach taken in most climate finance projects that involve stoves (i.e. stove dissemination without follow-up support with repairs and maintenance).

In another study cited, women who used Improved Biomass Stoves self-reported improved respiratory health and less eye irritation, even though monitors showed that their exposure to smoke had not reduced at all – i.e. there was no logical reason why their health should have improved. The authors suggested that this could be due to a courtesy-bias, i.e. women wanting to show gratitude for the stoves (see Appendix 2)

In three further studies, also discussed in Appendix 2, women using Improved Biomass Stoves reported fewer respiratory symptoms, but lung function measurements revealed no difference – although in one of the two studies, blood pressure measurements improved when the new stoves were used. The authors of one of the two studies pointed out that reported benefits might have been due to a ‘wish-bias’. It is, however, possible that the the lack of peak flow improvements reflected respiratory health benefits that were real but minor.

One study (also discussed in Appendix 2), bizarrely reported improved lung function measurements, but no improvements in self-reported respiratory symptoms – a result far less plausible than the inverse result in the three studies mentioned above. This was a very small study in central Honduras, with a high drop-out rate and no control group. Studies of this type are discouraged by the Cochrane Effective Practice and Organisation of Care (EPOC) group, regarded as setting the ‘gold standard’ for medical research.

The final study listed in Appendix 2 saw no more than 38 women enrolled, of whom only 24 undertook the full study. Clearly, this sample was far too small to yield any statistically meaningful results.

This leaves just three studies which credibly demonstrate at least marginally positive impacts on women. They are discussed in detail in Appendix 3.

In one of those studies, women in central Mexico who were given a chimney stove to replace open indoor fires and who chose to actively use it saw their exposure to smoke decline by half. Women given a new stove also reported health improvements, and one out of five different lung function measurements confirmed such improvements within 10 months (greater improvements might take longer to manifest themselves). However, half the women given a new stove did not use it and another 20% chose to use both the new stoves and the open fires. Low take-up and continued use of new stoves, and their combination with traditional fires is a recurrent challenge for biomass stoves projects. Regrettably, researchers did not try and explore the reasons for this.

In a trial in Senegal, women were given a very basic improved stove without a chimney. Initial take-up was a relatively high 85% and most households continued to use the new stoves even after 3.5 years, although those which broke were not replaced. Women self-reported health benefits, although no additional respiratory health tests were undertaken. The researchers suggested that health improvements were most likely due to the fact that the stoves had better wind shields than open fires and therefore allowed more women to cook outdoors.

In a trial in Kenya, women who switched from 3-stone fires to ceramic wood stoves were shown to have lower exposure to smoke and better self-reported health, although no additional respiratory tests were done. However, the study found that the most effective intervention was switching from wood to charcoal rather than switching from traditional to improved biomass stoves – even though switching to charcoal meant using more wood and thus had a negative environmental impact.

Reasons why improved biomass stoves are not more effective:

Reasons for the failure or low success rate of projects include:

- stoves being disseminated which have been shown to perform efficiently and with low emissions when used to boil a pot of water under laboratory conditions – but turn out to be not nearly as clean or efficient when used to cook family meals;¹¹
- stoves which are only efficient and low-emissive if they are operated in ways that are not practical for women – e.g. if wood needs to be cut into tiny pieces;
- failure to maintain and repair stoves because support is not available and/or women have to spend more time on stove maintenance than they save on reduced fuelwood use or cooking time;
- lack of quality control: According to an investigative article published by ProPublica in 2018, the Clean Cooking Alliance – the main global partnership promoting and supporting improved cookstoves and other alternatives to open fires – only 2 million out of tens of millions of stoves disseminated by its partners met its standard for ‘clean’. Yet, that standard was equivalent to levels of pollution from indoor second-hand smoking of 40 cigarettes per hour.¹²

Greenhouse gas emissions from biomass: A tale of double standards

The main argument for claiming greenhouse gas reductions from projects involving improved biomass stoves is that the wood traditionally burned by women for cooking is non-renewable, i.e. that it depletes forest carbon sinks. Therefore, all of the carbon emitted from biomass stoves is accounted for. Greenhouse gas savings are based on the amount of biomass ‘saved’ by using more efficient stoves. The actual figures are based on idealised scenarios, i.e. laboratory tests. Invariably, stoves perform less well in the real world, i.e. when used to cook actual meals, than they do when used in a laboratory to boil one pot of water. This means that the amount of greenhouse gas savings claimed is always exaggerated. Indeed, dissemination of supposedly efficient stoves may not result in any reductions in wood burning at all, as was shown in a trial in Nepal.¹³

¹¹ See for example Up in Smoke: The Influence of Household Behavior on the Long-Run Impact of Improved Cooking Stoves, Rema Hanna et.al., American Economic Journal: Economic Policy, February 2016

¹² [propublica.org/article/cookstoves-push-to-protect-the-planet-falls-short](https://www.propublica.org/article/cookstoves-push-to-protect-the-planet-falls-short)

¹³ Unbelievable but improved cookstoves are not helpful in reducing firewood demand in Nepal, Mani Nepal et.al., Environment and Development Economics, February 2011

In theory, there are good arguments for always accounting for carbon emissions from burning wood for energy. However, under accounting rules agreed for the Kyoto Protocol and now transferred to the Paris Agreement, carbon emissions from burning 'renewable' biomass are not accounted for at all. This basically includes all of the biomass burned for heat and electricity in the Global North.

In the Global South, however, carbon emitted from burning fuelwood sourced from forests (classified as 'non-renewable biomass') is accounted for, at least for the purpose of climate finance and CDM and other carbon credit methodologies. However, carbon emitted from burning wood or charcoal produced from plantations and sold to households is ignored because that is classed as 'renewable'. What is meant by 'renewable biomass' in practice is biomass from commodified supply chains, and preferably from plantations.



Girl carrying firewood in Tanzania, Photo: Alto Vicky Wikimedia

The wood collected by this girl will be burned by her family to cook food. Climate financiers class this wood as '**non-renewable**' and account for the greenhouse gas emissions from burning it. If families like this girls', burn **less** wood, this is treated as mitigating climate change.



Roundwood outside Uniper's Gardanne power station in France, Photo: Nicholas Bell

Power stations and heat and power plants like this one burn woodchips and pellets from millions of tonnes of logged trees every year, for which they receive renewable energy subsidies. Burning **more** wood for energy this way is treated as mitigating climate change.

Desktop Assessment of three climate finance projects involving improved biomass cookstoves

Angola Promotion of Sustainable Charcoal in Angola through a Value Chain Approach - Global Environment Facility¹⁴

Project overview:

This is a project under the auspice of UNDP, to which the Global Environment Facility has committed \$4,720,000 and UNDP a further \$875,000, out of a total cost of \$23,431,799. The majority of the total cost - \$16 million - is born by the Angolan government.

The project aims to reduce the deforestation of subtropical Miombo forests in Huambo Province by raising the efficiency of charcoal production and of charcoal stoves used by populations around the main coastal cities, Luanda and Benguela. Reducing pollution from charcoal production and burning is a secondary aim.

The project incorporates the entire charcoal supply chain, except for forest management: this includes energy efficient charcoal kilns, briquetting machines, and energy-efficient charcoal stoves.

The core aim is to lay the foundations for a future Payments for Environmental Services charcoal programme financed via carbon credits - although the project description states that 'initially', the scheme is to be financed via subsidies by the Angolan government. Certification and verification to allow for carbon credits are therefore central to the overall project.

Plantation element?

The project does not directly involve forest management or plantations. However, in the greenhouse gas methodology, wood from plantations is treated as 'renewable' and 'carbon neutral', unlike wood from native forests. Support for more efficient charcoal production is available to plantation owners and smallholders alike. The project documents state that the long-term aim is the replacement of native forest resources with plantations - a statement which probably refers to the sourcing of wood for charcoal rather than proposed forest conversion as such.

Stoves element:

The project includes the dissemination of 10,000 more efficient charcoal stoves, as well as the incorporation of fuel-efficient stoves into government programmes. It is proposed that the government would in future subsidise stoves for low-income households (initially supporting 15% of the cost).

No details of the stoves are published. However, Biofuelwatch was able to obtain further information from the UNDP contact for the project, Florie Chazarin.¹⁵ According to Ms Chazarin, stove efficiency was calculated based on the Water

¹⁴ <http://thegef.org/project/promotion-sustainable-charcoal-angola-through-value-chain-approach>

¹⁵ Email 12th June 2019

Boil Test. The stoves chosen are a modified metal Adarsh Cook Stove (for households living around the cities) and the Chitetezo claim stove (for rural households). No decision had been made about the possible monitoring of how the stoves actually performed when used to cook meals.

Concerns about the stoves element:

The Water Boil Test is the most basic stoves test. It is used to measure efficiency and emissions from using the stove to boil a set amount of water in a pot. As the Clean Cookstove Alliance's guidance states, this test is useful as an initial assessment of stove technologies, it ensures that basic designs are met, and it can be used to select designs for subsequent field trials. However: "*In order to confirm desired impacts (whether it is fuel conservation, smoke reduction, or other impacts), stoves must be measured under real conditions of use.*"¹⁶ In other words, this project relies on a test which is not designed to show whether stoves are in fact fuel efficient or cleaner than traditional ones when used by women to cook actual meals. Yet, assumed greenhouse gas savings are based on the false – and widely disproved – assumption that stoves will be just as efficient and low-emissive in real-life conditions as they are in the laboratory.

Furthermore, neither of the two stove designs incorporates a chimney or any obvious ventilation. This makes even minimal health benefits less likely.

" Promotion of Renewable Energy and Energy Efficiency Programme (PREEEP)" - BMZ climate finance project¹⁷

Project overview:

The PREEP is a component within the multinational Energising Development (EnDev) programme which aims to increase access to sustainable affordable energy in 25 countries in Africa, Asia and Latin America.¹⁸ The current project period of the PREEP programme is 2017-19, however previous related projects date back to 1999. BMZ is funding the present project – implemented by GIZ – with 3.2 million Euros, with additional funding coming from the German Environment Ministry.

The programme involves capacity building in government and district authorities, mini-grids for rural electrification that rely on solar power, the dissemination of solar lights and domestic appliances, the promotion of carbon markets, and the dissemination of energy efficient improved biomass stoves.

Forest management and plantations do not feature in this programme.

Stoves element:

According to GIZ, 465,000 individuals had benefit from improved cookstoves by the end of 2016 – a figure which EnDev states had increased to 564,000 by the end of 2017. The figures appear to refer to households given a new stove, not individuals (see the larger figures mentioned below for individuals). 900 jobs had been created in stove manufacturing, one third of them taken by women. Funding had allowed the Carbon Foundation for East Africa to develop a transnational programme, including in Uganda, which has had biomass stoves

¹⁶ <https://www.cleancookingalliance.org/binary-data/DOCUMENT/file/000/000/399-1.pdf>

¹⁷ <https://www.giz.de/en/worldwide/19268.html>

¹⁸ <https://endev.info/content/Profile>

projects registered under the Clean Development Mechanism (CDM) since 2012.¹⁹

GIZ has published no information about the type of stoves disseminated, nor about possible monitoring of the impact of those stoves. Although a GIZ staff member was very helpful in clarifying the links between PREEP and EnDev and the German government's role, emails to the GIZ lead staff member working on PREEP have remained unanswered.

However, EnDev reports from 2017²⁰ and 2018²¹ shed some light on the effectiveness of the stoves. In 2017, an assessment of stoves according to a tier system was published, and in 2018, EnDev had started to develop a "Cooking Energy System CES approach" taking account of vital aspects such as improving ventilation during cooking. Clearly, a more holistic assessment of stoves and their impacts had been long overdue.

Concerns about the stoves element:

According to an evaluation of the quality of stoves – not looking at the actual impacts on households related to the project – only 58,713 people were members of households given a stove with high ratings for health and convenience (i.e. ease of use). Another 41,292 had access to a stove with 'fair' ratings on both counts. 3.64 million had been given access to stoves considered merely 'sufficient' in terms of health impacts and convenience, and 4.36 million had gained access to stoves with low ratings for both.

The great majority of supposed 'beneficiaries' had thus been given stoves that provided little or no protection from high levels of smoke inhalation and that were either inconvenient or not very convenient to use. Low stove convenience means that stoves are highly likely to be abandoned, as confirmed by peer-reviewed trials.

This renders the calculations of greenhouse gas savings completely meaningless – claims which were reflected in CDM projects developed with the help of PREEP.

Promoting Better Access to Modern Energy Services through Sustainable Mini-grids and Low-carbon Bioenergy Technologies Among Guinea-Bissau's Forest-dependent Communities²²

This is a Global Environment Facility project approved in 2018, with GEF project funding of \$2.9 million out of a total cost of \$17.5 million.

It seeks to promote renewable energy mini-grids as well as efficient charcoal kilns and improved biomass stoves.

¹⁹

https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/QMD6V3B5IHFRYW4NLX0JTKOAE21ZGS/view

²⁰ endev.info/images/6/6f/Progress_Report_2017-short_version.pdf

²¹

endev.info/images/7/77/External_Evaluative_Review_on_EnDev_2018_incl._joint_response_GB_and_EnDev.pdf

²² <https://www.thegef.org/project/promoting-better-access-modern-energy-services-through-sustainable-mini-grids-and-low-carbon>

50 kilns and 5,000 stoves are to be sold to low-income households, with microfinance and loan guarantees promoted.

The project was approved without any specific stove(s) having been identified.

Remarkably, it is claimed that improved stoves and “adequate management of firewood” will reduce the time women spend collecting fuelwood from 2-3 hours a day to 2-3 hours a week. Clearly, even a very efficient stove will not cut wood use seven-fold. More likely, such a steep reduction in fuelwood gathering by women would need to be accompanied by a switch to charcoal that is purchased by households, which would translate into greater wood use overall.

While the Project Description contains no information as to how the stoves would be chosen or about any proposed monitoring, the review by the Scientific and Technical Advisory Panel includes some very critical observations:

The review highlights the fact that *“recent scientific studies have shown that many stoves do not deliver on the promised air pollution and climate benefits”*. It references four studies which show that improved biomass stoves, at least one of them approved under the Clean Development Mechanism, could emit more black carbon than traditional stoves. It recommends that: *“before selection and deployment, the cookstoves for this project should be rigorously tested for effectiveness in delivering the expected climate and health benefits. Furthermore, the stove should be a type that is easy to use, both technically and practically. Alternatives to solid fuel cookstoves should also be sought where possible, such as biogas stoves...or solar cookstoves”*. Yet, neither biogas nor solar stoves are included in the project. Furthermore, studies clearly show that testing stoves before deployment is not sufficient – they must be tested and monitored during actual use.

Thus, although the expert review acknowledges the potential for the stoves not to deliver benefits, it does not recommend credible actions to address this problem (apart from cleaner cooking alternatives which, ironically, do not form part of the project at all).

An email to the project contacts querying whether any stoves had been chosen remained unanswered.²³

Conclusions:

Improved biomass stoves do not solve the problems of dangerous indoor air pollution – at best, good projects can reduce the harm. Based on the studies discussed above, the very best biomass stoves projects may lead to women suffering less from coughs or itchy eyes, and they may reduce the amount of time women spend gathering fuelwood, the money spent on charcoal, and/or the time spent cooking – all of them very meaningful improvements to women’s quality of life. However, women’s health will likely still be poorer than it would be had they access to clean means of cooking. Their children will be no less likely to become ill and possibly die from pneumonia than they would have been without switching to ‘better’ stoves’, and the risk of the most serious lung disease in adults – COPD – will not be reduced.

²³ Email sent 2nd June 2019

Unfortunately, access to clean energy for cooking remains a distant prospect for some 2.8 billion people.²⁴ There clearly remains a great need to at least reduce the harm caused by solid fuel cooking. Achieving even that modest aim remains a major challenge. It cannot be addressed through mass-dissemination of stoves. Stoves need to be developed and chosen to meet different needs (e.g. different types of meals cooked) and to be easy to use. They also require ongoing repair and maintenance and, when necessary, replacements. Furthermore, the only studies showing even modest success with wood burning stoves are ones involving better ventilation or easier outdoor cooking.

Climate finance, on the other hand, should mobilise funding to increase access to genuinely clean, low-carbon energy for cooking.

Appendix 1

Studies falsely listed in the systematic review discussed as showing health benefits for women:

- **Study of ceramic wood fuel stoves sold in rural Western Kenya found low take-up and no statistically significant reduction in coughs and severe pneumonia and children:**
This was an observational study in villages where around 2,500 ceramic cookstoves had been sold.²⁵ It did not look at health impacts on women at all. Researchers measured exposure to small particulates (PM2.5), and fieldworkers (not medically trained) diagnosed coughs and pneumonia in children every two weeks over one year. They found that only 15.7% of households were using the new stoves exclusively and another 2.3% alongside traditional 3-stone fires. These households were generally better off economically, i.e. more able to afford the stoves. There was no evidence of PM2.5 exposure having been reduced and according to fieldworkers' observations, the incidence of pneumonia and coughs in children was not reduced. The authors acknowledged that the lack of medical training among fieldworkers and the absence of accurate diagnostics, makes the findings less reliable.
- **Small and short-term trial showing no impact on reported symptoms at all:** A third study²⁶ was a very small and short randomised control trial in **Malawi**, with only 51 women enrolled over a period of just 7 days. The aim was to find out whether a larger and longer such trial was feasible within limited budgets (which it was found to be). Unsurprisingly, given the short duration, there was no impact on reported health symptoms.
- **Large long-term trial, showing no impacts on health and failure to repair and maintain stoves causing most to be abandoned after one year:** This was a Randomised Control Trial involving 2,575 households in 44 villages in **Orissa, India**, looking at the take-up and

²⁴ <https://www.iea.org/access2017/>

²⁵ Impact of Locally-Produced, Ceramic Cookstoves on Respiratory Disease in Children in Rural Western Kenya, Eric M. Foote et.al., Am J Trop Med Hyg, January 2013

²⁶ Feasibility of conducting a randomised controlled trial of a cookstove intervention in rural Malawi, HR Jary et. al., Int J Tuberc Lung Dis, 2014

impacts of low-cost improved biomass stoves over a period of four years.²⁷ This was a longer trial, involving more participants than most other studies. The results of the study showed that although smoke exposure amongst women was reduced in the first year, the reduction was much smaller than predicted from laboratory tests. After one year, as stoves fell into disrepair, there was no difference in exposure to pollutants. Far from proving positive health impacts, the study showed no statistically significant differences in lung function, in the probability of coughs, in the probability of any illness in the 30 days preceding women self-reporting about their health, nor any difference in blood pressure. Differences in self-reported eye problems “would not be judged to be statistically significant by conventional criteria, despite the relatively large sample sizes.”

Appendix 2

Studies reporting (some) positive impacts of biomass stoves but where the evidence is not conclusive:

- **Positive results from self-reporting of respiratory and eye symptoms, but authors warn this could be due to a ‘courtesy bias’:** In a short-term randomised-control trial in rural Ghana,²⁸ women trainers showed participating women how to build and best use an improved biomass cookstove. After several weeks, participants were watched preparing the same meal (in a ‘controlled cooking test’) while wearing a monitor. They were also questioned about their cooking activity, how much fuel wood they had been using and their health. Their use of the stove was monitored for three weeks. The evidence showed that, although fuel wood use had declined by 12%, women’s exposure to air pollution/smoke was not reduced at all. Women self-reported health improvements, even though there was no obvious reason for their health to have improved when their exposure to smoke remained unchanged. The authors state: “*We emphasized health concerns as a rationale for the improved stove; it is possible that members of the treatment group responded with ‘courtesy bias’ during the survey by giving encouraging responses on self-reported health.*”

Furthermore, after eight months, half of the improved biomass stoves had been abandoned.

- **Positive results from self-reporting of respiratory problems in an 18-months trial, but no improvements in lung function beyond 6 months:** As part of research in **Highland Guatemala** which focussed mainly on the impacts of improved biomass stoves (plancha stoves) on children’s respiratory health, researchers also assessed the effects on women’s respiratory symptoms and lung capacity.²⁹ 504 mothers were enrolled in a Randomised Control Trial. They were interviewed with

²⁷ Hanna R et.al., Up in smoke: the influence of household behaviour on the long-run impact of improved cooking stoves. NBER Working Paper No. 18033, 2012

²⁸ A rapid assessment randomized-controlled trial of improved cookstoves in rural Ghana, Burwen J et.al., Energy for Sustainable Development 2012

²⁹ Effect of Reducing Indoor Air Pollution on Women's Respiratory Symptoms and Lung Function: The RESPIRE Randomized Trial, Guatemala, Tone Smith-Sivertsen et.al., American Journal of Epidemiology, June 2009

questionnaires about their health at the beginning of the study and after 6, 12 and 18 months. The women who had been given an improved stove reported significant improvements in respiratory symptoms, especially wheezing, although the authors acknowledge that there were problems with the translation of that term into the local Mayan language. Women also reported less eye irritation. Smoke exposure tests showed that women's exposure to carbon monoxide declined by 61.6%. However, lung function tests showed no difference between the women with and without a plancha stove at 12 and 18 months. On the other hand, a separate study that involved measuring the blood pressure of 120 women in the same RESPIRE trial³⁰ found that average blood pressure in women using improved biomass stoves declined, which means that at least one positive health impact was confirmed through an objective measurement.

As has been pointed out elsewhere,³¹ the RESPIRE trial involved high-quality biomass stoves that would be prohibitively expensive for most of the population. Furthermore, fieldworkers visited the households every week to advise on proper use and maintenance, and they also arranged for free repairs of stoves. This level of support goes far beyond what would be provided through any stoves project supported through climate finance.

- **Short-term study relying on self-reporting only - positive results possibly due to wish-bias:** One of the studies looked at two stoves programmes in Pakistan, one in **Sindh** and the other in **Punjab**.³² In Sindh, where women cooked mostly indoors, those using improved biomass stoves reported fewer incidents of coughs, phlegm, breathing problems and conjunctivitis after three months. In Punjab, where women cooked mostly outdoors, the self-reported impacts were far smaller. However, even in Sindh, there was no statistically significant difference in peak flow³³ or blood pressure measurements. Importantly, this was a very short-term study (despite the fact that many studies show that usage rates of improved cookstoves tend to drop off after the first few months), no initial baseline health assessment was done, and the positive findings were entirely based on self-reporting. As the authors admit, there could have been a "wish bias", i.e. women being over-optimistic in reporting health improvements;
- **Positive results from personal interviews but not from lung function tests in short-term study without a control group:** In 2003/4, 371 rural households in one of the poorest provinces in **China** (Gansu Province) were enrolled in a programme to replace polluting biomass stoves with cleaner chimney stoves. The project also involved

³⁰ Chimney Stove Intervention to Reduce Long-term Wood Smoke Exposure Lowers Blood Pressure among Guatemalan Women, Anaité Díaz Artiga et.al., Environmental Health Perspectives, August 2007

³¹ Up in Smoke: The Influence of Household Behavior on the Long-Run Impact of Improved Cooking Stoves, Rema Hanna et.al., American Economic Journal: Economic Policy, February 2016, <https://www.povertyactionlab.org/sites/default/files/publications/52%20Up%20in%20Smoke%20AEJ2016.pdf>

³² Evaluation of short-term health effects among rural women and reduction in household air pollution due to improved cooking stoves: quasi experimental study, Tanzil Jamali et.al., Air Qual Atmos Health, June 2017

³³ Peak flow is a measurement of the amount of air exhaled in one breath. It is measured to assess asthma, as well as longer-term lung capacity (e.g. in COPD).

educating residents about the impacts of indoor air pollution and about how to change practices in order to keep it to a minimum.³⁴ During personal interviews, women reported fewer symptoms associated with respiratory and eye disease 5-8 months after they started to use the new stoves. However, the lung function tests of 49 women showed no improvements. Like the study discussed immediately above, this one had no control group, making it less reliable than Randomised Control Trials. Moreover, women were interviewed about their health not long after getting 'health education', presumably telling them that the stoves interventions would improve their respiratory and eye symptoms. Finally, the study period was very short and objective tests (lung function tests) were only carried out on 49 women – and those showed no improvements at all.

- **Positive results reported for lung function but not for self-reported respiratory symptoms from a small study with a problematic design:** In this study, all 30 households in a village in central **Honduras** were given an improved biomass stove (Justa stove) with a chimney.³⁵ Women and children had their peak expiratory flow rate measured before and six months after getting the stove, and they were interviewed about respiratory health symptoms, asthma diagnoses and visits to clinics. Out of 137 women and children over 6 who were enrolled in the study, 57 dropped out. On average, their peak flow improved after six months, although they did not report fewer respiratory symptoms, nor fewer new asthma diagnoses or clinic visits. The authors' optimistic conclusions from the study are questionable: This was a small study with a high drop-out rate and, importantly, without any control group. Studies of this type are discouraged by the Cochrane Effective Practice and Organisation of Care (EPOC) group, regarded as setting the 'gold standard' for medical research.³⁶ To be meaningful at all, they would need an adequate number of participants and show a large effect – neither of which was true in this case. Furthermore, the peak flow metre test used is much less reliable than the test used, for example, in the RESPIRE study in Guatemala. In that study, women with and without new stoves got higher peak flow measurements over time and the authors suggested that they and the fieldworkers carrying out the tests may simply have learned how to better apply the peak flow metre test.
- **Non-randomised trial involving very few women which found improved self-reporting of respiratory health and improved respiratory tests, but without a persuasive link to improved biomass stoves:** This was a study in rural **Kenya**,³⁷ in which researchers enrolled just 38 women who were given a supposedly more efficient cookstove. Of the 38 women, 3 were then excluded because they already

³⁴ Effectiveness of an Indoor Air Pollution (IAP) Intervention on Reducing IAP and Improving Women's Health Status in Rural Areas of Gansu Province, China, Cheng Y, Kang J, Liu F, et al., Open Journal of Air Pollution, March 2015

³⁵ The effects of smokeless cookstoves on peak expiratory flow rates in rural Honduras, W.P. Rennert et.al., Journal of Public Health, 4th November 2014,

³⁶ Randomised and non-randomised studies to estimate the effect of community-level public health interventions: definitions and methodological considerations, Wolf-Peter Schmidt, Emerg Themes Epidemio, September 2017

³⁷ Air quality, respiratory health and wood use for women converting from low- to high-efficiency stoves in rural Kenya, K.Critchley et.al., Air Pollution XXIII, June 2015

had an efficient woodstove. The women undertook respiratory tests, monitored air pollution whilst cooking (Volatile Organic Compounds) and completed questionnaires about their health in the past six months and about the amount of time they had spent collecting wood and in the cookhouse. However, of the initial 38 women who were enrolled in the trial, only 24 undertook respiratory assessments and only 29 completed pollution monitoring after receiving the new stoves. The researchers found that air pollution from the new stoves was as high as that from the traditional 3-stone fires. It would have been lower if the women had closed the stove doors, but to do so, they would have had to cut wood into smaller pieces (which would have involved significantly more work). The women reported fewer coughs, but not fewer colds or eye problems. Breathing tests showed improvements. The researchers concluded that this must have been due to women needing less wood and thus spending less time in the cookhouse. However, the self-reported information on this appears contradictory and no monitoring of wood use was done. It seems more likely that the number of women who took part in the full study was simply too small to yield any statistically significant results.

Appendix 3:

Studies showing some positive respiratory health impacts on women, linked to better ventilation or more outdoor cooking:

- **Limited positive impacts on women using improved stoves but with a small take-up rate of new stoves:** This was a 10-months randomised control trial in **Central Mexico**, involving 552 women.³⁸ There, self-reporting of health improvements went together with measured improvements of one out of five assessed measurements of lung function. Exposure to pollutants declined by 50%, with stoves being installed with a chimney and replacing open fires with no such ventilation. This, however, was only true for women who used their new stoves: only 30% of households given an improved stove reported using it most of the time, 20% combined the improved stoves with open fires, and 50% continued to use open fires for cooking. Unfortunately, the authors did not investigate the reasons why most women chose to abandon or reject the new stoves or to use their traditional stoves alongside the new ones.
- **Positive results from a one-year trial based on self-reporting by women - linked to shorter cooking times and more outdoor cooking rather than cleaner-burning or more fuel-efficient stoves:** This was a one-year Randomised Control Trial in **Senegal**, involving 253 households in 12 villages, 98 of which were given basic, low-cost improved biomass stoves (called Jambaar stoves).³⁹ Total firewood use with and without the new stoves was measured, and participants were asked to fill in questionnaires about coughs, asthma and breathing difficulties. 85% of the households that were given a new stove ended up mainly relying on it, until the stoves broke down and were not replaced. On average,

³⁸ Improved biomass stove intervention in rural Mexico: Impact on the respiratory health of women, I. Romieu et. al., American Journal of Respiratory and Critical Care Medicine, July 2009

³⁹ The intensive margin of technology adoption - Experimental evidence on improved cooking stoves in rural Senegal, Gunther Bensch & Jörg Peters, J. Heath Econ., March 2015

households that were given a new stove used 30% less firewood. Women benefited by spending around one hour less time per day cooking (after accounting for the extra time needed to chop firewood into smaller pieces to burn on the new stoves). They further reported significant improvements in respiratory problems and eye infections, although no diagnostic tests were used. The authors suggest that the reduction in overall wood burning – and thereby exposure to smoke – was not great enough to explain such health improvements. Instead, they suggest that women’s health improved because they spent less time cooking, and because the stoves were portable, leading to more women cooking outdoors.

- **Study showing that switching from three-stone fires to ceramic wood stoves reduced smoke exposure and self-reported respiratory symptoms, but that burning charcoal rather than wood on traditional stoves had twice the positive impact:**

This was an older longitudinal study based in the rural highlands in central **Kenya**.⁴⁰ It looked at a range of interventions: ceramic woodstoves used indoors or outdoors, moving 3-stone fires outdoors, and switching indoor cooking from wood to charcoal. Women and men in all the intervention groups reported improved respiratory health including in their children. However, the benefits of switching to charcoal were twice as high as those from switching to improved ceramic stoves.

⁴⁰ Evaluating the health benefits of transitions in household energy technologies in Kenya, Majid Ezzati et.al., Energy Policy (30), 2002