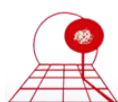


Cooking Health Energy Environment and Gender (CHEEG) - guiding Covid recovery plans.

Working Paper 19/June/2020 V1.1

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Gamos



Loughborough
University

Working Paper for Comment



This material has been funded by UK Aid from the UK government; however the views expressed do not necessarily reflect the UK government's official policies. Photo by J Folio Todd, of Lucy, a participant of MECS in Kenya.



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Cooking Health Energy Environment and Gender (CHEEG)- guiding Covid recovery plans.

Author S Batchelor, E Brown

Why recovery plans should focus an integrated response to modern energy access for cooking in Low and Middle Income countries (LMICs) which enhances women and children's lives.

Please note that this version mainly does not have references per se and uses footnote hyperlinks to the source papers and webpages. All hyperlinks accessed between Jan and June 2020.

This paper is presented for feedback.

Throughout the paper MECS (in capitals) is used as meaning the UK Aid funded MECS programme; mecs (lowercase) is used as shorthand for the concept of modern energy cooking services.

Acknowledgements: - We are grateful for the various conversations that have informed this paper. In particular we acknowledge the review comments from Prof Matt Leach, Dr Meron Tesfamichael and Dr Nigel Scott. Many conversations contributed to this overview, and we acknowledge the views of the many - however the views expressed are ours and do not necessarily reflect everyone's ideas!

This report was originally inspired by the report "Cooking with Gas: Why women in developing countries want LPG and how they can get it", Report developed for the World LP Gas Association by ENERGIA International Network on Gender and Sustainable Energy, 2014¹ and its update in 2018².

Of concern to the authors was the need to expand the narrative to include forms of modern energy other than LPG and use the evidence presented there alongside recent research on electrical cooking on energy efficient appliances to make a case for 'modern energy cooking services' why women want it and how they can get it.

As described in the preface, the paper has since pivoted to include a response to the Covid 19 virus. We, however, retain an acknowledgement to the work of WLPGA and Energia.

Also utilize the SDG7 energy and gender brief³

In memory of Kirk Smith, champion of clean air. Our thanks for his support in the development of MECS.

¹ <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

² <https://www.wlpga.org/wp-content/uploads/2019/07/Cooking-with-Gas-Why-Women-in-Developing-Countries-Want-LPG-and-How-They-can-Get-It.pdf>

³ <https://sustainabledevelopment.un.org/content/documents/17489PB12.pdf>

1 Executive Summary

This paper argues that in a world that is considering how it will recover from the first wave of the Covid 19 virus and how it will live with its ongoing impacts, utilizing Covid 19 recovery plans to accelerate the transition of those who use biomass for cooking to modern energy cooking services could be a very effective strategy with multiple gains.

It presents the idea that if we focus on the intersectional nature of recovery plans, we can leverage existing and recovery finance to lower the impact of subsequent waves of the virus on women and children, improve our economic responses to the emerging global recession, accelerate responses to climate change and make rapid gains on three sustainable development goals; SDG 3 Ensure healthy lives and promote well-being for all at all ages, Sustainable Development Goal (SDG) 5 Gender equity and SDG 7, access to reliable, sustainable, affordable modern energy for all (inclusive of their cooking needs) .

There is an urgency and an opportunity in this. The need for Covid recovery plans is an opportunity to create equitable economic recovery that puts women in the foreground, rethinking our approach to this intersectional space.

The paper starts by outlining the pre virus state of SDG7, access to modern energy, for Low and Middle income countries (LMICs) in Africa and Asia, and then the pre-virus state of SDG 5, gender equity. It then makes **three key assumptions** about the impact of the virus:-

- that the virus causes death by co-morbidity,
- that the virus puts increased pressure on already inadequate health services and infrastructure and
- that LMIC economies will be damaged for the next 5 to 10 years by a global economic downturn caused by this first wave of the Covid 19 virus.

The paper then considers the impact of biomass cooking on the lives of women and how it may intersect with the virus impacts.

Biomass cooking endangers the health of women and children. Non Communicable Diseases (NCDs) caused by household air pollution are prevalent amongst a large proportion of the population in LMICs⁴; and that many such NCDs increase the risk of severe illness from Covid. The virus uses underlying health conditions to cause death by comorbidity, and those recovering from Covid may be more susceptible to the impacts of air pollution because of its medium-term effects on lung function⁵. Indeed we note that even in the pre COVID world, biomass cooking endangers the health of women and children through household air pollution resulting in far

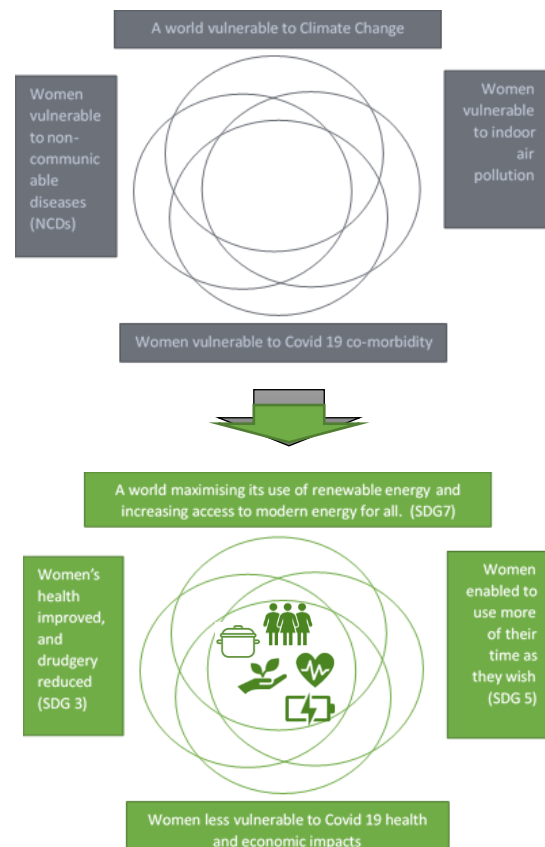


Figure 1 The intersectional nature of vulnerabilities transitioning to positive outcomes

⁴ <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>

⁵ <https://www.bloomberg.com/news/articles/2020-05-12/covid-19-s-health-effects-can-last-long-after-virus-is-gone>

more deaths every year than the current impact of the virus⁶ – and it's only going to get worse. Beyond NCDs and air pollution, biomass cooking also endangers women and children in the collection of fuels and threatens food security in times of hardship.

Biomass cooking consumes women's' time in unpaid work. While significant time collecting woodfuel or purchasing it from market, the preparation, cooking and cleaning of utensils when using a biomass stove all consume considerably more time than cleaner alternatives. Releasing the time taken up by these activities through the strategic spread of modern energy cooking services would enable women to engage in employment, develop their own economic activity (which in turn will act as a mechanism for strengthening economies addressing economic recovery and ensuring that the benefits of economic growth when it returns are more evenly distributed) , or improve child care and/or release opportunities for education or enhanced leisure time.

The paper also includes a brief discussion on gendered violence. There is already evidence that domestic violence has increased in developed economies due to the lockdowns imposed by the virus⁷ In LMICs there is still a significant proportion of the population, both men and women, who hold the view that it is acceptable to beat your wife under certain conditions and there is evidence that levels of violence have increased significantly during previous pandemics⁸. Research reveals that food is often a trigger to violence in these situations and one of the phenomena that generates domestic violence is the burning of food. While the authors do not assume that a technocentric intervention would change the core of the matter, the paper does discuss how access to modern energy cooking services reduces the risk of burnt food and therefore could mitigate at least one trigger of domestic violence.

Biomass cooking has significant impact on the environment. Alongside the health and equality-based cases for accelerating the spread of modern energy cooking services, there are also strong environmental drivers. Deforestation is of great concern, particularly for the health of the soils and water sheds. But also the burning of biomass contributes significant CO₂ and black carbon particulates are said to have a significant contribution to climate change. Black carbon is a short-lived climate-forcing (SLCF) agent but is said by some to be the second most important contributor to global warming⁹. They are of particular interest because it is also said that action on black carbon could enable a quick action on climate change¹⁰.

The paper discusses the significance of urbanization and how it is shaping African and Asian futures. With inward migration and population growth, cities in these regions will more than double in size over the coming twenty years and the percentage of urban population will continue to grow rapidly. The paper notes that city residents in LMICs are still using biomass for cooking (with consequent impacts on health outcomes given the predominance of particularly polluting fuels and the higher density of population). Clearly, biomass cooking is not confined to the rural areas, and as such, Covid recovery plans that start with a focus on the urban locations where the disease is likely to take root could be easy wins.

Indeed the paper discusses, 'gendered cities' and notes that for women one of the main consequential impacts of Covid is going to be socioeconomic. Women are particularly burdened by this because they are overrepresented in precarious employment including within the informal sector where the support system is either not there or not enough. Women working in service sectors or manufacturing are likely to be the first to

⁶ <https://www.who.int/airpollution/household/health-impacts/en/>

⁷ an increase of 60% in emergency calls by women subjected to violence by their intimate partners across Europe in April this year according to Dr. Hans Kluge, the WHO's Regional Director for Europe, UNRIC.org

⁸ John, N, Casey, SE, Carino, G, McGovern, T. Lessons Never Learned: Crisis and gender-based violence. *Developing World Bioeth.* 2020; 00: 1– 4. <https://doi.org/10.1111/dewb.12261>

⁹ <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/jgrd.50171>

¹⁰ Jose Goldemberg et al 2018 *Environ. Res. Lett.* **13** 030201 <https://iopscience.iop.org/article/10.1088/1748-9326/aaa49d>

lose their jobs either due to the lockdown measures or due to subsequent economic downturn. There are some reports already of companies tied to the global value chain that are letting staff go or cutting down hours to stay afloat. The risk of losing what has been gained so far in paid employment makes it even more important that recovery plans pay attention to gender equity.

1.1 COVID 19 Recovery plans

The paper then presents six key concepts that we argue should be integrated into national Covid recovery plans in order to address what we have identified as a crucial Cooking, Health, Energy Environment, and Gender nexus (CHEEG).

1. Integrate plans for accelerated access to modern energy cooking services with plans for electrical infrastructure development. Electricity for cooking has been ignored for too long, with many decision makers arguing that it is too expensive for the majority of people, and that LMICs do not have enough generating capacity to promote widespread adoption. Advances in renewable energy technology and recent investments in generating capacity are, however, challenging the latter, and recent research with energy efficient appliances has proven that cooking with electricity can be extremely cost effective and affordable given the right contextual conditions¹¹. The section suggests that by leveraging investments in electrical infrastructure considerably accelerated gains in meeting clean cooking demands could be made. Using Covid recovery strategies to integrate cooking into planning for grid and off-grid investments could significantly help the mitigation of the gendered health, time, violence and environmental effects of biomass cooking, and possibly also make gains towards gender equalities.

2. There is a role for LPG in the toolkit of responses. While electricity presents a clean cooking opportunity that should be nurtured under Covid, there is also a case for LPG to be part of the modern energy cooking services Covid recovery portfolio. LPG has seen significant growth of use recently, not least in India and there are lessons to be learnt from these experiences that could inform the integration of rapid acceleration in the provision of modern energy cooking services under Covid recovery plans. LPG is a fossil fuel and while it does give less emissions than biomass, its use should be strategically. There are calls by the EU and the UK to 'Build Back Better'^{12 13 14} and for recovery plans to be based on green economic responses. This does not preclude LPG as a transition fuel, but it should not push aside integrating cooking with load planning for electrical grids. Indeed, the two fuels can work together to give a clean cooking stacking that covers the shortfalls in electricity until the system matures¹¹. The section also notes that there might be a role for other modern energy cooking fuels such as bioLPG and ethanol.

3. Identify and justify transition finance. How are the recovery plans to be financed? How does the world with its shrinking economy find the upfront capital to enable billions of biomass users to transition to modern energy? The paper shows how the past few years have seen many calls for increased attention and finance to be given to the financing of clean energy transitions. Whilst funding for electrification efforts was/is relatively buoyant (although of course more could be done), the gaps in relation to the funding of clean cooking transitions are without exception depicted as being far more challenging. By integrating clean cooking with electrical planning, revenue collection can be built into strategies much more easily, and such strategies become more convincing

¹¹ Forthcoming Leary, Leach, Batchelor, Scott, Brown Battery-supported eCooking: a transformative opportunity for 2.6 billion people who still cook with biomass Draft submitted Energy Policy July 2020

¹² https://ec.europa.eu/commission/presscorner/detail/en/ip_20_940

¹³ <https://ncdalliance.org/news-events/blog/europe%E2%80%99s-post-covid-19-recovery-plan-seeks-to-build-back-better-for-health-environment-and-development>

¹⁴ <https://www.businessgreen.com/news/4015783/boris-johnson-owe-future-generations-build>

to investors. Batchelor 2015 estimated that users spend over \$100 billion a year on their biomass fuels¹⁵, and our proposition is that by bringing a large amount of that expenditure into consumption on electrical networks (grid and off-grid) or financing PAYG LPG, investments in modern energy cooking services can see a healthy return. Financiers need to be convinced of this.

While ‘biomass’ clean cooking (improved stoves) has struggled to raise investment because most actors are nascent private sector actors without assets to mitigate the risk of loans, the renewable energy sector and grid utilities are characterised by larger players who can underwrite risks. At the same time, transition finance could also come from other budgets. The paper cites the EU and UK calling for action that ‘Builds back better’. Focusing on low carbon or green recovery plans, new investments could be seen as a way of recovering the economy while working towards low carbon economies. Health budgets currently spent on health services, could get a greater return by preventing NCDs and mitigating the need for hospitalisation. Similarly, the release of women’s time is an argument for strengthening the economy and the report shows how much contribution to GDP this could make. Discussions with the Treasury and private finance institutions to identify transition finance should go beyond the simplistic ‘this is an energy project’ and illustrate how the Cooking health energy environment and gender nexus as a Covid recovery strategy requires a much more systematic view that can overcome the inertia of business as usual.

By building back better and balancing the gender inequity of unpaid work, several trillion could be released into the economy. McKinsey (2015) ¹⁶calculated that \$12 trillion could be added to global GDP by 2025 by advancing women's equality. The point being –CHEEG Covid recovery plans could rapidly justify transition finance by economic gains.

4. Use lifeline tariffs to ensure inclusion of the poor. A rapid acceleration in the spread of Modern Energy Cooking Services needs to be accompanied by measures that ensure that this access is made available to the poorest and most marginalized social sectors. There are challenges in providing long standing subsidies to LPG, and while this may be applicable for a rapid economic recovery plan, it is best avoided for the long term. In contrast to LPG subsidies which often come from the national purse, lifeline tariffs are a cross subsidy within the utility. Tiered tariffs charge users with higher consumption a slight premium which is then used to offer the reduced lifeline rate. A lifeline tariff is in place in most countries so new legislation would not be needed (except perhaps within the off-grid sector). The lifeline tariff is a reduced rate for the first 20 to 100kWh of electricity consumption. Since poor households connected to the grid currently use only about 20kWh per month, and since three meals a day can be cooked on 30kWh a month, a lifeline tariff of 50kWh effectively supports poorer households to cook with electricity. The paper describes how households will likely switch payments from polluting fuels to electricity, and with energy efficient appliances even without the lower tariffs, households will likely save on their monthly expenditure. This growth in electricity use strengthens the utility delivering the electricity (either grid or off-grid)¹⁷.

¹⁵ Batchelor 2015

https://assets.publishing.service.gov.uk/media/57a08975ed915d3cfd00025a/Solar_Electric_Cooking_Synthesis_Report.pdf 40% of 3 billion, spending median \$10 (citing Bacon et al 2010)

¹⁶

https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Employment%20and%20Growth/How%20advancing%20womens%20equality%20can%20add%2012%20trillion%20to%20global%20growth/MGI%20Power%20of%20parity_Full%20report_September%202015.pdf

¹⁷ There is a significant imbalance between the use of lifeline tariffs on grid provision and the full cost recovery expected from the off-grid sector. Analysis have long realised the need to subsidise the urban poor’s access to electricity, why is the same case not made for the off-grid sector. The development of electric cooking makes this imbalance an even bigger injustice to confront.

5. Balance increased tax collection with lifeline tariffs. It may seem at odds in a recovery strategy to talk about tax revenue, but such a consideration will enable long term sustainability for the strategy. In the short term utilities may not be able to maintain the balance between lifeline tariff users and premium customers particularly as the Covid recession reduces energy consumption in manufacturing industries, nevertheless the long-term commitment to utilities and their infrastructure are a solid stable ground for recovery strategies. In the immediate, a growth in use of the lifeline level of consumption may stretch the utilities finances, and they may need support from the treasury, but in the longer term it lays the foundation for a sustained infrastructure and business – resulting in the longer term to profitability. It would be a mistake to remove lifeline tariff to avoid treasury interventions in balancing the utilities books in the short term. Leaving them in place will lead to long term profitability as consumers fund and grow electricity infrastructure.

Even with the lifeline tariff, bringing the informal expenditure of households on polluting fuels into the formal sector of electricity (and LPG) provision, offers an opportunity for tax revenue collection to replenish the treasury finances. With a global economic recession, governments will need support to find the resources to undertake and maintain broader recovery plans. The evidence from previous global recessions is that there may well be a sharp decline in international donor support, and many countries will suffer economic setbacks from the lack of tourism and the lack of international remittances. To address this, governments should put in place strong measures to ensure that corporation tax is paid. If, as we suggest, electricity utilities and LPG distributors benefit from an increased uptake of modern energy cooking services (over the longer term) then it will be crucially important that they pay their fair share of tax revenue. The formality of these industries has advantages over the charcoal economy which is so dispersed that effective tax collection is difficult. By making expense on cooking a formal expenditure to an institution (utility), the government has more opportunity to collect tax revenue without penalizing the poor¹⁸.

6. Strengthen decentralised energy and governance systems. This section of the paper discusses how energy systems are becoming increasingly decentralized with power generation for the national grid being decentralized through the growth of renewable energy technologies. It briefly points to the role of energy storage in promoting these changes, strengthening weak grids and facilitating off-grid electrification. This energy decentralization needs, however, to be placed within the context of the growth of political decentralization and the decentralizing of many elements of service delivery. If Covid recovery plans are to be sustainable then they need to be embedded effectively within these decentralized governance landscapes. The African Union's "African Charter on the Values and Principles of Decentralisation, Local Governance and Local Development"¹⁹ states that "Central government shall create enabling conditions for decision-making, policy and programme initiation, adoption and implementation to take place at lower levels of government where local governments or local authorities offer a better guarantee of pertinence and efficacy." (Article 6.1) By getting city municipalities and county governments to manage their own budgets, develop more effective locally-designed cross-sectoral policy-making and integrate decentralised energy into recovery plans the Cooking health energy environment and gender nexus as a Covid recovery strategy could be much more effectively addressed.

7. Empower women within industry and governance. Building on the importance of ensuring that the response to Covid is based on integrated locally-owned strategies where energy, health, water and other forms of service delivery are brought together more effectively, the final section of the report goes on to argue that women need to be more explicitly represented (a) in the planning processes as actual decision makers, b) in the implementation within the supply side value chain, and (c) in the informal economy responses that will create

¹⁸ although we recognise that rapid transitions away from charcoal will require support for those currently involved in the industry

¹⁹ <https://au.int/en/treaties/african-charter-values-and-principles-decentralisation-local-governance-and-local>

multiplier effects from the use of modern energy cooking services. The role of women in recovering the economy is explored. These include improving profitability of enterprises, strengthening supply chains, focusing on women's empowerment as a key message and ensuring financial inclusion.

Section 7 considers some of the underlying principles or concepts that if embedded in the recovery plans will strengthen their impact. It points to the various balancing acts that are required to balance the supply chains and transition pathways; the potential impacts on health, the environment and the economy, and it talks about the opportunities to leverage existing resources to support recovery strategies.

The paper concludes that these strategies could leverage investment in Covid recovery such that there will be **better** progress towards gender equity and the aspirations of SDG5, **greater progress** towards SDG7 and preventing climate change, the economic downturn caused by the virus can be mitigated by creating **better** private sector responses to a huge market opportunity and **better** taxation and finance mechanisms for creating sustainable growth in renewable energy technologies.

The paper has a number of annexes. Annex 9 explores the possible outcomes of these integrated recovery plans regarding the benefits to women in the home. Annex 10 considers the current research gaps and the need for enhancing the evidence base to support the decision making on recovery plans.



Figure 2 Lucy, on the outskirts of Nairobi is a participant in a study conducted by BURN²⁰.

CHEEG Covid recovery plans are about real people and real food.

²⁰ <https://mecs.org.uk/eating-through-power-cuts-with-epcs/> Photo J Folio Todd



2 Preface

This working paper was started in early 2019 as a paper on gender and modern energy cooking services. The complexity and breadth of the subject slowed its publication such that a reasonable draft was first available in September 2019. Since then the world has changed! During early 2020, Covid 19 overtook the world, and at the time of writing many of us are in lockdown and facing the challenges of social distancing to limit the uptake of the virus.

Originally this paper was intended to provoke and prompt research questions and policy action around the intersect of gender and modern energy cooking services.

However, the paper has now pivoted to reflect on the challenges of cooking in developing countries pre virus and ask the question how these challenges might change in the near future, 'post virus'. We use the term 'post virus' but this will unlikely be a world without the virus, it will be a world that has adapted to cope with the virus after a global outbreak and including the ongoing consequences with potential further outbreaks and a deep global economic recession.

Recovery plans for the world post virus will need to take into account, the health of people, the health of the economy and the health of the environment. In this paper we will show how cooking in developing countries is a major element of all three health considerations. Biomass cooking currently creates household air pollution and burdens millions with non-communicable diseases (NCDs) that cause co-morbidity should someone get the virus²¹. Cooking as an everyday activity is as core to the household as food and security, and the current supply chains of biomass fuel create economic hardship particularly in urban areas in Low and Middle Income Countries (LMICs). Reduction of the biomass cover and the associated deforestation, is harming food and water systems, creating droughts, floods and soil degradation.

If Covid 19 recovery plans take into account and address these burdens, the population will have fewer NCDs, and the co-morbidity from the virus will be mitigated, the economy will be strengthened by creating employment and releasing women for productive work, and farm lands and food production could be enhanced by greater tree coverage and lower soil degradation.

In this paper we unashamedly consider the recovery options from the woman's point of view. Women and children are the focus of household air pollution related NCDs, and if recovery plans include modern energy cooking services the 'post virus'²² world can move forward to a better world.

²¹ Also NCDs can move people into the group at potentially serious risk, taking them out of the productive economy as they are shielded

²² 'Post virus' means a world after the onset of virus, not a world free of the virus.

Contents

1	Executive Summary.....	3
1.1	COVID 19 Recovery plans.....	5
2	Preface.....	10
3	Introduction – the grand intersects	14
3.1	Build Back Green	14
3.2	Build better gender equity.....	14
3.3	Build better health.....	15
3.4	What solutions should we be promoting?.....	16
4	As at 2020	17
4.1	State of energy 2019.....	17
4.2	State of gender equality 2019	19
4.3	State of Covid 19 2020.	21
4.3.1	The virus causes death by co-morbidity.....	21
4.3.2	There is a lack of health facilities and equipment	22
4.3.3	Economies will be damaged by a global downturn due to the virus	23
5	The case for tackling Covid, Health, Energy, Environment, and Gender equity (CHEEG), hand in hand	25
5.1	Gendered health.....	25
5.1.1	Household air pollution.....	25
5.1.2	Beyond household air pollution	29
5.1.3	Food security	30
5.1.4	The bottom line?.....	33
5.2	Gendered time	33
5.2.1	Collecting biomass	33
5.2.2	Unpaid domestic work	35
5.2.3	The bottom line?.....	36
5.3	Gendered violence.....	37
5.3.1	Safety outside the home	37
5.3.2	Safety inside the home.....	38
5.3.3	The bottom line?.....	41
5.4	Gendered environmental decay.....	41
5.4.1	Deforestation.....	41
5.4.2	Climate emissions	41
5.4.3	The bottom line?.....	42
5.1	Gendered cities	42

5.1.1	The bottom line?.....	45
6	COVID 19 Recovery plans	46
6.1	Business Unusual.....	46
6.2	Integrate gender equity, cooking and economic stability into the planning of electrical networks....	48
6.2.1	A quick sales pitch on electricity for cooking	49
6.2.2	The benefits and flaws of the gender electricity intersection	50
6.2.3	Let's be real about the problems.....	55
6.3	Include LPG in the toolkit of responses where appropriate?.....	60
6.3.1	The quick sales pitch on LPG	60
6.3.2	The benefits and flaws of the gender LPG intersection	61
6.3.3	Let's be real about the problems.....	63
6.4	LPG and electricity – a comparison	66
6.5	Identify transition finance.....	68
6.5.1	Let's be real about the synergies.....	69
6.6	Use lifeline tariffs to ensure inclusion of the poor.	73
6.7	Balance increased tax collection with lifeline tariffs	74
6.8	Strengthen decentralised energy and governance systems	77
6.9	Empower women within industry and governance	80
6.9.1	Using modern energy to improve profitability of women's enterprises	80
6.9.2	Engaging women in the modern energy supply chain.....	82
7	Underlying concepts for CHEEG COVID recovery strategies	83
7.1	Supply and transition balancing acts	83
7.1.1	Balance decentralized responses with centralised	83
7.1.2	Balance national finances.....	84
7.1.3	Balance women's engagement in the supply chain.....	84
7.1.4	Balance Demand	84
7.2	Focus on the potential impacts	85
7.2.1	The benefit of improved health.....	85
7.2.2	The benefits on the environment.....	85
7.2.3	The benefits on the economy.....	86
7.2.4	The benefits on gender equity.....	86
7.3	Leverage existing funds with recovery funding.....	87
7.3.1	Leverage of climate investment	87
7.3.2	Leverage of urban planning.....	87
7.3.3	Leverage tax collection.....	87

7.3.4	Leverage investment in youth	88
7.3.5	Leverage digital economic investment	88
7.3.6	Leverage the aspiration of a better life	88
8	Conclusions	90
9	Annex - Social change and impact after recovery plans	91
9.1	Modern energy cooking as an aspiration	91
9.2	Can modern fuels change gender roles in cooking?	91
10	Annex – Research gaps	94
10.1	Transition barriers and drivers	94
10.2	Improved gendered time	94
10.3	Improved gendered agency	94
10.4	Infrastructure development and ‘bundling’	94
10.5	Fuel stacking and health	94
10.6	Modern energy stacking	94
10.7	Impacts on the local environment	95
10.8	Impacts on urban environment	95
11	Annex Consider other fuels for ‘modern energy cooking services’	95
11.1.1	Ethanol	95
11.1.2	bioLPG and biogas	96
11.1.3	Tier 4 and above only please	97
11.1.4	A Multi-Tier View?	97

3 Introduction – the grand intersects

3.1 Build Back Green

COVID 19 was first identified in China. From there, it spread around the world within a few short weeks, and at the time of writing we are still experiencing the first wave of its impact. There are already calls for rebuilding economies, recovery plans and government bail outs to industry to be tied to the environment and low carbon approaches. The EU²³ and the UK²⁴ are already signalling that they want to "Build Back Better".

At the moment there are high levels of public agreement about such aspirations. Many have experienced the improved air quality that has come from lower traffic, and electric cars were already on the agenda, and have come to the foreground. These calls currently focus on developed economies who are indeed the main polluters and it would be great if the major global economies were to rebuild via extensive investment into low carbon industries. But can we extend this call for a Green Recovery to developing countries? In this paper we started by asking how could we consider the intersect between the recovery plans that will be needed for 'post virus' and the reach for Sustainable Development Goal 7 – *affordable, reliable, sustainable and modern energy access for all*, with a particular focus on its clean cooking dimensions

Whilst good progress was being made in some dimensions of SDG7, progress was uneven and insufficient. (a) responses were underplaying clean cooking – often dismissed as a woman's issue, (b) electrification was being achieved via grid roll-out but leaving areas under-served – 'under the grid', (c) the off-grid sector was targeting the richer segments and not providing employment opportunities for women (or finance for women entrepreneurs)

All of this got us thinking that actually tackling these issues requires more systematic integration of SDG7 (energy), SDG5 (gender) and SDG3 (health)

Our argument is, therefore, that instead of just focusing on energy when considering how we might 'build back better' we do so by looking at the interconnections between cooking, health energy the environment and gender equity. Gender inequality is an ongoing struggle, with improvements in the last 100 years but with significant challenges still in place. Is this a moment to 'Build Back Better' by integrating gender equality with the recovery plans – Green and Gender Equitable Recovery? How could we consider the intersect between needs of women, including their health needs, the reach for Sustainable Development Goal 5, *achieving gender equality and empower all women and girls*, and the recovery planning?

3.2 Build better gender equity

Like Covid 19, let us start in China with a statement by perhaps the most famous Chairman of all.

"Women hold up half the sky". Mao Zedong^{25 26}

²³ <https://www.globalelr.com/2020/05/the-eu-recovery-fund-building-back-better-in-a-post-covid-19-world/>

²⁴ <https://www.businessgreen.com/news/4015783/boris-johnson-owe-future-generations-build>

²⁵ Chairman Mao famously proclaimed that women "hold up half the sky" and they did enjoy unquestionable advances after the 1949 revolution, as China's leader fought to simultaneously liberate women and harness their economic potential. <https://www.theguardian.com/world/2017/oct/14/in-china-women-hold-up-half-the-sky-but-cant-touch-the-political-glass-ceiling>

²⁶ "Women Hold Up Half The Sky," is a proclamation made by Mao Zedong, mainly to prove that women are a resource that ought to be deployed outside of the homes into the professional fields. <https://www.thedrum.com/news/2018/01/23/women-hold-up-half-the-sky-how-china-building-gender-equal-ad-industry>

The phrase or saying above has been used for a number of gender based initiatives, including becoming the name of a charity itself. Attributed to Mao Zedong, the New York times critiqued it as sloganeering by interviewing one of Mao's two daughters, Ms Zhang, who is quoted as saying ***"My mother got home from work when it was already dark," she said. "Then she had to prepare everything for the evening meal, meals for us for the next day, she had to cook, clean and sew. Women discovered that equality meant a double burden."***²⁷

For women sharing in focus groups and interviews, even captured on video, particularly those in poverty, the demands of cooking for the family are noted as ***'an enduring burden'***. Women talk about the repeating need to, as Ms Zhang puts it, "prepare everything for the evening meal, meals for us for the next day, she had to cook....." In the CCA video (2016)²⁸ one woman states ***"I finish cooking one meal and then start preparing for the next"***.

This repetitive task is made all the more difficult in poor households by the use of biomass. Biomass based cooking creates health, economic and environmental problems. With 3 billion people still using biomass as their main fuel, and a further billion or more regularly fuel stacking with biomass for a proportion of their cooking needs, the challenges for women are significant.

If women are holding up half the sky, they are doing more than half the cooking. In the move towards gender equality in the 21st century, cooking remains central. Mechanisms to alleviate the enduring challenge of every day cooking will be central to moving towards gender equality.

3.3 Build better health

And in 2020, the world is characterized by COVID 19. At the time of writing the measured deaths, mainly found in developed economies, stands at 260,000. Each death is a grieving family and our hearts go out to those who have had their lives cut short – but 4,000,000 are the annual lives cut short from household air pollution within LMICs. The virus kills by co-morbidity working with non-communicable diseases to finish lives. What will happen when it becomes part of daily life in developing countries, and how can recovery plans be made that address this co-morbidity nightmare? The issue is not just the susceptibility of individuals to the virus due to pre-existing lung and other conditions caused by household air pollution but also, and perhaps more importantly, the impacts of widespread exposure of populations to Covid on their longer-term vulnerability to a variety of chronic diseases due to any longer-term damage inflicted by the virus on lung health, heart conditions etc.

Figure 2 illustrates the intersectional nature of the challenge.

We know from years of research that women and children are those most affected by their exposure to household air pollution. Despite years of funding and advocacy of clean cooking across the international community, this is an issue that has shown very little progress. Clearly, for all of the pain and disruption that Covid stands to cause globally, it does provide us with an opportunity to finally propel the whole issue

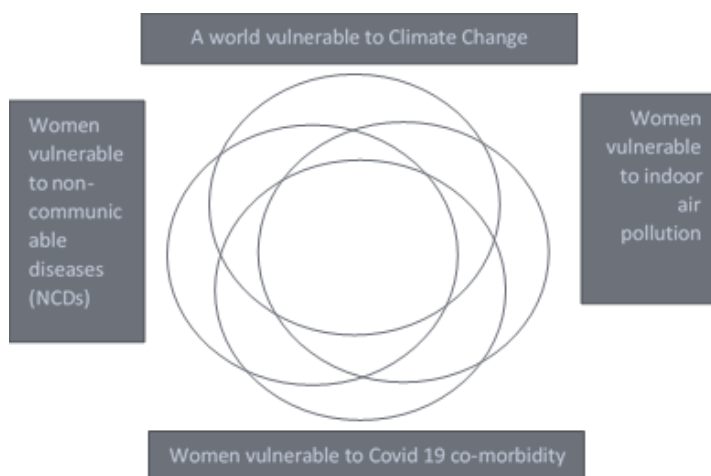


Figure 3 The intersectional nature of vulnerabilities

²⁷ <https://www.nytimes.com/2012/03/07/world/asia/holding-up-half-the-sky.html>

²⁸ <https://www.youtube.com/watch?v=yAIKQt992CM>

of household air pollution back onto the international agenda and use that opportunity to promote alternative solutions, break unhelpful orthodoxies and make new alliances.

3.4 What solutions should we be promoting?

A new discussion has been emerging on the possibilities of cooking with electricity. The programme of Modern Energy Cooking Services under which this working paper is made is a growing repository of research evidence showing the possibilities of integrating cooking and electricity²⁹. Electricity generated by renewables is becoming increasingly cost effective. The world transport sector is moving to an electric base with all the implications on infrastructure and energy storage. Indeed energy storage learning and gains are increasingly opening up new possibilities for new approaches. There is now discussion and research about the decentralized use of Solar PV to supply electricity for cooking. Energy efficient electrical cooking appliances hold great potential for cost effective cooking with almost no household air pollution. Cooking with electricity is only low carbon if the source of the electricity is low carbon. This is the case for many developing countries with Hydro power, and increasingly so for those using solar power, but while cooking with electricity might overcome health and equity issues, it may be situational as to whether it is a low carbon approach.

LPG has its benefits to the lives of women (over and instead of biomass use). Should recovery plans include the promotion of LPG? In the intervening years, the world has become increasingly aware of the issues surrounding fossil fuels and the possibility that targets for the mitigation of global climate change may not be reached. Considered LPG use through the lens of women's empowerment seems a viable strategy although it may not be the optimum response to climate change issues. Does LPG work against the call for a Green Recovery?

Both LPG and electric based cooking present new opportunities for enhancing gender equity. While there is and should be a focus on health, beyond NCDs and air pollution, biomass cooking also endangers women and children in the collection of fuels and threatens food security in times of hardship. Biomass cooking consumes women's time in unpaid work. The preparation, cooking and cleaning of utensils when using a biomass stove all consume considerably more time than cleaner alternatives. Releasing the time taken up by these activities through the strategic spread of modern energy cooking services would enable women to engage in employment, develop their own economic activity (which in turn will act as a mechanism for strengthening economies addressing economic recovery and ensuring that the benefits of economic growth when it returns are more evenly distributed), or improve child care and/or release opportunities for education or enhanced leisure time.

Figure 3 illustrates the intersectional outcomes resulting from introducing modern energy cooking services. **Modern energy cooking services presents a breadth of ideas and opportunities that can address the major intersectional challenges and create an intersectional outcomes.**

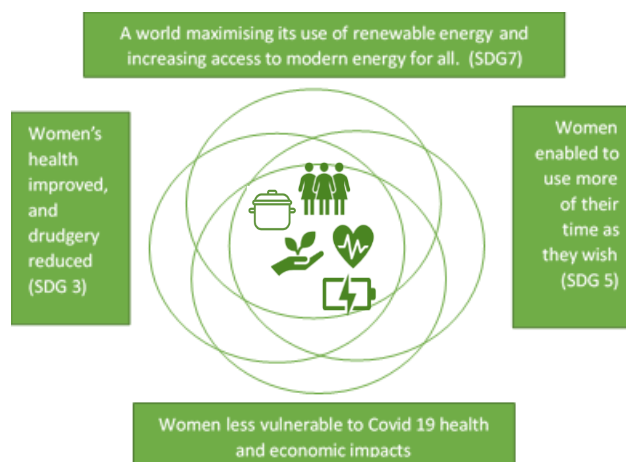


Figure 4 The intersectional nature of positive outcomes

In this paper we consider the intersectional nature of recovery plans and explore what could be done to make rapid gains on several sustainable development goals.

²⁹ www.mecs.org.uk

4 As at 2020

4.1 State of energy 2019

SUSTAINABLE DEVELOPMENT GOAL 7

Ensure access to affordable, reliable, sustainable and modern energy for all

- By 2030, ensure universal access to affordable, reliable and modern energy services
- By 2030, increase substantially the share of renewable energy in the global energy mix
- By 2030, double the global rate of improvement in energy efficiency
- By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
- By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support

There is evidence that there is progress towards SDG7. However it tends to be uneven across the globe. In 2017 the number of people without electricity access fell below 1 billion, a fall of 97 million compared to 2016, and it has dropped further to 860 million in 2018. Three-quarters of the 570 million people who gained access since 2011 concentrated in Asia. (IEA 2018).

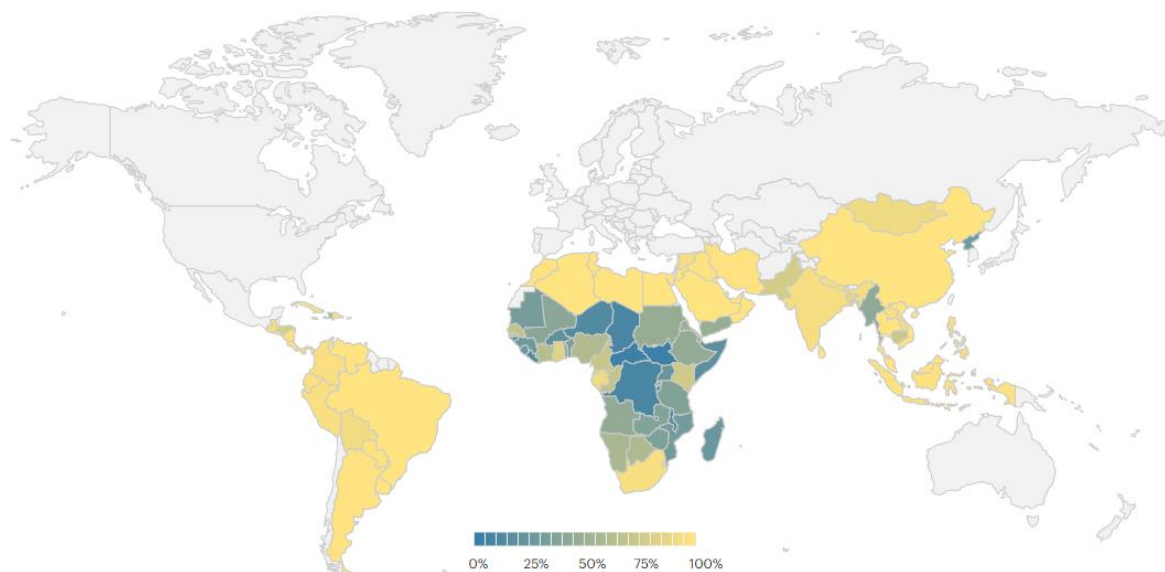


Figure 5 Proportion of population with access to electricity, 2018 IEA 2019 ³⁰

Many of those who have access to electricity do not have access to modern energy for cooking. The IEA reports differentiate between access to electricity, access to clean cooking, renewable energy and energy efficiency. They and others note that “Nearly 2.7 billion people do not have access to clean cooking facilities, relying instead on biomass, coal or kerosene as their primary cooking fuel.”

³⁰ IEA (2019), SDG7: Data and Projections, IEA, Paris <https://www.iea.org/reports/sdg7-data-and-projections>

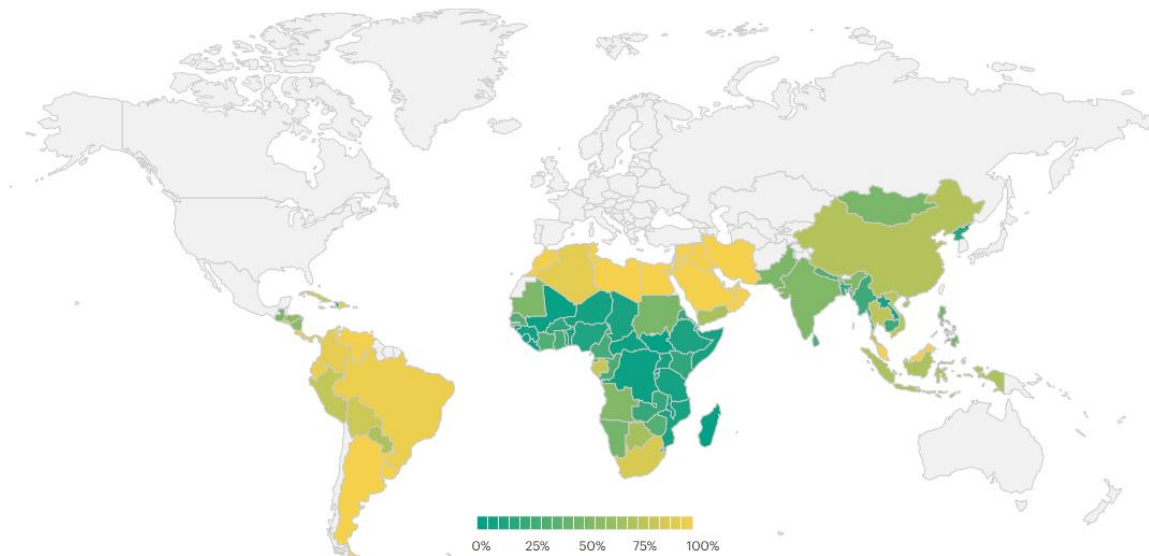


Figure 6 Proportion of population with primary access to clean cooking facilities, 2018 IEA 2019³¹

Analysis of SDG 7 separates out access to electricity and access to clean cooking, because until recently, modern energy for cooking has just not been scalable. There has been a growth of LPG over the last 10 years particularly in India. In contrast, the use of electricity for cooking among that population “without access to clean cooking” (figure 5) has been remarkably low. Some would argue that this separation of ‘access’ and ‘cooking’ is based on gendered issues. Some researchers would argue that there has been a lack of attention in the past to household energy reflecting that it has a particular importance to women, and it is men who are making decisions. (Parikh, et al., 2003³²; Cecelski, 1995³³). They suggest this is reflected in investments in energy citing a World Bank report on its investments in energy access over the period 2000-2008 which found that while physical investment in electricity access accounted for nearly half of energy access-related assistance, the support for promoting the transition to modern cooking fuels was quite small - less than 5% of total lending (Barnes, et al., 2010³⁴). However such analysis by the World Bank and others has led to a call for increased investment in clean cooking, new strategies and joined up thinking between electricity access and other forms of modern energy for cooking. (ESMAP, World Bank 2015³⁵)

*While there has been some progress on access to clean cooking, our analysis shows that by 2030 2.3 billion people will still lack access to clean cooking facilities, with 2.5³⁶ million premature deaths each year still attributable to the resulting household air pollution. If we are to witness the kind of progress expected on electricity, clean cooking must be placed on a par with electricity access on the policy agenda. Women spend on average 1.4 hours a day collecting fuelwood and four hours for cooking and also suffer the most from household air pollution: **they must be at the heart of finding solutions.** [IEA 2017](#) (our emphasis)*

Before examining that claim in more detail, and whether it continues to manifest in 2020, we need to acknowledge the final two foci of the SDG7, the increasing share of renewable energy, and increasing energy

³¹ IEA (2019), SDG7: Data and Projections, IEA, Paris <https://www.iea.org/reports/sdg7-data-and-projections>

³² <https://www.sciencedirect.com/science/article/pii/S0973082608603488>

³³ <https://www.sciencedirect.com/science/article/abs/pii/S0301421595912414>

³⁴ <http://documents.worldbank.org/curated/en/405151468339604567/pdf/632240WPOModer00Box036150880PUBLIC0.pdf>

³⁵ Putti, Venkata Ramana; Tsan, Michael; Mehta, Sumi; Kammila, Srilata. 2015. The State of the Global Clean and Improved Cooking Sector. ESMAP Technical Paper; No. 007/15. World Bank, Washington, DC. © World Bank. <https://openknowledge.worldbank.org/handle/10986/21878> License: CC BY 3.0 IGO.

³⁶ This figure has been revised upward to 4 million by WHO 2018

efficiency. According to SE4All and the IEA, the world is not on track to achieve the target on renewables. There is a call for acceleration. Nevertheless, there was an increase in the share of renewables in the total consumption, up a percentage point since 2010. As to be expected the response to the call for energy efficiency is also uneven. In the majority of developed countries, peak energy use occurred between 2005 and 2010. While the majority of countries have declining primary energy intensity (with China leading the way), some countries in Africa and South America are seeing an opposite trend.

How then do these trends affect the hopes, aspirations and wishes of women, children and men in developing countries regarding their meals?

4.2 State of gender equality 2019

The Sustainable Development Goals for 2030 include Goal 5:

Achieve gender equality and empower all women and girls. Goal 5 includes measures relevant to the energy sector, including:

- *end all forms of discrimination against all women and girls everywhere, including to eliminate violence against women;*
- *recognise and value unpaid care and domestic work through the provision of infrastructure;*
- *ensure women's effective participation and equal opportunities for leadership in political, economic and public life;*
- *reform to give women equal rights to economic resource, access to ownership and control over land, financial services and natural resources;*
- *enhance the use of enabling technologies; and*
- *strengthen sound policies and legislation.*

Here is not the place to unpack the global progress towards gender equality, but it is necessary to acknowledge that almost all agree that “serious challenges remain” (World Bank 2018³⁷). *“In education, only 23 percent of low-income countries have achieved gender parity at primary school level and 15 percent at secondary level. Girls enrolment is increasing, but attendance and completion remain a challenge, especially at secondary level for both girls and boys, albeit for different reasons.”* (ibid) Between 2015 and 2017, 65 economies made 87 legal reforms towards greater gender equality and yet as Figure 6 shows, there remain restrictions on preventing women to work in specific jobs. 2.7 billion women in 104 economies are restricted by laws preventing them from working in specific jobs, while 59 economies have no laws on sexual harassment in the workplace, and in 18 economies, husbands can legally prevent their wives from working.

³⁷ <https://www.worldbank.org/en/topic/gender/overview>

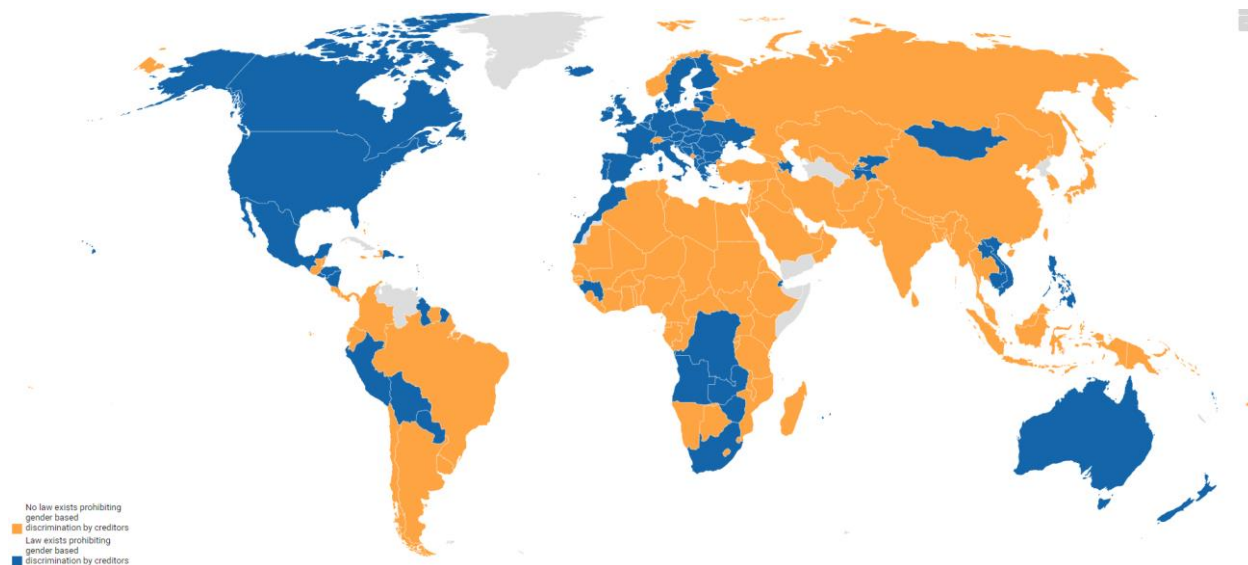


Figure 7 Legal Discrimination in Access to Credit: A Global Snapshot World Bank 2020³⁸

Some statistics have changed as we have gained more evidence. The path to the SDG5 is increasingly being mapped with more evidence and clearer data. Using the latest data, we can say that there are 105 girls for every 100 boys (between the ages 0- 25) living in extreme poor households, across all ages. 122 women between the ages of 25 and 34 live in poor households for every 100 men of the same age group. Gender differences in poverty rates even out between the ages of 40 and 65 but emerge again in the elderly years in reverse.

As the World Bank declared in 2012:- *“In the run up to SDG5 Empowering women and improving their status are essential to realising the full potential of economic, political and social development. Empowering women is also an important equity and human rights goal in itself. Women are now 40% of the global labour force, 43% of the world’s agricultural labour force, and more than half the world’s university students. Improvements in women’s education and health have been linked to better outcomes for their children in many countries. Empowering women as economic and social actors has changed policy choices and made institutions more responsive (World Bank, 2012). Yet despite progress, gender disparities continue to limit economic growth: 70% of the approximately 1.3 billion people living in poverty are women, women have access to a disproportionately low share of land, credit and schooling and receive in general lower average wages than men. Globally women occupy only 20% of parliamentary seats, and women continue to face unequal treatment under the law as well as sexual violence and harassment in society and the workplace, World Bank, 2012* ^{39 40}.

One of the calls of SD5 is to “enhance the use of enabling technologies” in the fulfilment of the goal. As outlined below, while cooking with modern energy cannot on its own address gender inequality, it can make a contribution. A movement away from biomass for cooking, could give women more control over their time, better health, and a higher quality of life. This equity gain combined with a green recovery and measures designed to increase women’s access to financial resources could inform recovery plans to make significant progress towards the SDGs.

³⁸ <https://datawrapper.dwcdn.net/CxCGS/5/>

³⁹ <https://blogs.worldbank.org/developmenttalk/no-70-world-s-poor-aren-t-women-doesn-t-mean-poverty-isn-t-sexist>

⁴⁰ <https://www.worldbank.org/en/topic/poverty/overview>

4.3 State of Covid 19 2020.

At the time of writing, the state of the impact of Covid 19 on the world is changing daily. China has just released its citizens from lockdown, as has Italy but others are only just entering lockdown. Death tolls are being updated daily and revised in the light of care home deaths. An army of health workers are being applauded for their resilience and dedication, as are key workers in various industries.

There is an emerging literature about the impact of the virus on developing countries^{41 42 43 44 45 46 47 48 49 50}. Based on this emerging mix of speculation and evidence, this paper is predicated on three assumptions:-

4.3.1 The virus causes death by co-morbidity

The majority of deaths in developed economies is due to co-morbidity, the respiratory challenges of the virus work with underlying conditions such as heart disease or COPD to create a finality. This is why the elderly are particularly vulnerable. By 5th May 2020, in the UK, 95% of all deaths had a pre-existing condition, and 92% were above the age of 60⁵¹.

At the moment we do not know if there is an age related aspect to the disease, or whether the high elderly numbers are due to the high prevalence of pre-existing conditions in that age group. It is possible that it is the latter, and therefore we should be concerned by the presence of Non Communicable Diseases (NCDs) in a population.

According to the WHO⁵² Noncommunicable diseases (NCDs) kill 41 million people each year, equivalent to 71% of all deaths globally. Of these 15 million people between the ages of 30 and 69 die from an NCD and over 85% of these "premature" deaths occur in low- and middle-income countries. One would have to go back to the data to determine how many of these were between 60 and 69, but it is safe to say that a significant proportion of people in LMICs have NCDs. In breaking down the NCDs, WHO report that cardiovascular diseases account for most NCD deaths, or 17.9 million people annually, followed by cancers (9.0 million), respiratory diseases (3.9million), and diabetes (1.6 million). These 4 groups of diseases account for over 80% of all premature NCD deaths.

Disentangling this, the WHO⁵³ previous work has identified that household air pollution (HAP) causes NCDs, including stroke, ischemic heart disease, chronic obstructive pulmonary disease (COPD) and lung cancer. So of the 41 million identified above, close to 4 million people die prematurely from illness attributable to household air pollution from inefficient cooking practices using polluting stoves paired with solid fuels and kerosene.

⁴¹ <https://elibrary.worldbank.org/doi/abs/10.1596/33540>

⁴² <https://www.developmentaid.org/api/frontend/cms/uploadedImages/2020/04/wp2020-43.pdf>

⁴³ https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3573306

⁴⁴ <https://academicjournals.org/journal/JPHE/article-abstract/6B9614663516>

⁴⁵ https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3586785

⁴⁶ <https://www.knomad.org/covid-19-remittances-call-to-action/>

⁴⁷ <http://documents.worldbank.org/curated/en/559181590712052524/pdf/COVID-19-Mortality-in-Rich-and-Poor-Countries-A-Tale-of-Two-Pandemics.pdf>

⁴⁸ <https://www.cgdev.org/publication/no-regret-policies-covid-19-crisis-developing-countries>

⁴⁹ <https://www.theigc.org/wp-content/uploads/2020/04/Vazirelli-2020-policy-brief.pdf>

⁵⁰ <https://set.odi.org/wp-content/uploads/2020/04/Global-Action-Plan-Southern-Perspectives.pdf>

⁵¹ <https://www.england.nhs.uk/statistics/statistical-work-areas/covid-19-daily-deaths/> Accessed 5th May 2020

⁵² <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases> Accessed 5th May 2020

⁵³ <https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health>

What will happen when the virus intersects with the large group of people between 30 and 60 that have NCDs in LMICs? The death toll from biomass based cooking is in itself so high that it currently dwarfs the virus global death toll. Reduced to a weekly death toll touching 50,000 deaths in one week the virus is currently at about 40,000. Biomass cooking related deaths sit at about 77,000 deaths per week, all year every week, and show no sign of decline.

Imagine now that the virus hits populations in LMIC that already struggling with NCDs, the death toll is likely to increase dramatically. Some may argue that the hard life in LMIC tends to produce a sturdier constitution within people, but the data on NCDs suggests otherwise. Indeed the number of deaths attributed to household air pollution could rise as Covid recovery could leave people more susceptible to other lung diseases or other illnesses.

4.3.2 There is a lack of health facilities and equipment

Linked to the deaths by NCDs is the lack of health facilities. The role of social distancing in developed economies was to 'flatten the curve', i.e. to prevent everyone vulnerable getting the virus all at once and overwhelming the health system. This has tended to work, and at the time of writing, the emergency constructed hospital facilities in the UK are being paused, and the demand for ventilators is being reduced.

The WHO data suggest that 45% of countries have less than 1 doctor per 1000 population, and unsurprisingly these are mainly the LMICs.⁵⁴

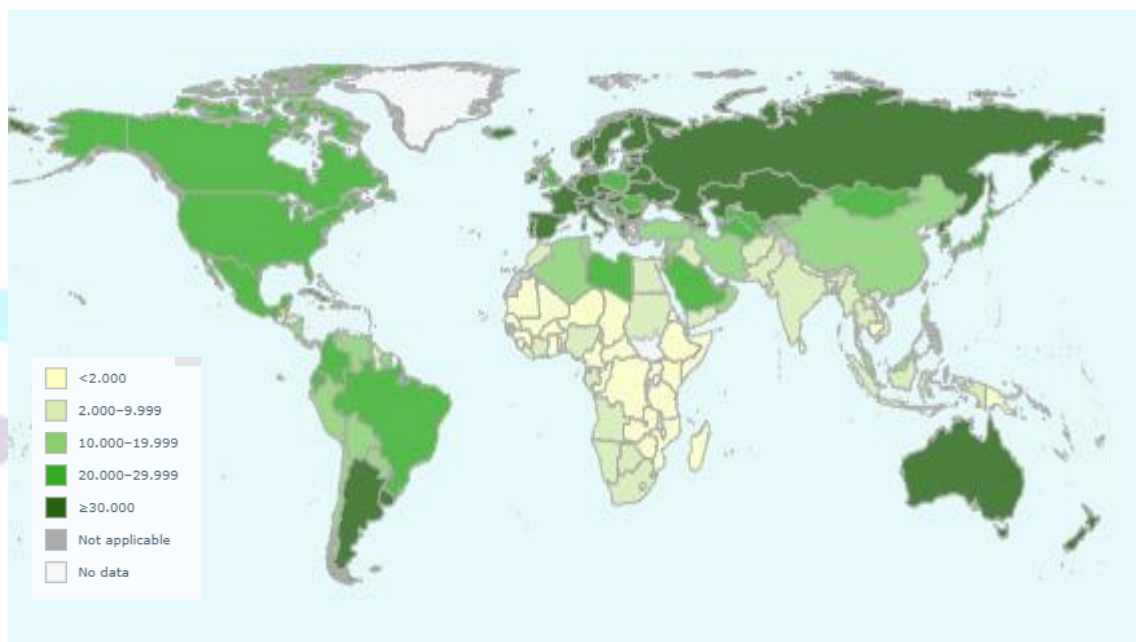


Figure 8 Density of physicians (total number per 1000 population, latest available year) WHO 2020⁵⁵

Many governments and donors are gearing up to improve health facilities.

However, one of the reasons the NCDs generally are such a significant killer in LMICs is the lack of health facilities in LMICs. So how will these countries cope with the sudden demand for COPD patients requiring ventilators?

⁵⁴ https://www.who.int/gho/health_workforce/physicians_density/en/

⁵⁵ https://www.who.int/gho/health_workforce/physicians_density/en/

4.3.3 Economies will be damaged by a global downturn due to the virus

If one could predict how exactly the global economy will change over 2020 to 2025, one would likely become a rich person. The response of governments and citizens to the virus has changed the shape of the global economy. As yet we do not know whether that is a permanent change of shape or a 'new normal' will arise.

To date though there are apparently four obvious effects.

- **Developed economies will shrink, and in that shrinkage the global supply chain will likely shrink too.** Demand for oil has reduced leading to one day last week when the oil price went negative, demand for fashion has diminished leaving some LMICs without orders for their workforce, even demand for food has changed – without public eating and drinking, certain coffees are now in surplus, and repackaging even of milk has been slow such that milk has been poured down the drain. All these have an effect on the economies of LMICs⁵⁶. This links to the longer-term effects on commodity prices which are particularly important for many of the poorest LMICs⁵⁷. This also relates to the need to renegotiate debt.- even before Covid, 44% of low income countries (LICs) and least developed countries (LDCs) either at high risk of, or already in, debt distress.
- **Tourism and international travel will diminish considerably.** Many LMICs have tourism as significant income as illustrated in Figure 8.

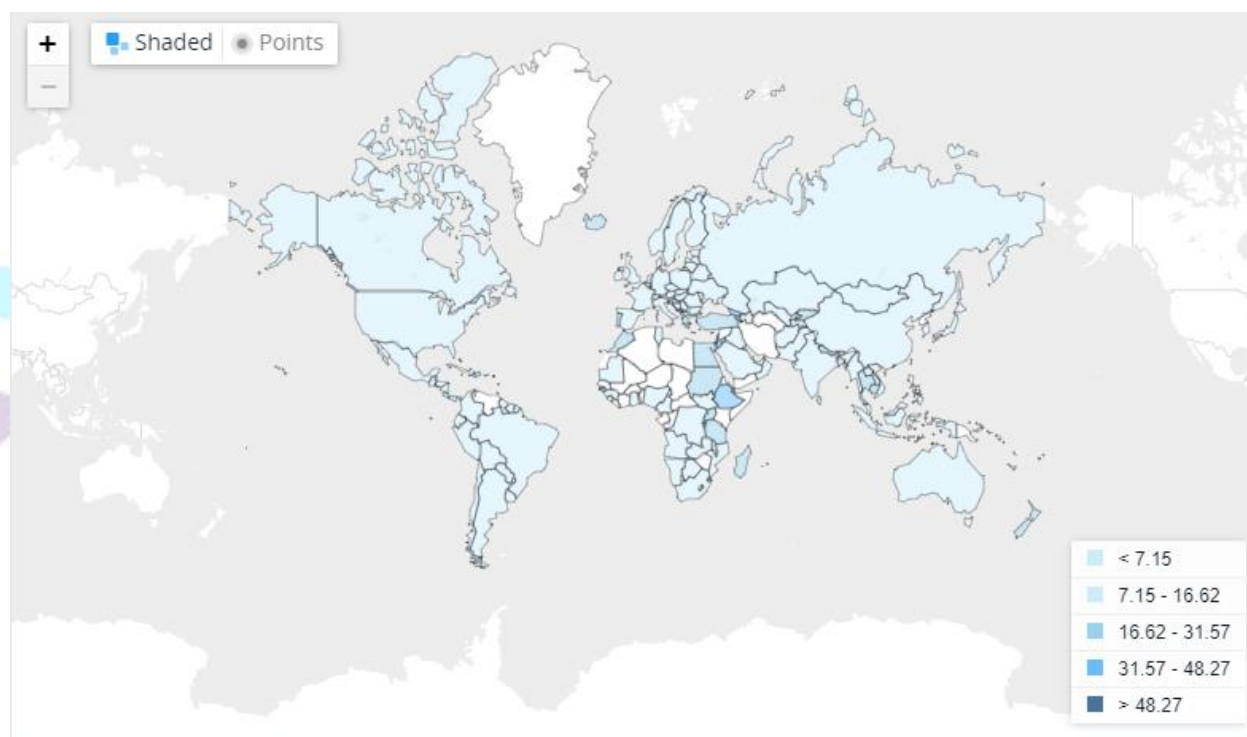


Figure 9 International tourism, receipts (% of total exports)⁵⁸ World Tourism Organization, Yearbook of Tourism Statistics, Compendium of Tourism Statistics and data files, and IMF and World Bank exports estimates. License : CC BY-4.0

⁵⁶ <https://www.un.org/development/desa/en/news/policy/policy-brief-covid-19.html>

⁵⁷ <https://www.worldbank.org/en/news/press-release/2020/04/23/most-commodity-prices-to-drop-in-2020-as-coronavirus-depresses-demand-and-disrupts-supply>

⁵⁸ <https://data.worldbank.org/indicator/ST.INT.RCPT.XP.ZS?view=map&year=2018>

Warren Buffet one of the richest men in the world, divested himself of his four airlines a few days ago. Airlines are struggling to say the least – they have to pay to park their planes, and social distancing at airports and on planes even with the low levels of travel is a major challenge. Will people want to take a holiday in Africa in the coming two years? All tourism in Africa saw a dip after the economic crisis of 2008 (by about 15%), and some countries have not recovered. The virus is not only causing an economic change (with less disposable income), but a behaviour change (with people wary of travelling to unknown locations)⁵⁹.

- **International remittances could reduce substantially.** With less international travel, it is possible that migrant workers will not only experience the downturn in the economy by for instance not being hired in the middle east for construction projects, but also in terms of restrictions on travel. 5 million Bangladeshi workers are currently in the middle east, and if their international remittance flow dries up that will have its own impact on the Bangladesh economy.

While this is only one example, international remittances are a substantial portion of some LMIC economies. Global remittance flows to LMICs are predicted to fall by 20% from the virus, from \$545 billion to \$445 billion⁶⁰. As we shall see below and to put this loss in context, we note that this loss of \$100 billion is a lot less than the public investment asked for by the international community⁶¹ required to completely address the gender equity, modern energy cooking, Covid 19 intersect⁶².

- **Developing economies may receive less aid.** Developed economies have had to borrow to fund their fight against the virus. National debts will be considerably higher once the urgency of 2020 is over. Again, even yesterday at the time of writing, there was a call by the EU for EUR8 Billion to create a common fund for creating a virus vaccine. To put that in context, total world aid has tripled since 2000 from 56 billion to 160 billion. However, this is still only one third of the international remittances sent home by migrant workers and it is worth noting that this is the rich supporting the poor while remittances are the poor supporting the poor. Some would say that aid is spent ineffectively and that new approaches are required, but that is another debate.

With less aid, how will countries address their failing economies, protect the poor, strengthen their health systems, create green economies and prevent further waves of comorbidity with the virus. The answer we believe is in tackling Gender equity, Covid 19 and modern energy cooking together⁶³.

⁵⁹ <http://www.albasud.org/blog/en/1219/covid-19-and-the-prospects-for-the-radical-transformation-of-tourism>

⁶⁰ <https://www.knomad.org/sites/default/files/2020-05/Migration%20%26%20Development%20Brief%2032-COVID-19%20Crisis%20Through%20a%20Migration%20Lens.pdf>

⁶¹ <https://www.forbes.com/sites/paulbledsoe/2019/06/03/cleaner-cooking-solutions-can-save-millions-of-lives-but-far-more-investment-is-needed/>

⁶² <https://ecdpm.org/wp-content/uploads/Impact-COVID-19-remittances-development-Africa-ECDPM-discussion-paper-269-May-2020.pdf>

⁶³ : <https://devinit.org/publications/coronavirus-and-aid-data-what-latest-dac-data-tells-us/>

5 The case for tackling Covid, Health, Energy, Environment, and Gender equity (CHEEG), hand in hand

Since women are primarily responsible for cooking in virtually all cultures, access to clean cooking energy is a gendered issue. Even in cultures where women are increasingly in the marketplace, the burden of cooking tends to remain with them. Overlay this with the burdens of collecting fuel and the safety concerns involved with that, the tendency for children to collect fuel which has an impact on education, and the respiratory health issues that result from smoke and emission inhalation (which primarily affect those ‘in the kitchen’), and it is clear that biomass cooking will be central as to whether the world reaches SDG3 and SDG5. **Intersect this with the impact of Covid 19, and a picture emerges where recovery plans that take into account gender, and leverage changes in modern energy cooking services, could ‘build back significantly better’** In this section we talk through the current key gender issues pointing out the intersection of energy access, clean cooking the environment and Covid.

5.1 Gendered health

“SDG 3: Ensure healthy lives and promote wellbeing for all at all ages”

To this point in the document we have acknowledged that all the SDGs are interwoven with each other, and in particular SDG 3, SDG 5 and SDG 7 go hand in hand, to contribute to the aspiration of healthy lives and wellbeing for all ages.

5.1.1 Household air pollution

Intriguingly given the WHO 2018 statistics in the introduction, SDG 3 targets do not explicitly point to the significant problem of biomass burning in the kitchen. 3.9 states “By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.”

Thus capturing the role of air pollution, but barely illustrating the gendered role of kitchen emissions. Given that SDG 3 mentions TB (29,000 deaths per week), HIV (15,000 dpw) and Malaria (8000 dpw), it seems odd not to point to the headline that air pollution kills more people every year than the sum of those three diseases (77,000 dpw). Researchers have speculated that because it is a gendered problem so little focus is given to something that might otherwise be declared a health epidemic Vivien Foster, Global Lead for Energy Economics, Markets & Institutions, The World Bank said that “Clean cooking is not a priority for most governments although Indonesia is doing quite well, “Indoor air pollution has a bigger health impact than HIV/AIDS and malaria combined”. She goes on to suggest that a reason clean cooking is a low priority is that decisions makers in governments are mainly and quite simply at the household level and they often are not involved in cooking⁶⁴.

“The leadership of BRICS, G7 and G20 on global health is welcome. However, their relatively narrow focus on the potential impact of ill-health primarily in relation to the economy and trade may not be sufficiently comprehensive to achieve the Agenda 2030 vision of promoting health equity and leaving no-one behind. “⁶⁵ Can we in Covid recovery plans ensure that women are in the loop for decision making and these health needs are a key focus.

To be clear; three billion people worldwide continue to cook on biomass (and solid coal) fuels. Some of these are migrant households where the male might be cooking, and some of these may be extended families where one person is cooking for tens of people. However, if we assume that the average family size is 4 then that



⁶⁴ <https://www.seforall.org/news/world-lags-on-clean-energy-goals>

⁶⁵ McBride, B., Hawkes, S. & Buse, K. Soft power and global health: the sustainable development goals (SDGs) era health agendas of the G7, G20 and BRICS. *BMC Public Health* **19**, 815 (2019). <https://doi.org/10.1186/s12889-019-7114-5>

suggests that about 700 to 800 million households are experiencing daily exposure to toxic fumes during their cooking process. The level of toxicity will vary depending on whether it is an open fire or an improved stove, whether indoors or outdoors, chimney or no chimney, windows or no windows. The health risk will vary depending on the context – nevertheless household smoke contains a range of pollutants (e.g. small particles, carbon monoxide, etc) that are damaging to women's health. The WHO (2014) suggests that in many of these situations particulate pollution levels may be 20 times higher than accepted guideline values and a champion for changing this situation, Kirk Smith, has framed this as an exposure equivalent to 400 cigarettes in an hour⁶⁶.

This exposure to household air pollution translates into Non-Communicable diseases, which as discussed in the introduction could work with the virus with the result of comorbidity. The common number that is quoted for household air pollution deaths is 4 million⁶⁷. However, this figure is extracted from known non communicable disease data and is a mixture of strokes, ischemic heart disease, chronic obstructive pulmonary disease (COPD) and lung cancer. As discussed above according to the WHO⁶⁸ Noncommunicable diseases (NCDs) per se kill 41 million people each year, equivalent to 71% of all deaths globally. Of these 15 million people between the ages of 30 and 69 years die from an NCD and over 85% of these "premature" deaths occur in low- and middle-income countries. There is therefore a large population who are vulnerable to Covid due to underlying conditions, the NCDs quoted above.

The largest ratio of current premature deaths (per 100,000) from household air pollution are in Asia, dominated by India and China, followed by Sub-Saharan Africa, as shown in Figure 2.4.

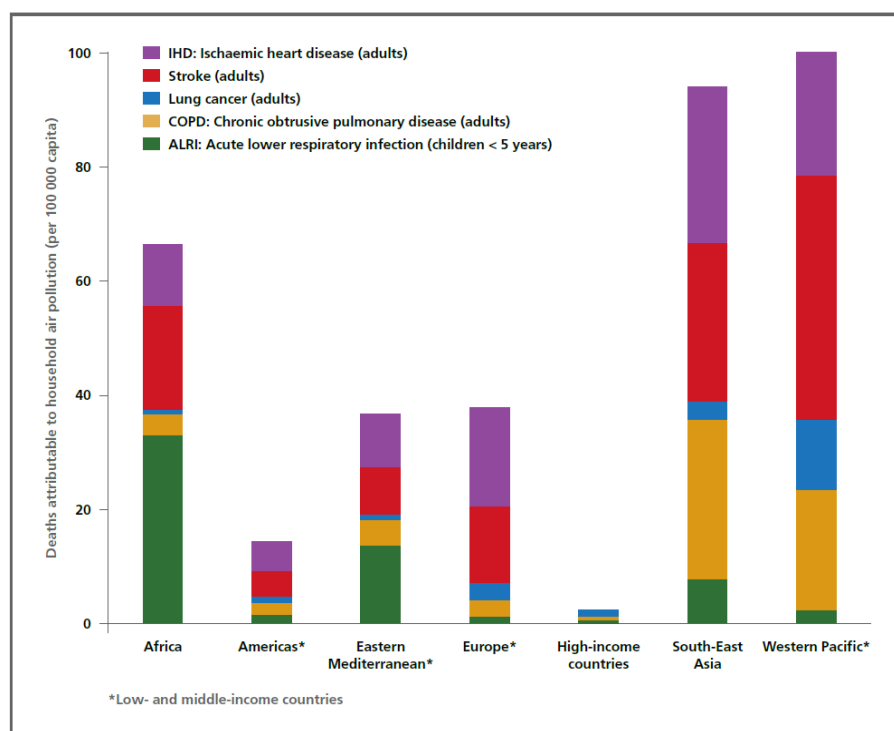


Figure 10 Deaths attributable to household air pollution (100,000 per capita) WHO 2013 cited Energia 2014⁶⁹

⁶⁶ <https://www.who.int/features/2014/clean-household-energy/en/>

⁶⁷ <https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health>

⁶⁸ <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases> Accessed 5th May 2020

⁶⁹ <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

As said the NCDs associated with household air pollution are ischaemic heart disease, stroke, chronic obstructive pulmonary disease and lung cancer in adults. In Africa the highest levels of NCD, acute lower respiratory infections, can be found in children under 5 years. The presence of Covid 19 could comorbid these NCDs, and the worrying implication is that while in developed economies NCDs sit with the elderly, and thus countries have seen the elderly die, the presence of NCD ALRI in children in Africa could lead to a high number of deaths amongst young people. This is without considering the likely wider exposure to the disease across Africa and Asia amongst communities that are unable to successfully lockdown their economies and the implications of contracting the disease for susceptibility to future exposure to household air pollution.

Household air pollution during pregnancy slows down the development of children's lungs, and also increases the risk of premature birth and low birth weight. Children born prematurely or with a low birth weight are more likely to develop a lung condition (Ekouevi & Tuntivate, 2012⁷⁰; Smith, et al., 2005⁷¹). There are studies that indicate that children in particular can recover from lung infections quite quickly if the underlying cause was removed (less than one month), so if household air pollution improved it is possible that the new generation could grow up without ALRI. Women look after the children while cooking e.g. Parikh (2011)⁷². Although women have the greater exposure to household pollution the larger underlying disease rates in men suggest that men, women and children will all benefit from decreasing household air pollution. While the effect on under 5's susceptibility to pneumonia is key, recent studies suggest that even adults can recover their lung condition if the source of the pollution is removed.^{73 74}

While most of these studies focus on tobacco smoke, a number of studies show that the NCD effect of biomass smoke is similar to that of smoking tobacco⁷⁵ and pre-virus there were strong and growing calls for cleaning up household air pollution across the international community.⁷⁶



Figure 11 Nama Woman Smoking Kalahari Desert Namibia; Photo taken by Luca Galuzzi * <http://www.galuzzi.it>

⁷⁰ Ekouevi, Koffi; Tuntivate, Voravate. 2012. Household energy access for cooking and heating : lessons learned and the way forward (English). A World Bank study. Washington, DC: World Bank. <http://documents.worldbank.org/curated/en/277861468346440968/Household-energy-access-for-cooking-and-heating-lessons-learned-and-the-way-forward>

⁷¹ Smith KR, Rogers J, Cowlin SC (2005) Household Fuels and Ill-Health in Developing Countries: What improvements can be brought by LP Gas? World LP Gas Association and Intermediate Technology Development Group (Practical Action), Paris. pp. [http://ehsdiv.sph.berkeley.edu/krsmith/publications/2005%20pubs/Household%20Fuels%20Ill%20health%20\(complete%20for%20web\).pdf](http://ehsdiv.sph.berkeley.edu/krsmith/publications/2005%20pubs/Household%20Fuels%20Ill%20health%20(complete%20for%20web).pdf)

⁷² <https://www.sciencedirect.com/science/article/abs/pii/S0301421511004678>

⁷³ <https://lunginstitute.com/blog/lung-health-after-smoking-cessation/>

⁷⁴ <https://www.livescience.com/59667-quit-smoking-lungs-heal.html>

⁷⁵ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5912365/> and <https://erj.ersjournals.com/content/43/3/725>

⁷⁶ <https://www.who.int/features/2014/clean-household-energy/en/>

We shall examine the role of modern energy cooking services as a near zero household emitter within the pages which follow, but there is a strong need to acknowledge the weakness of the currently dominant international strategy for addressing clean cooking. The key features of the strategy and the weakness of it are captured in an article by Gayathri Vaidyanathan in 2018⁷⁷. She quotes the now famous Malawi study where a cluster RCT enrolled 10 750 children from 8626 households. Published in the Lancet this study found no evidence that an intervention comprising cleaner burning biomass-fuelled cookstoves (a fan-driven gasifier stove) reduced the risk of pneumonia in young children in rural Malawi. The study provoked a strong discussion, and we acknowledge that further research is needed^{78 79 80 81 82 83 84 85}.

“Having an open fire in your kitchen is like burning 400 cigarettes an hour,” says Dr Kirk Smith, a Professor of Global Environmental Health from the University of California at Berkeley

While improved stoves with a fan greatly reduce emissions, they still do not fall within the WHO guidelines for safe air quality. While they may mitigate some of the NCD health effects of biomass cooking, it is still unlikely moving to higher tier biomass stoves will make a significant difference. Chimneys are helpful for the household air pollution but can in turn just eject the smoke onto children playing nearby. The problem is illustrated in Figure 9.

⁷⁷ <https://howwegettonext.com/the-failed-quest-for-a-cleaner-cookstove-d24e9f29f351>

⁷⁸ <https://www.sciencedirect.com/science/article/abs/pii/S0013935120304679>

⁷⁹ <https://www.ingentaconnect.com/content/iuatld/ijitld/2020/00000024/00000002/art00002>

⁸⁰ <https://www.sciencedirect.com/science/article/pii/S0048969719359637>

⁸¹ <https://www.nature.com/articles/s41533-019-0126-x>

⁸² <https://link.springer.com/article/10.1007/s42452-019-0405-8>

⁸³ <https://link.springer.com/article/10.1007/s11356-018-3769-1>

⁸⁴ <https://thorax.bmj.com/content/73/11/1026.abstract>

⁸⁵ <https://www.atsjournals.org/doi/full/10.1513/AnnalsATS.201710-831GH>

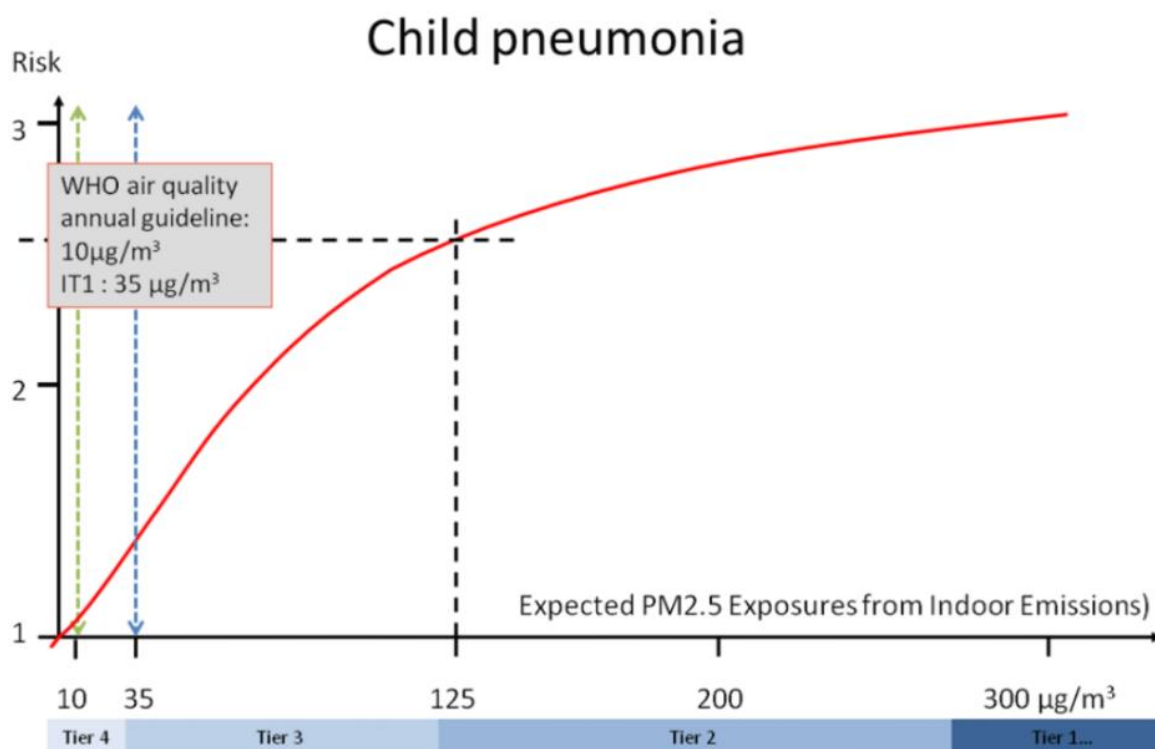


Figure 12 exposure-response relationship for child pneumonia CCA 2012⁸⁶

Respiratory health. The localised emissions from stoves adversely affects the whole family. However, it is women who are cooking in confined spaces that experience the most negative impact. It has been recently realised that even an open window can make a huge difference to the breathing in of particulates. Stoves with chimneys can take the particulates away from the chef, although recent studies suggest that this merely moves the problem outside, and dense clusters of households all cooking with biomass just make for air polluted communities. We will not reiterate here the efforts that those working in biomass cooking have gone to to mitigate the emissions. There are a myriad of stoves and designs, and there has been considerable finance spent on trying to promote the better stoves. However, as Fraser⁸⁷ states – it has made nearly no difference to the health objectives^{88 89}.

Of late, ESMAPs work with the multi-tier framework⁹⁰ has acknowledged that there is a huge difference between the impact of a stove in a windowless room and one used outdoors. Accordingly the World Bank are continuing with their 'improved cookstove' strategy, albeit defining it as Tiers, and aiming at Tier 4 and above.

5.1.2 Beyond household air pollution

There are also hardships and health impacts associated with other biomass cooking related activities such as fuel wood collection, transportation and processing (Parikh 2011⁹¹). Anyone who has watched the women of

⁸⁶ <https://www.cleancookingalliance.org/binary-data/ATTACHMENT/file/000/000/150-1.pdf>

⁸⁷ <https://www.scientificamerican.com/article/improved-cookstoves-little-reduce-harmful-indoor-emissions/>

⁸⁸ <https://www.sciencedirect.com/science/article/pii/S2468203917300912>

⁸⁹ <https://www.tandfonline.com/doi/full/10.1080/00102202.2019.1614922>

⁹⁰ <https://www.esmap.org/node/71201>

⁹¹ <https://www.sciencedirect.com/science/article/abs/pii/S0301421511004678>

Ethiopia bringing huge bundles of wood into Addis Ababa will surmise that such actions result in neck aches, headaches, back aches and bruises. Parikh's study shows that such physical ills, as well as and animal attacks, were more frequent than coughing. Matinga, 2010⁹²; Clancy, et al., 2013⁹³; ENERGIA, 2006⁹⁴ all reported the pain that collecting can cause and Echarri and Forriol, 2002⁹⁵; 2005⁹⁶ found significant degeneration of the cervical spines of women who carry firewood on their heads against a control group.

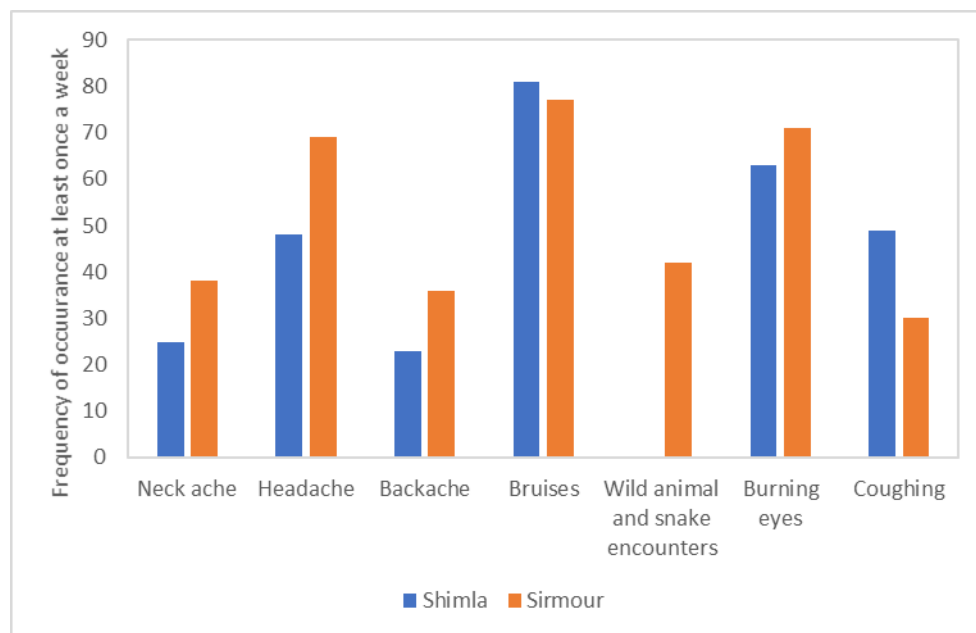


Figure 13 Health impacts of collecting fuels in Himachal Pradesh, India (Parikh 2011 *ibid*)

These ills in themselves rarely cause death and are unlikely candidates for the virus to add to a cause comorbidity. Nevertheless the health and well-being of women is reduced by such and one can imagine the challenges of fighting the virus while always having a headache from the wood carrying. The collection of wood, its transportation and processing, all contribute to the drudgery of women's lives, and we shall return to this in the next section on time and unpaid work.

5.1.3 Food security

Cooking of food requires both the cooking fuel and of course, the food. WLPGA & Energia (2014)⁹⁷ point out that women's health is linked to access to food. We are told that "After decades of steady decline, the number of people who suffer from hunger – as measured by the prevalence of undernourishment – began to slowly increase again in 2015. Today, more than [820 million people regularly go to bed hungry](#), of whom about [135 million suffer from acute hunger](#) largely due to man-made conflicts, climate change and economic downturns.

⁹² Matinga, M. N. (2010). "We grow up with it": an ethnographic study of the experiences, perceptions and responses to the health impacts of energy acquisition and use in rural South Africa. Enschede: University of Twente. <https://doi.org/10.3990/1.9789036530965>

⁹³ Clancy, J. S., Mohlakoana, N., & Matinga, M. N. (2013). Energy poverty: have we got the measure of it? In UKDSA Annual meeting https://research.utwente.nl/files/5528816/DSAconf2013_clancy-et_al-energy_poverty.pdf

⁹⁴ https://assets.publishing.service.gov.uk/media/57a08c28e5274a31e0001030/R8346-dfid_synthesis.pdf

⁹⁵ <https://europepmc.org/article/med/12073104>

⁹⁶ <https://pubmed.ncbi.nlm.nih.gov/15863085/>

⁹⁷ <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

The COVID-19 pandemic could now double that number, putting an additional 130 million people at risk of suffering acute hunger by the end of 2020, according to the World Food Programme⁹⁸.

Food security is itself a vast subject and again one that we cannot do justice to here. Increased energy access, however, is said to have an impact on reducing malnutrition. Most food (about 95% of staple foods) needs cooking before it can be eaten, and many of the staple foods of Africa require very long cooking. It is not uncommon to hear people say they have to boil their beans for over three hours. Matoke in Uganda made the traditional way takes nearly 4 hours. If the household is aware they are short of cooking fuel, they may choose less nutritious foods. Scarcity of firewood has therefore been linked to abandonment of certain nutritious foods such as beans (Brouwer, et al., 1997⁹⁹). Malnutrition plays a role in more than half of all child deaths and affects women's capacity to meet the physical demands placed upon them. Maintaining good nutrition is also difficult for women when they spend several hours in far-away forests collecting firewood.

While rural households at least have the option to collect firewood (which may or may not constitute a monetary expense for the household), most urban communities are reliant on purchased fuel. As the cost of charcoal or alternatives such as kerosene rises, and the supply chains become stretched, qualitative data is emerging that suggests poor urban households are struggling to access food and the fuel to cook it¹⁰⁰.

Barnes¹⁰¹ and others suggest that one approach to energy poverty is to consider when expenditure on energy is above a threshold in relation to the poverty line of the country and an individual household's available income. He suggests that "when energy is above 10% of income, then conceivably it will begin to have an impact on general household welfare. The idea is that when households are forced to spend as much as 10% of cash income on energy they are being deprived of other basic goods and services necessary to sustain life". Data from DHS studies suggests that the lowest quintile households in urban Ethiopia and Nigeria spend nearly 20% of their income on energy for cooking, while in Zambia and Liberia they spend 10%. These expenditures are high enough that they perhaps influence what they might spend on food.

It should be noted that this definition of energy poverty can be considered quite limiting. Focusing on a particular parameter such as income fails to factor people's capacity to convert that income to desired outcomes (due to a number of factors – such as quality of service, reliability of supply and availability of choices, gender, environment etc.). It also precludes us from exploring how energy poverty arises from a mixture of interconnected elements. Perhaps definitions that link energy poverty with wellbeing [and treat lack of access and affordability of modern, clean energy resources/technologies as a form of deprivation] might be useful to explore the multidimensionality of energy poverty women are susceptible to. A livelihoods capacity approach might be better.

Nevertheless Sola et al 2016¹⁰² present some of the mechanisms that link energy access for cooking, and changes in diet. Figure 10 and 11 take their mechanism diagram and adds to it the NCDs.

⁹⁸ <https://www.un.org/sustainabledevelopment/hunger/>

⁹⁹ <https://www.sciencedirect.com/science/article/abs/pii/S0305750X96001003>

¹⁰⁰ <https://www.nytimes.com/2020/04/22/world/africa/coronavirus-hunger-crisis.html>

¹⁰¹ <http://documents.worldbank.org/curated/en/405151468339604567/Modernizing-energy-services-for-the-poor-a-World-Bank-investment-review-fiscal-2000-08>

¹⁰² <https://link.springer.com/article/10.1007/s12571-016-0570-1>

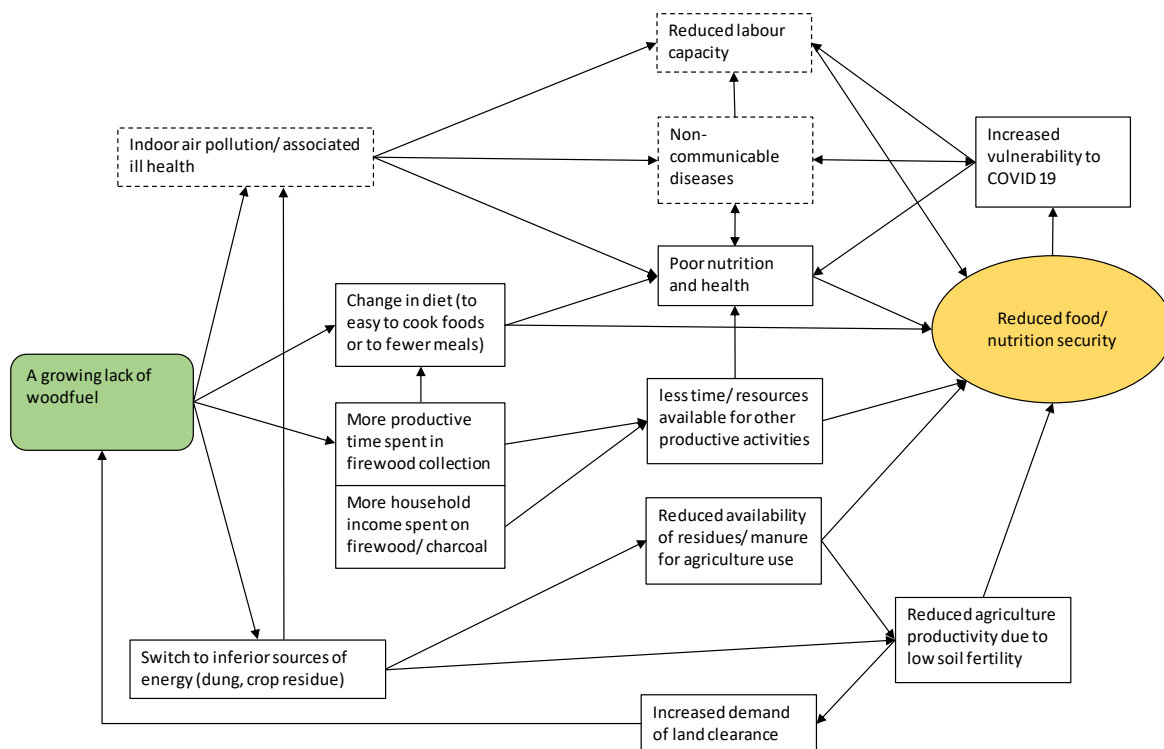


Figure 14 Mechanisms reduced food security from biomass fuel consumption in rural areas, Derived from Sola et al 2016 with added NCDs

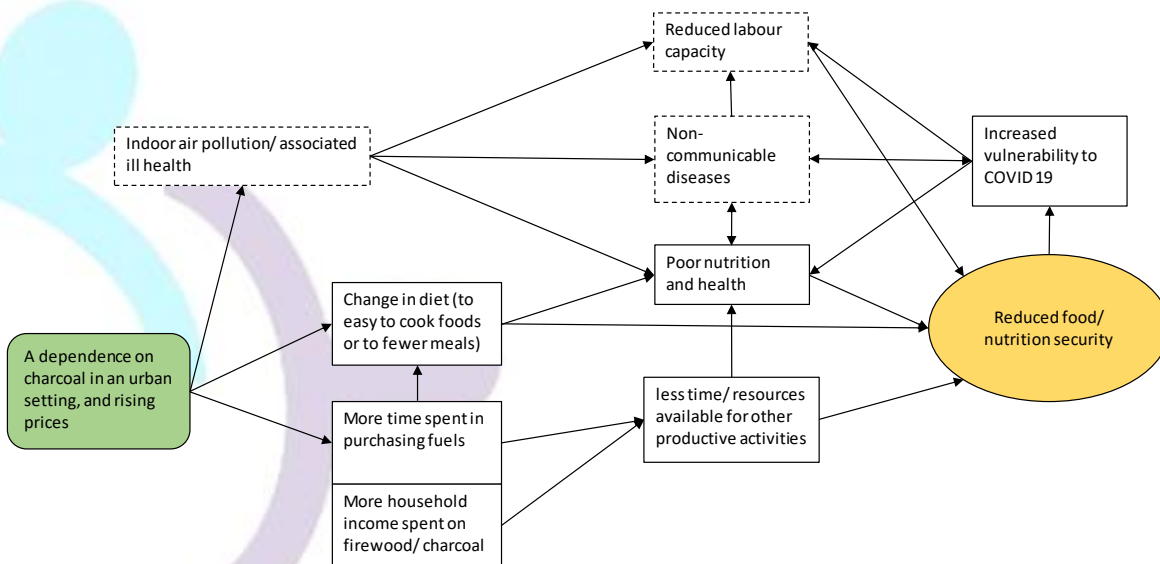


Figure 15 Mechanisms reduced food security from biomass fuel consumption in urban areas, Derived from Sola et al 2016 with added NCDs

And of course, the intersect with Covid 19 has already been mentioned. The temporary reduction of food supply may well be overcome, but in the longer term the stresses on the economy will increase the price of food, and locally produced fuels such as charcoal. True, a global recession may hit the oil price, and modern energy may go up in price – however, they are mainly controlled by the government and later in the report we shall see that they offer a certain price stability. Affordable fuel for cooking such as modern energy sources at stable pricing could alleviate the difficult choices poor households have to make about food or energy which reduce the nutritional intake of women and children.

5.1.4 The bottom line?

Biomass cooking on anything less than a tier 4 stove is likely to cause underlying health conditions.

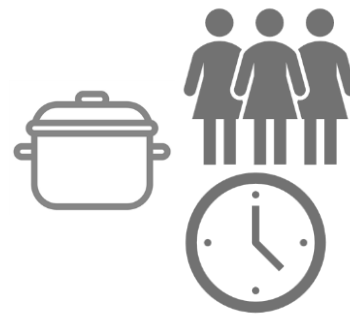
Underlying health conditions leave an opening for Covid 19 to kill through comorbidity and weakness from Covid could lead to greater vulnerability to the onset of NCDs.

Tackling gendered health conditions created by the use of biomass stoves would mitigate NCDs, reduce the impact of the virus, and create better health for women and children (and men).

5.2 Gendered time

SDG5: “recognise and value unpaid care and domestic work”; “ensure women’s effective participation and equal opportunities for leadership in political, economic and public life”

In the preceding sections we have discussed the impacts of the continued use of biomass fuels on women’s health via both the direct health impacts of household air pollution and a set of additional health concerns related to safety, nutrition and economic trade-offs. For many women and children, the use of biomass for cooking involves a significant unpaid time commitment in the cooking process itself, fuel collection and transportation. Beyond the drudgery that this embodies, this time commitment also has impacts on children’s time available to study, women’s time for engagement in income earning activities or unpaid care and domestic work. It also impinges on their ability to participate effectively in political life or enjoy



5.2.1 Collecting biomass

Collecting wood is often cited as being a major time consumer for rural women. What is often neglected is the time it takes to shop for carbon in cities – because the poor shop in small quantities, regular visits to a nearby ‘convenience’ seller of charcoal in smaller quantities or to go the bigger markets to buy in bulk.

Collecting wood is indeed a time consumer – and it is generally (unless the collection is part of the urban supply chain of wood or charcoal) it is, for the household, unpaid domestic work¹⁰³.

103

https://www.researchgate.net/publication/325750384_Gender_Specific_Perspectives_Among_Smallholder_Farm_Households_on_Water-Energy-Food_Security_Nexus_Issues_in_Ethiopia

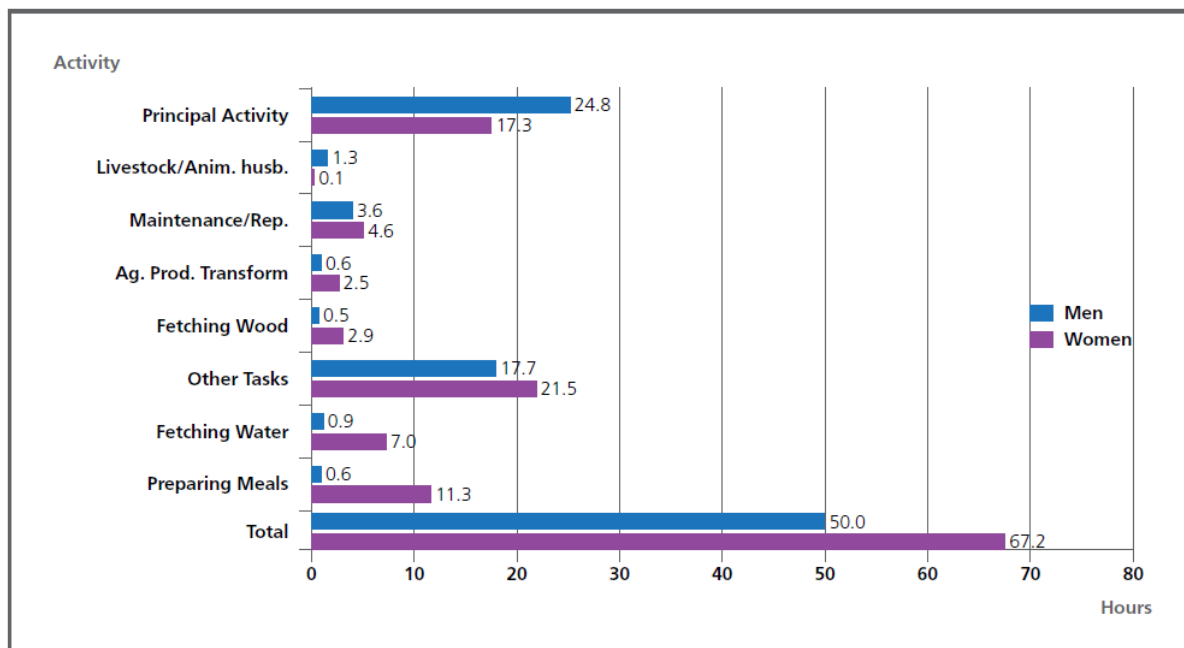


Figure 16 Weekly work hours by task and sex, Benin, UNDP 1998 in Blackden 2002, in Energia 2014¹⁰⁴

Table 1 Average minutes spent on housekeeping (age 7 upwards) Ghana GLSS 7 2017¹⁰⁵

Activity	Urban	Rural	Both
Collecting firewood			
Male	16.8	19.8	19.3
Female	20.0	23.7	23.1
Fetching water			
Male	11.6	16.6	14.0
Female	15.2	22.9	19.0
Washing clothes			
Male	12.3	12.6	12.4
Female	19.3	19.8	19.5
Cleaning			
Male	10.8	11.6	11.1
Female	16.1	18.2	17.1
Cooking			
Male	24.2	28.8	26.4
Female	41.8	47.8	44.6

Table 2 draws from the GLSS 7 surveys of Ghana 2017, to show the lack of difference between urban and rural time use. Purchasing fuel and/or collecting it takes on average about 20 minutes, with a slightly more time being spent by women and by rural dwellers. With the actual cooking, the differential is more stark. Women in both settings are taking about 45 minutes per day, while men spend about 25 minutes per day. And cleaning, which includes the soot covered pots and pans, and the seat on dresses, adds another significant time burden to

¹⁰⁴ <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

¹⁰⁵ <http://www2.statsghana.gov.gh/nada/index.php/catalog/97/study-description>

women more than men. The slight caveat here that needs further investigation is that the time is an average for both adults and children over 7 years of age. One can imagine that boys are asked to help with the housework, and the time spent by males over the age of 18 would be significantly less.

5.2.2 Unpaid domestic work

As discussed above, the figures and tables illustrate the time spent in rural Benin and across Ghana on collecting wood and other domestic activities. While collecting wood is a burdensome 3 hours for the rural Benin woman, this figure should be considered against the time taken to prepare meals. Biomass stoves also require time to light, and then they need supervision. So if the cooking time for a meal of beans is say 3 hours, that is 3.5 hours of the woman's time preparing and cooking. Open fires and most biomass stoves cannot be left unattended, and so the time preparing meals is not available for any other task. We shall see that a great advantage of modern energy cooking is the controllability and the safety, such that in certain contexts the cooking appliance can be left unattended.

This is important because even in the rural situation like Benin, or across Ghana, the preparing of meals timewise is about 3 times that of the actual collecting of wood which has been the major focus of previous work on the topic. We note also though that experience suggests that 'preparing wood' is also time consuming. Collecting wood results in a pile of unwieldy sticks – creating sticks that fit into the stove can be in itself a time consuming task. Indeed, the author once lived with a poor household in Ethiopia (for a week) which was struggling with HIV in the husband, wife and ten year old daughter. The man purchased wood bundles from a neighbour, spent his days converting them to small bundles of smaller sticks suitable for a fire and made a minimal income from selling these bundles. The point is that converting a pile of wood to fuel suitable for a stove is in itself time consuming.

And this also illustrates why the time spent on unpaid work does not significantly alleviate in urban situations¹⁰⁶. The Ghana data suggests that even in an urban situation there is significant time 'collecting fuel' (purchase or collection). If she is preparing meals on a biomass stove, she may still be spending 12 hours on this task. The time may vary according to the eating habits of the household. In rural areas the majority cook food from its raw state, and they often cook more than one meal at a time, while in urban situations there may be more use of pre-cooked or convenient food. And if we move from Africa to Asia, then the complexity of the food preparation increases but generally the time taken decreases.

Nevertheless, the preparation time is a significant proportion of the unpaid work, and for urban women who have to go to paid employment, time is a valuable commodity. Qualitative data suggests that breakfast is the most vulnerable meal, when households in the Kibera slums of Nairobi told us they either got up really early to light the stove or left the children to cook their own breakfast.

¹⁰⁶ <https://oxfamlibrary.openrepository.com/bitstream/handle/10546/620910/rr-nairobi-kenya-household-care-survey-191119-en.pdf>

The time taken to prepare food on a biomass stove could be used to engage in political, economic and public life, and so the use of modern energy could contribute to change in this arena ^{107 108 109 110}.

There is also the time spent cleaning the utensils. Cooking and cleaning sooty pots can take just as much time daily as fuel collection, and often more.

Regarding Covid 19, there is an added effect in the intersect regarding social distancing. Queues at the market, the extra time taken to shop safely, the need to seek health care – these are all extra time consumed by society responding to and trying to mitigate the effects of the virus. Less time preparing a meal could be a valuable contribution, similar to the argument that you don't need to go out of the house to collect charcoal if you are using an electric stove (this might be true in the case of LPG – at least less frequent trips). Household income is likely to decline significantly therefore freeing up more opportunities for women to generate income is certainly to be encouraged (particularly if in activities that afford the same advantages to other women – e.g. jobs created in marketing EPCs or LPG). When McKinsey consider a “full-potential” scenario in which women participate in the economy identically to men, they find that it would add up to \$28 trillion, or 26 percent, to annual global GDP in 2025 compared with a business-as-usual scenario across the whole world. The shift to modern energy cooking does not create equality per se in the workplace, but it could release significant portions of women's time.

Another effect of quicker meals might be on women and children's nutrition. It is common in urban poor areas, for the adults to leave the home for work without breakfast, or to get up very early to prepare breakfast. Lighting a charcoal stove takes time, and the time savings of modern energy cooking are nearly always the first advantage cited by women. Unpaid work includes the “triple burden” of market work, housework, and family care.

Releasing time is a key necessity for women's education, agency and life choices, the take up of economic opportunities and their participation more broadly in economic, political, and social life (World Bank, 2012).

5.2.3 The bottom line?

Biomass cooking on anything less than a tier 4 stove takes time, to collect the fuel, to process the fuel, to light the stove, to undertake the preparation of the meal and to clean up afterwards.

COVID 19 has added to the time taken for simple tasks such as shopping for food and fuels and is going to have significant impacts on household income

The hours spent preparing meals (and purchasing or collecting fuel) are unpaid work and could be used by women for income generating activities or lifestyle choices.

Tackling gendered health conditions created by biomass stoves could release women from dictated unpaid work and generate opportunity for improved lifestyles that include by choice paid or unpaid activities.

¹⁰⁷ <https://www.oecd-ilibrary.org/sites/a3436c8e-en/index.html>

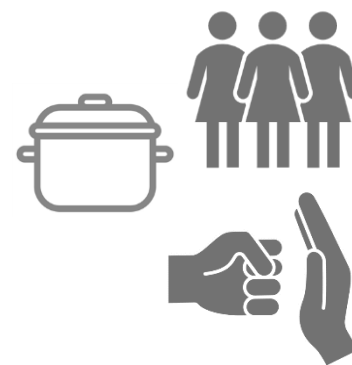
¹⁰⁸ <https://oxfamlibrary.openrepository.com/bitstream/handle/10546/620532/rr-gender-roles-care-economy-uganda-130818-en.pdf>

¹⁰⁹ https://www.researchgate.net/publication/261030519_Gender_Patterns_and_Value_of_Unpaid_Care_Work_Findings_From_China's_First_Large-Scale_Time_Use_Survey

¹¹⁰ https://www.oecd.org/dev/development-gender/Unpaid_care_work.pdf

5.3 Gendered violence

SDG5 calls on governments to work towards to “end all forms of discrimination against all women and girls everywhere, including to eliminate violence against women.” Taking action to transition households away from the use of biomass for cooking also has considerable relevance in relation to this goal.



5.3.1 Safety outside the home

WLPGA & Energia (2014)¹¹¹ note that “Physical, sexual¹¹² and psychological violence against women is endemic across the world and is also present in the biomass energy system.” Many texts talk about the dangers of collecting wood.

Safety is a concern for women and children. This is particularly true for humanitarian and conflict settings. UNHCR survey of 3,308 refugees in Chad, Ethiopia, Kenya, and Uganda found 90 percent rely on wood to cook and 30 percent came into conflict with a host community while collecting firewood.

- In 2014 in Uganda's Nakivale refugee camp, 41% of households reported incidences of violence during firewood collection in the past six months. The types of accident reported included confiscation of firewood (23%), beating (20%), bodily injury (12%), assault (10%), attempted rape (5%) and rape (4%). (UNHCR Uganda, 2014)
- In Ethiopia, 33% of refugee households reported one or more violent incidents in the past 12 months while collecting firewood, and 13.5% experienced rape, assault, or attempted rape. (UNHCR Ethiopia, 2014)
- In Chad, 42% of households reported incidents of assault, attempted rape, rape, or other forms of SGBV during firewood collected in the past six months. (UNHCR Chad, 2014)
- In Doro, South Sudan, 54% of refugee respondents reported incidents of violence against women in firewood collection places in Doro, South Sudan. In 8 out of 13 focus group discussions with adolescent girls, incidents of physical and sexual assault were reported in firewood collection places. (Danish Refugee Council, 2012)¹¹³

As Josette Sheeran of the UN World Food Programme stated, “My awakening moment was being in Darfur, meeting with the women, and realizing they’re getting raped trying to cook the food we bring them.”¹¹⁴ Women in South Sudan experience rates of violence twice the global average¹¹⁵. “During a period of just two months in 2013, there were 19 documented cases of rape reported to local authorities from women and girls in the logging sites of South Sudan. Due to an illegal logging industry, there were no contracts or proof of employment, and thus no way to seek recourse for these crimes”.

In Abdelnour¹¹⁶ he argues that there are assumptions about improved cookstoves reducing the time taken to collect wood, and therefore the exposure to rape. However, he states that there is little to no actual data supporting this hypothesis. Modern energy which might take away the need to go to remote locations and collect wood might tackle this problem – but again we accept there is as yet no evidence to support this

¹¹¹ <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

¹¹² <https://www.unhcr.org/uk/news/makingdifference/2014/7/53c53bb26/curbing-time-consuming-dangerous-searches-firewood.html>

¹¹³ <https://www.cleancookingalliance.org/binary-data/ATTACHMENT/file/000/000/331-1.pdf>

¹¹⁴ <https://www.cleancookingalliance.org/resources/272.html>

¹¹⁵ <https://pdfs.semanticscholar.org/9e79/6a84ff017ae5e759dea5f3bbdd1a2652513e.pdf#page=99>

¹¹⁶ <file:///C:/Users/Simon/Downloads/Ch18AbdelnourEPFL2015.pdf>

hypothesis. As in humanitarian settings as elsewhere most rapes and violence are committed by family members rather than strangers.

While this form of assault is serious, the data focuses on refugees and their host communities. It is not clear how much rape is an everyday occurrence in fuelwood collecting in stable communities. However, while the incidence of rape may be unclear, violence as an accepted norm presents in many surveys, not just in relation to fuel collection but also in relation to cooking.

In stable communities rape and violence are less prevalent, even if depressingly widespread globally. The violence in stable communities is not limited, however to incidence of rape and sexual violence (although this remains a threat), it can also be connected to the physical effort that exposes women to particular health risks – risks that subject the body to violence. As discussed above “Fuel collection entails much physical effort and exposes women and girls to a host of risks. Those who carry wood in large bundles on their backs or heads over a lifetime can develop spinal conditions and chronic headaches. Out in the forest or on back roads, they are susceptible to injuries, animal attacks and threats of physical and sexual violence”¹¹⁷

Is there also a case to be made that there is structural violence endemic within the charcoal trade – women being denied access to the most lucrative elements of the value chain. Women tend to be primarily involved with tree seedling planting, watering, tending and selling. Men tend to be more heavily involved in tree cutting and tree burning (e.g. Charcoal production in Western Kenya¹¹⁸. ‘Production as a last resort’ might be particularly prevalent among female producers leading to sexual exploitation.¹¹⁹ Female charcoal producers tend to be less educated than their male counterparts as well as non-producing women, and female producers tend to have fewer alternative income sources compared to male producers.

5.3.2 Safety inside the home

Another form of gendered violence associated with energy takes the form of the expectations of the head of the household (who is normally a man). Indeed even in terms of violence against women within their own home, food can be a trigger for violence and cooking has been an issue. This has been and is for developed economies such as the USA - “Many women face serious repercussions if food is not prepared correctly or on time. Women who fail to please their husband’s food preferences often experience negative consequences ranging from small arguments to domestic violence. Indeed, the purchase, preparation and serving of food often serves as a key instigator of violent incidents in the home.”¹²⁰ -

The attitudes of a significant proportion of the population of Low and Middle Income countries can be somewhat shocking to the mind of those in developed economies. While the developed economies have some way to go before women experience equality of pay, equal access to jobs and freedom from harassment in public, there is a generally accepted norm that in a marriage relationship (or living together partnership) neither partner has the right to ‘beat’ (physical violence) the other. Indeed it is both legally and socially **unacceptable** for violence to happen within the domestic situation (and for that matter outside the domestic context – but that is another point).

However, when we consider LMICs, the situation changes, with a significant proportion accepting and believing that it is acceptable for a husband to ‘beat’ their wife under certain conditions. These attitudes have been captured in DHS surveys for the last 20 years or more. One of the five statements that make up the composite

¹¹⁷ http://apps.who.int/iris/bitstream/handle/10665/204717/9789241565233_eng.pdf

¹¹⁸ https://assets.publishing.service.gov.uk/media/57a08aace5274a31e00006f8/Gender_Charcoal_Value_Chain_LR.pdf

¹¹⁹ Sexual exploitation in the charcoal trade - <https://www.iucn.org/news/gender/202001/environmental-degradation-driving-gender-based-violence-iucn-study>

¹²⁰ P.Allen and C.Sachs () [International Journal of Sociology of Agriculture and Food](#) 2007 Vol.15 No.1 pp.1-23

index on violence is that the respondent believes that it is 'ok for a man to beat a woman if she burns their food'. Other statements include issues around infidelity, exiting the house.

These statements are combined to give an indication of the acceptance of domestic violence. Figure 16 presents the prevalence of an attitude that it is acceptable to 'beat your spouse' under certain conditions (5 attitudes measured - infidelity, going out, burning food, etc).

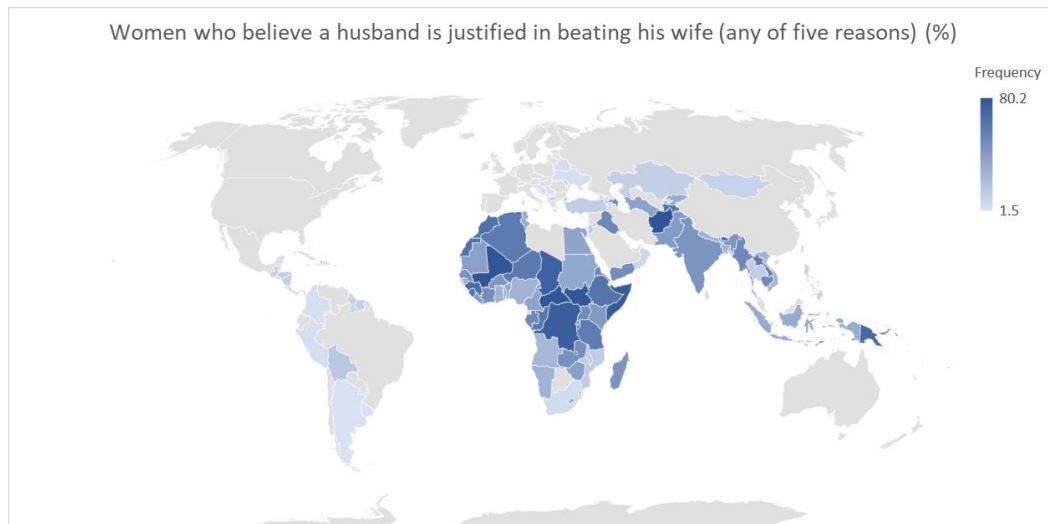


Figure 17 Women who believe a husband is justified in beating his wife (any of five reasons) (%) World Bank data 2020¹²¹

This attitude translates into actual violence, with the percentage of women experiencing violence being shown in figure 17

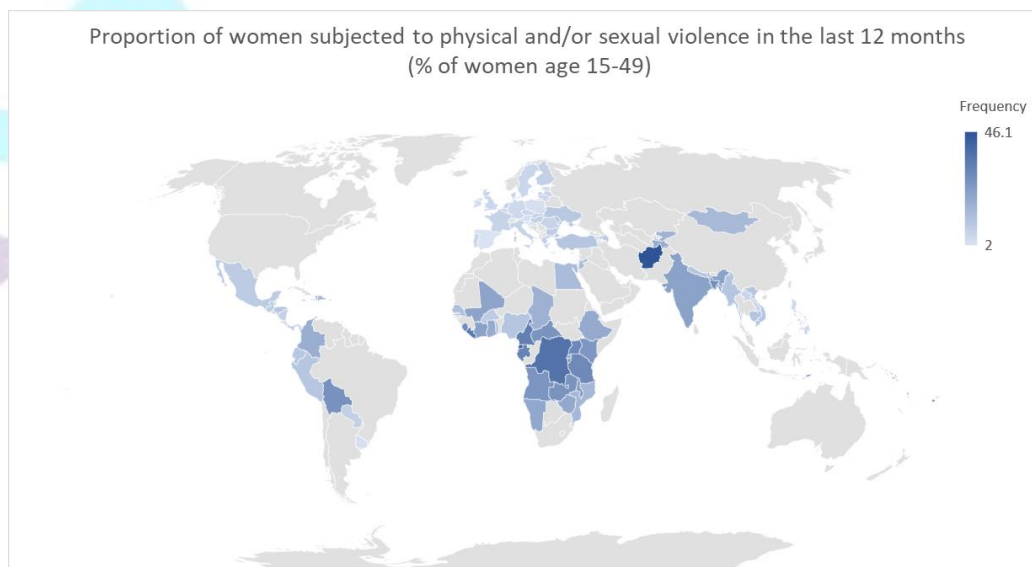


Figure 18 Proportion of women subjected to physical and/or sexual violence in the last 12 months (% of women age 15-49) World Bank Data accessed 2020¹²²

¹²¹ Note, not all countries report every year, and so this is based on the latest reported year (which could be as old as 2012) Assembled by authors from the WB database.

¹²² Note, not all countries report every year, and so this is based on the latest reported year (which could be as old as 2012) Assembled by authors from the WB database.

The role of domestic violence in LMIC societies is a complex mix of culture, poverty, tradition, education and global change. Overlaid or perhaps underlaid on these are the effects of religion, modernity and human rights, with the intersect of gender quality (feminism), race and general (Global) inequality. It is also made worse by recent or regional conflict¹²³.

It is a complex discussion, and in no way do we seek to minimise or simplify the narrative or say there is a simple technocentric solution. However, in working with clean cooking through modern energy cooking services, the authors began to explore the relationship between the ‘cooking related’ indicator of violence stated as ‘acceptable to beat wife if burn food’ and other influencers. Our interest started because with a modern electric pressure cooker, it is quite difficult to burn food. The temperature sensors at the base of the appliance switch the whole thing off if they sense overheating, and while it is possible to ruin the taste of the food (something implicit in the statement), the opportunities to burn food in an electrical appliance are considerably less than with an open fire (see section gendered safety).

The progress on clean cooking mirrors the changes in attitude to violence against women. Figure XX shows a close correlation at a national level between the proportion of the country utilizing clean cooking and the attitude towards domestic violence. We are not stating a cause and effect here but observing such correlation. We might hypothesise that the change in attitude reflects the wider societal modernization, and that modernity means a change towards clean cooking, and a change in attitude. However, undertaking the same analysis of the data with education and poverty, shows correlates much weaker than with electricity access and clean cooking access. At the same time taking a simple cause and effect time displacement theory, we find that the advent of clean cooking relates in a deeper change of attitude 20 years later to domestic violence than the other way around.

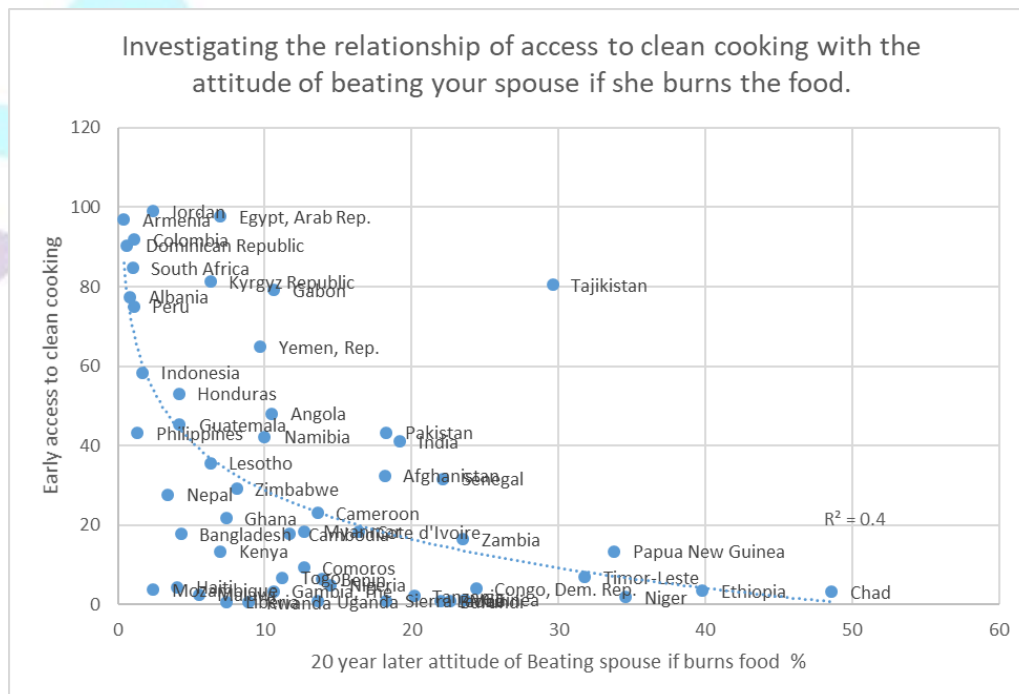


Figure 19 Investigating the relationship of access to clean cooking with the attitude of beating your spouse if she burns the food (Authors own)

¹²³ <https://www.voanews.com/africa/regional-conflicts-place-west-african-women-danger-abuse>

Much more research on this is required but there are indications that western attitudes to domestic violence are somewhat related to access to energy, and even access to clean cooking. It is therefore possible that a stronger emphasis on modern energy cooking services could mitigate domestic violence over the longer term.

5.3.3 The bottom line?

Food and cooking are triggers for domestic violence. In many LMICs the idea that a wife can be beaten by the husband for certain reasons is prevalent.

Biomass cooking on anything less than a tier 4 stove leaves women vulnerable to criticism by their partners and potentially creates situations of concern in accessing the fuel for cooking.

COVID 19, where lockdown has occurred, has added to the stress the household feels in its day to day life.

The risk of burning food or triggering violence could be mitigated by the use of modern energy cooking services.

While not an actual solution to a social ill, tackling gendered violence by mitigating the triggers found biomass stoves could release women from threatening situations and, could mitigate the opportunities for violence.¹²⁴

5.4 Gendered environmental decay

“reform to give women equal rights to economic resource, access to ownership and control over land, financial services and natural resources”

5.4.1 Deforestation

Climate change will adversely affect the poor. It may likely change the availability of biomass^{125 126}. Longer collecting times for firewood are expected, more extreme weather may make collection more difficult, agriculture and cropping may depend more on microclimates created by trees. As climate change affects the ability to collect firewood, it can be conceived as a gendered issue (as women are the main collectors). The increased time taken also then has an impact on the provision of basic services key to women’s empowerment, such as water, health, education, and grain milling, once again becoming a gendered issue.

The SDG calls for greater women’s rights to economic resources, to ownership and control over the land. While this will be a deeply cultural change, releasing the dependence of the household on the nearby land for fuelwood, could effectively give women more control over their time and resources.

5.4.2 Climate emissions

Of course, the impact of climate change on the use of biomass is mirrored by the use of biomass as a cause for climate change. Remarkably there is very little clarity on the contribution of biomass cooking to climate change. Ramanathan & Carmichael, 2008 stated that black carbon contributes to 18% of temperature increases and is second only to CO₂ in its contribution to climate change. About 25% of global black carbon emissions are



¹²⁴ We note the work of Alison Brysk & Aashish Mehta (2017) When Development Is Not Enough: Structural Change, Conflict and Gendered Insecurity, Global Society, 31:4, 441-459, DOI: [10.1080/13600826.2016.1272046](https://doi.org/10.1080/13600826.2016.1272046)

¹²⁵ <https://www.climatecouncil.org.au/deforestation/>

¹²⁶ <http://climate.org/deforestation-and-climate-change/>

attribute to residential solid fuel burning and about 84% of this black carbon is from households in developing countries¹²⁷. However black carbon, which results from incomplete combustion, is a short-lived climate-forcing (SLCF) agent, and when that is taken into account some authors estimate it to be contributing the equivalent of 25 to 50 per cent of CO₂ warming globally¹²⁸

“The products of the incomplete combustion of biomass in cookstoves has an impact on the climate, both through carbon dioxide (CO₂) and such climate-related gases as methane (CH₄), nitrous oxide (N₂O), carbon monoxide (CO), and non-methane volatile organic contaminants (NMVOCs) as well as black carbon, with the latter receiving substantial attention in recent years, motivated by a desire to enable quick action on climate change through a focus on short-lived climate-forcing (SLCF) agents, especially given the inability of major industrialized economies to take the lead on significantly reducing CO₂, which is the major greenhouse gas. The co-benefits of reducing many SLCFs, such as reducing local air pollution and health impacts, provides an additional impetus for focusing on these greenhouse pollutants” (ibid)

In 2000, a sophisticated comparison of the relative global warming impact of the emissions of all major greenhouse species, including SLCFs, in the year 2020 found the biomass used in cookstoves to be the second largest greenhouse sector globally after on-road transport (Unger *et al* [2010](#)¹²⁹).

Perhaps exact figures don't matter - a significant climate contribution from biomass cooking is a gendered environmental impact.

5.4.3 The bottom line?

Biomass cooking on anything less than a tier 4 stove creates environmental stress, not least through deforestation. Deforestation can harm both the local and global environment. Reduced tree coverage disrupts agricultural processes, leading to soil degradation and water shed decline.

Biomass cooking emissions contribute to climate change.

Women will bear the brunt of climate change and environmental decay. Agricultural yields will likely decline, urban and rural households will experience climate related stress, and women will have to work harder to care for their families.

Covid 19 will add to the stress the household feels in its day to day life, reduce funding for environmental programmes due to its effects on the global economy

5.1 Gendered cities

Urban growth will dominate the run up to 2030. Africa is projected to have the fastest urban growth rate in the world: urban areas currently contain 472 million people and will double over the next 25 years. Much of this growth is taking place in small and medium-sized towns. Africa's urban transition offers great opportunities, but it also poses significant challenges. Urban agglomerations are developing most often without the benefit of policies or investments able to meet these challenges. Urban planning and management are therefore key



¹²⁷ <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>

¹²⁸ <https://www.ccacoalition.org/en/file/4544>

¹²⁹ <https://pubs.giss.nasa.gov/abs/un01100t.html>

development issues.¹³⁰ “SSA’s 143 cities generate a combined \$ 0.5 trillion, totalling 50 percent of the region’s gross domestic product (GDP). Urban centres play a critical role in fighting poverty and sustaining economic growth and are often considered the future of prosperity in the developing world.”¹³¹

How then do gender, energy and COVID 19 intersect within urban conurbations? All the issues above – health, time, violence and environment are magnified in urban situations. People living close to one another no longer have the options of rural life, of social distancing, of unmonitored time, of growing trees as a response to climate change. They are locked into city systems which may or may not have a resilience built into them. Biomass cooking which still dominates many African cities creates indoor and outdoor pollution. Certainly traffic and transport planning also greatly contribute to air pollution and mitigating the biomass contribution may not create clean air. However, transport challenges are being transitioned and modern energy in the shape of electric vehicles is coming or in some cases already here. In Bangladesh, there are over a million three wheeled battery driven vehicles, most cities in China have transitioned to electric vehicles for their taxi services. The world is moving towards electric vehicles, particularly two wheeled vehicles, as a mitigation of climate emissions¹³². (interestingly the lockdown in developed economies has led to a greater use of two wheeled vehicles, and it will be interesting to see if this change has taken root.) Urban conurbations in Africa would benefit from a transition away from biomass based cooking for similar air pollution reasons.

We will discuss this more below, but for the moment, let us acknowledge the interest with gender concerns.

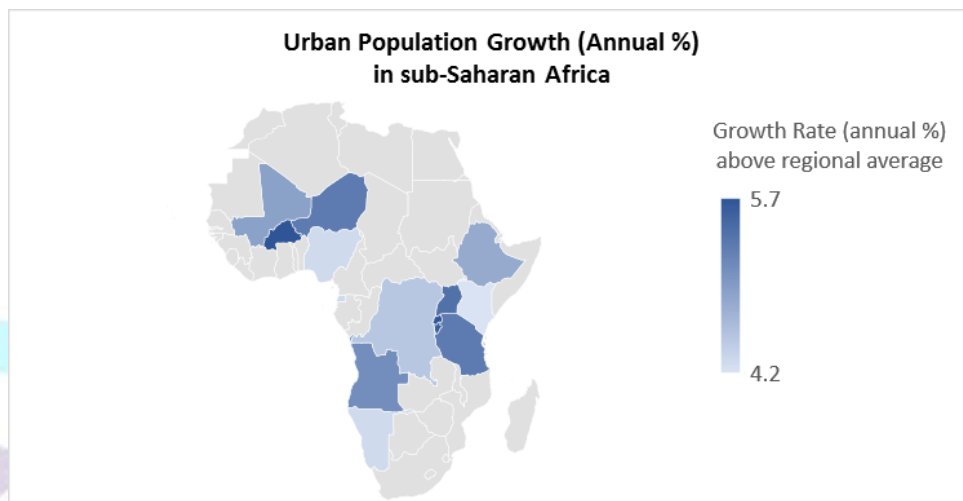


Figure 20 Urban population growth CSIS 2018¹³³

The recent Handbook for Gender-Inclusive Urban Planning and Design.¹³⁴ Suggests that cities have been designed by men for men. They identify six issue areas in the built environment that combine with gender inequity to constrain, inconvenience, and even endanger women, girls, and sexual and gender minorities of all ages and abilities:

¹³⁰ <http://www.oecd.org/publications/africa-s-urbanisation-dynamics-2020-b6bccb81-en.htm>

¹³¹ <https://www.csis.org/analysis/urbanization-sub-saharan-africa>

¹³² <https://www.mdpi.com/2071-1050/12/5/1906> - Rajper, S.Z.; Albrecht, J. Prospects of Electric Vehicles in the Developing Countries: A Literature Review. *Sustainability* **2020**, *12*, 1906.

¹³³ <https://www.csis.org/analysis/urbanization-sub-saharan-africa>

¹³⁴ <https://www.worldbank.org/en/topic/urbandevelopment/publication/handbook-for-gender-inclusive-urban-planning-and-design>

- Access – using services and spaces in the public realm, free from constraints and barriers – can women and in particular women headed households access services such as electricity, water and waste disposal without constraint?
- Mobility – moving around the city safely, easily, and affordably – can women access their food and cooking fuels safely, easily, and affordably?
- Safety and freedom from violence – being free from real and perceived danger in public and private spheres – as discussed above, can women avoid outdoor and indoor violence?
- Health and hygiene – leading an active lifestyle that is free from health risks in the built environment – can women who have to work and cook, find the time for a healthy lifestyle?
- Climate resilience – being able to prepare for, respond to, and cope with the immediate and long-term effects of disaster – what will be the impact on women and children of ongoing pollution from biomass cooking?
- Security of tenure – accessing and owning land and housing to live, work, and build wealth and agency – can the poor and women headed households secure tenure of their property?

Kovacic et al 2019 offer some answers to these questions¹³⁵. The gendered nature of urban informality and on the causes that tie women to informal settlements include:

- Women are more vulnerable to poverty because they are more likely to be responsible for unpaid work activities, such as childcare and house chores, which leaves less time for paid work;
- Women often depend on their partners for income and unemployment is higher among women;
- Women are likely to take low paid jobs such as washing clothes, cleaning, house help, small street-side or home-based eateries, which reinforce poverty because of the low income and volatile and informal nature of these jobs;
- Women are more often responsible for childcare, which forces them into home-based jobs that can be reconciled with childcare or excludes them from the job market if other childcare options are not accessible;
- Polygamous practices may generate a higher incidence of female-headed households.

While these challenges reflect the common intersectional challenges of health, energy and gender equity, they are expressed in a slightly different way within urban situations. While choices and amenities are more in cities than remote rural areas, the governance of the city is often more imposed than rural areas (particularly for the urban poor due to their marginalised status, insecure property ownership and hence inability to access services e.g. electricity, or have to pay more due to semi-legal or illegal intermediaries¹³⁶.

We shall see below that much of this links back to question of more participatory forms of governance which have a closeness to the constituency, and a tight feedback loop for ensuring the realities of any policies. Williams et al ¹³⁷ argue that durable inequality persists through asymmetric power relationships, such as gender, and the categories they produce. “These relationships provide the practices and meanings that justify exploitation, such as the naturalisation of women’s roles as ‘carers’, and the hoarding of resources and opportunities, such as the naturalisation of men’s roles as ‘leaders’” ¹³⁸ Participatory governance could be transformative to the extent that it challenges these identities, and the power asymmetries sustaining them, and Williams et al cite how this

¹³⁵ (Kovacic, Z., Musango, J.K., Ambole, L.A., Buyana, K., Smit, S., Anditi, C., Mwau, B., Ogot, M., Lwasa, S., Brent, A.C. and Nsangi, G., 2019. Interrogating differences: A comparative analysis of Africa’s informal settlements. *World Development*, 122, pp.614-627): <https://www.sciencedirect.com/science/article/pii/S0305750X19301792?via%3Dihub>

¹³⁶ <https://www.tandfonline.com/doi/full/10.1080/00220388.2019.1577384>

¹³⁷ <https://www.sciencedirect.com/science/article/pii/S0016718518302252>

¹³⁸ <https://www.sciencedirect.com/science/article/abs/pii/S0016718518302252#b0215>

has been done in Kerala. City municipalities have considerable powers, setting zoning, building regulations, urban planning, etc. City municipalities can work towards low carbon energy use intersected with greater gender equality – if they are sufficiently informed and motivated.

Often low density of population in rural locations allows for a consultation process, such that major changes in behaviour and lifestyle are a more consultative process. There are of course many exceptions to this generalisation – think evictions and land grabbing. Nevertheless, traditional societies tend to have a local authority that is ‘connected’ to the group interests. In urban life each household can be ‘isolated’ from their neighbour, or in smaller social groupings, without due wider community inclusion. The empirical research surrounding this is not clear. Cornwell and Behler 2017¹³⁹ point out that classical theories of urbanism suggest that sheer population size and density of urban areas weaken the kinds of traditional social bonds and kinship-based networks that characterized rural and/or preindustrial societies. However, while research in the 1980’s suggested that while urban residents have more segmented networks and fewer family ties compared to rural residents other research found that urban dwellers have larger networks and more frequent contact with family and friends. The key point here though is that cities are going to grow, and Covid recovery plans that take into account a participatory and consultative approach are likely to gain more traction than ones that issue policy by edict.

The other characteristic of urban life is the expense. Collected wood in rural areas has a non-monetary cost associated with it in terms of health, time, environment. But in urban life, the purchase of biomass fuel for cooking is a real monetary cost.^{140 141}

The anticipated recession coming in 2020 for the next few years will likely raise prices of key commodities, and the urban poor are likely to be the most disadvantaged.

5.1.1 The bottom line?

Increased urbanisation will be a dominant factor of change across the world, but particularly in Sub Saharan Africa.

Biomass cooking on anything less than a tier 4 stove will add both indoor and outdoor air pollution, and in crowded cities, particularly dense slum areas, biomass cooking will weaken city life.

Women, living in cities designed by men for men, will have to work harder to protect their families and ensure household finances are balanced.

Covid 19 will add to the stress the household feels in its day to day life, lockdowns and social distancing if continued will be an added burden on household’s life.

Having considered the gendered nature of the issues raised by biomass cooking, the next section looks at how action plans that take into account the Cooking, Health, Energy, Environment and Gender nexus alongside Covid recovery, will likely have multiple ‘wins’ and synergies of gain.

¹³⁹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5557022/>

¹⁴⁰ <https://theexchange.africa/money-deals/personal-finance/charcoal-prices-heat-up-businesses-in-east-africa/>

¹⁴¹ <https://www.theeastafrican.co.ke/business/Charcoal-traders-go-to-Uganda-after-Kenya-ban-/2560-5097292-lj12s4z/index.html>

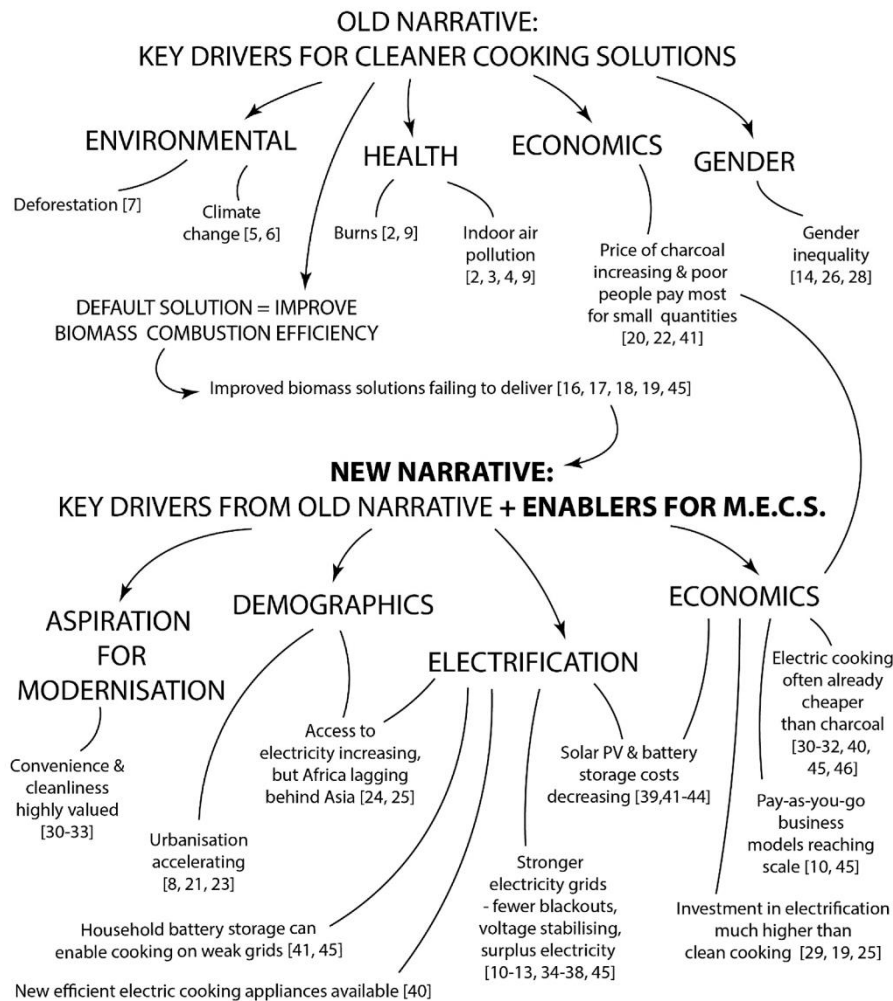
6 COVID 19 Recovery plans

Covid 19 stands to rapidly change the world. One of the consequences of this may be reduced global and national commitment to tackling clean cooking at a time when more people will be vulnerable to health impacts and economically less able to sustain fuel choices etc. We have shown over the previous pages why there is already an urgent case to address clean cooking (particular in terms of connections to gender and health). All 3 SDG targets are under attack. Unless action is taken to insist on the place of clean cooking promotion within Covid recover plans, progress made will be reversed.

In this section we consider how governments, donors, the private sector and civil society might work together on COVID 19 recovery plans that take into consideration the intersection discussed above, i.e. that of Cooking, Health, Energy, Environment, and Gender nexus, alongside the impacts of COVID 19.

6.1 Business Unusual

Before the virus, there was a growing consensus that progress on clean cooking was failing, not even keeping up with population growth, and that there would be as many people cooking on biomass on a basic stove in 2030 as there are today. The discussion was about how business as usual in the clean cooking sector was failing and that an alternative strategy was needed. Batchelor et al 2019 outlined the origins of the MECS programme and why UK Aid has funded it. Central to the programme was the alternative strategy of focusing on modern energy cooking services including starting with urban situations and most importantly exploring how to more closely integrate cooking needs with general energy access planning. The paper acknowledges a divide between electricity planning, increased generation on the grid, reduction of transmission losses, improved and extended distribution and off grid planning, and in the inclusion in that planning of cooking loads.



If Covid recovery plans are to make a difference, there is now a need to not only integrate cooking loads with modern energy access planning, but to ensure that spend on recovery plans:- supports the long term integration of cooking and the resulting reduction in NCDs, a contribution to Nationally Determined Contributions for climate mitigation and a strong economic recovery which has an inclusivity about it that is better than before. These are long term plans. The sustainable Development Goals are set at 2030, monitoring systems are in place and the world has been trying to reach them as targets for the last 5 years (building on the previous years of Millennium Development Goals and a long history of international development intervention perhaps first formalising after World War II).

However, **what we are acknowledging here is a shock**. In the language of ‘shocks, stresses and resilience’ most commonly used in livelihoods programmes, the world has experienced a shock.

- **Economic factors** will become increasingly unpredictable due to the immediate and long-term recession created by the virus in 2020.
- **Physical factors** as the virus causes societal upheaval at a time when the world is trying to cope with increased variability of weather patterns as a result of climate change.
- **Social change** as the virus changes our behaviour and changes social relations – intensifying inequality and marginalization, all while the world moves towards 9 billion people, many of whom will inwardly migrate to cities.

These are classic ‘livelihood’ shocks. The remarkable aspect of this shock is that the whole world is experiencing it at once, and the required resilience will need to be a global response. There is considerable research that

states that the poor have the least resilience in any stressful situation (we mean lack of resources not emotional competency – if anything the poor are often more emotionally stable than the middle class), and it will be the case that the poor will be the most vulnerable in this current shock.

So how then can COVID 19 recovery plans enhance a resilience to the long-term impact of the virus, particularly in the light of the biomass cooking issues stated above? Can basing recovery plans on the CHEEG intersect get multiple wins? Can it provide a cost-effective route to increased health and economic resilience while simultaneously benefit gender equity and speed up access to modern energy? We think it can.

6.2 Integrate gender equity, cooking and economic stability into the planning of electrical networks.

Let us start with the current emphasis by the MECS programme that the promotion of electricity for cooking provides a means of overcoming the inadequacies of years of failed strategies for accelerating access to viable modern energy cooking services.

It is important to realise how disassociated cooking has been in the thinking of policy actors dealing with electricity and indeed how disassociated electricity has been in the thinking of policy actors dealing with clean cooking. Electricity has to date always been presented as a far more expensive option to alternatives. Indeed, electricity as a solution to clean cooking can sometimes be completely overlooked. Take for example what the IEA 2017 outlook says *“Regarding access to clean cooking.....an additional \$42 billion, or roughly \$3 billion per year, is needed to ensure clean cooking for all above what is invested in the New Policies Scenario. The additional increment consists of \$18 billion for liquefied petroleum gas (LPG), \$23 billion for improved biomass cookstoves and biogas. It is important to consider this investment in context; for instance roughly \$270 billion was spent on fossil-fuel consumption subsidies in 2016”* (IEA, 2017). The surprising element here is not the promotion of LPG or biomass cookstoves, both of which will be in the energy mix up to 2030 and beyond, but rather the **absence** of any comment on electricity as a clean cooking solution.

Such an attitude is also reflected in the discussion of electricity access. In figure 20, the IEA 2017¹⁴² presents illustrative options for electricity access. Again, nothing in the figure is misleading or wrong, but it is the **absence** of cooking that is significant. While it is the case that cooking on off grids or mini grids has yet to be scaled, developed nations have utilized ‘the grid’ for decades for cooking. Just below 50% of all cooking across the EU uses electricity as its source of energy. In Sweden and Germany 98% of cooking is from the Grid¹⁴³ So why is it that a policy brief for developing countries should avoid putting it within the far right hand side of the diagram?



¹⁴² http://www.iea.org/publications/freepublications/publication/WEO2014_AfricaEnergyOutlook.pdf

¹⁴³ https://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_consumption_in_households

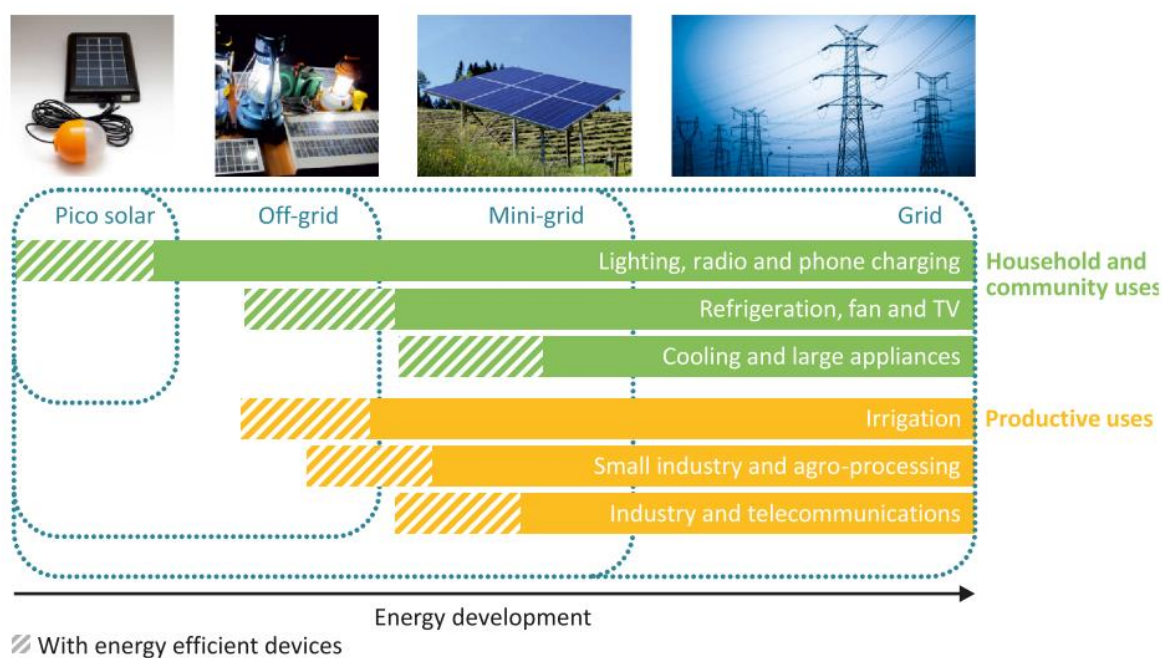


Figure 21 Electricity option and illustrative technology IEA 2017 (ibid)

We have noted that approximately 3 billion people still rely on biomass for their cooking needs, and that this has effects on women's health and environment. While the absence of clean cooking is often highlighted in Africa, approximately 1.7 billion of those people live in Asia¹⁴⁴. And yet Asia as a whole has increased its electricity access connections from 65% in 2000 to 94% in 2018¹⁴⁵. Some of those connections are not actually at the household level but at the community level. India has been criticized for saying that everyone is now connected, when it means that at least 10% of a village is connected¹⁴⁶. Nevertheless, those 1.8 billion now have an 'nearby' opportunity to be connected, and governments will work hard to ensure that a greater proportion of the village or community is connected over the coming decade. So, the possibility that 2 billion people who are more or less connected could utilize electricity for their cooking fuel is within the realms of being realistic – if its affordable, reliable and sustainable.

6.2.1 A quick sales pitch on electricity for cooking

So, is electricity significantly more expensive than other fuels, and what are the contextual conditions of its use?

If it is available, cooking with electricity is modern energy with considerable advantages over biomass cooking. It is a tier 5 fuel, it can be affordable, energy efficient, it is clean both in terms of household air pollution and leaving pots clean on the outside and, if from a renewable energy technology, is also clean for the environment. It thereby reduces the household air pollution in the kitchen to below the WHO recommended safe levels.

More than biomass (or LPG), it also potentially has a cook and go feature. Slow cookers, rice cookers or electric pressure cookers can be safely left to apply the energy, switching themselves on and off to keep the cooking temperature but minimize the energy use. Women in focus groups have appreciated this feature as it allows them to 'get on with other things'. This release of the cooking time is potentially very significant. We have seen

¹⁴⁴ <https://www.iea.org/reports/sdg7-data-and-projections/access-to-clean-cooking>

¹⁴⁵ <https://www.iea.org/reports/sdg7-data-and-projections/access-to-electricity>

¹⁴⁶ <https://www.bbc.co.uk/news/world-asia-india-43946049>

that cooking can consume many hours, and to have that time released gives women more option on what to spend their time on.

More than biomass, if the delivery chain is in place either through grid connections or through installed decentralized renewable energy, there is no need to collect or acquire fuel – it is available within the house. For pay as you go systems, digital money transfer and control can mean that even topping up can be done remotely. This can in theory eliminate the need for women to go to the market or to collect fuel.

Depending on the local context electricity can be price competitive with biomass or LPG, this being particularly true for urban locations, and the latest publications on the use of electric pressure cookers suggests that for certain meals the reduction in energy use is significant, leading to significant expenditure savings.

Quite simply, figure XX shows the savings made by using an EPC in Nairobi at 2019 prices for a particular meal of beans. The contrast is stark.

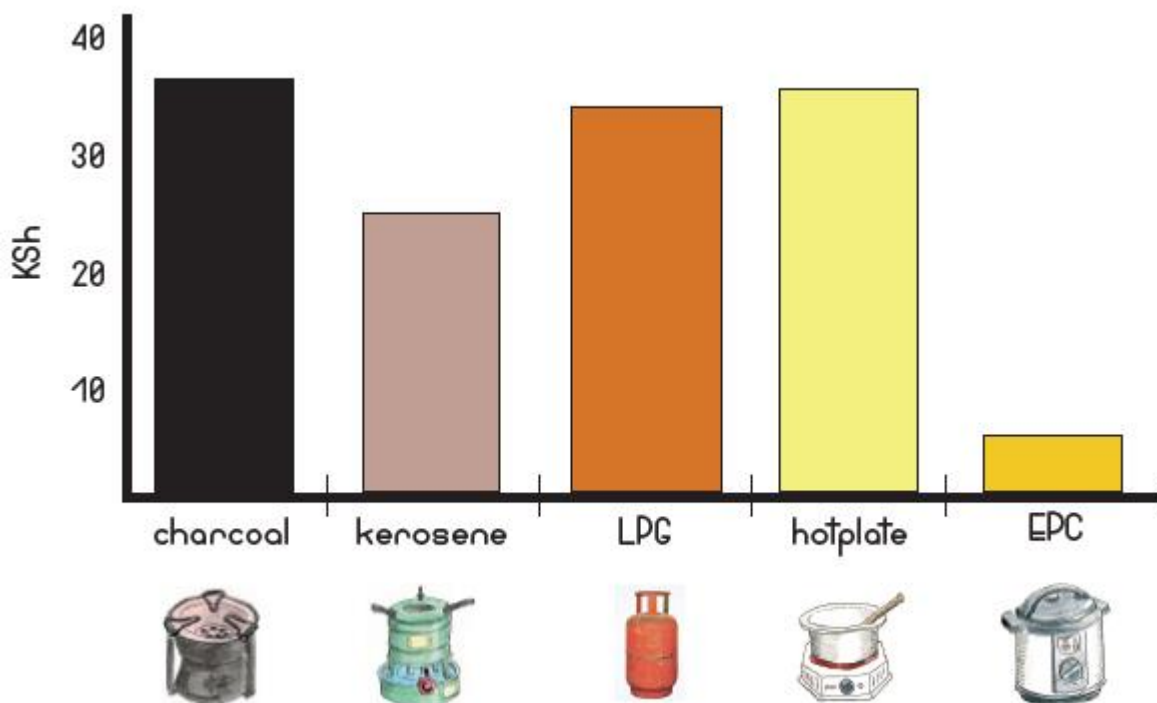


Figure 22 A comparison of fuel costs cooking beans (Nairobi 2018)¹⁴⁷

Leary et al 2020 unpacks these advantages into 5 case studies and presents the near possibilities of cost effective electric cooking.¹⁴⁸

6.2.2 The benefits and flaws of the gender electricity intersection

So, having stated some benefits around cooking with electricity let us line this option up against our CHEEG nexus and the COVID 19 intersection. Table 2 summarises the benefits and cautions of cooking with electricity.



¹⁴⁷ <https://www.mecs.org.uk/wp-content/uploads/2019/07/The-Kenya-eCookbook-Beans-Cereals-edition-3-July-FULL-RECREATED-WEB-1-4mb.pdf>

¹⁴⁸ Forthcoming Leary, Leach, Batchelor, Scott, Brown Battery-supported eCooking: a transformative opportunity for 2.6 billion people who still cook with biomass Draft submitted Energy Policy July 2020

Table 2 Benefits and cautions of electricity for cooking

Electricity and	Benefits	Cautions
<p>improved gendered health</p> 	<p>In terms of kitchen emissions, unless the chef burns the food there are insignificant emissions. Electric based cooking is a 'Tier 5' cooking experience, where convenience is matched by minimal respiratory health risks.</p> <p>Since appliances and fuel are available in the kitchen, there is no need to collect fuel with all the associated physical issues.</p> <p>While food security will remain a concern, the potential purchase of electricity in small regular amounts and used with energy efficient appliances can be lower than existing charcoal or frequently LPG prices in urban situations. Since electricity is a formal sector and tariffs are regulated (at least with grid electricity and at least where access is legal), the likelihood of large price increases is low, and households can plan their expenditure. Indeed, if we revisit the mechanisms diagram on reduced food security we can see how a transition to modern energy cooking services creates a virtuous cycle (figure 22).</p> <p>(Cleanliness is also another key factor. While professionals in health and development focus on 'clean cooking' as a term meaning cooking with minimal kitchen emissions, to women using modern energy for the first time, it is the cleanliness that strikes them. <i>"I can start cooking in a clean dress and I finish cooking in a clean dress. This is amazing"</i>)</p>	<p>Of course, fuel stacking plays a role in the use of electricity. It is common for people to have multiple stoves and use them for different parts of the meal.</p> <p>Fires:- Poor quality wiring and appliances can cause fires. In the USA there are about 5000 domestic fires a year started by poor electrical appliances (out of over 120 million). This causes about 40 deaths. The UK seems to be more careless with electricity, with 1400 fatalities and injuries. Cooking appliances were the highest cause of fires in England in 2015/16 at 8,759. We acknowledge that quality codes are often broken in LMICs, nevertheless the safety aspects while needing to be considered are not brakes on the proposition¹⁴⁹.</p> <p>Burns and shocks:- In the USA at home it is the children who have to be careful. There are at least 30,000 shock incidents per year which are non-fatal. Approximately 20% of all electrical injuries occur in children. These figures sit in the context of every household being electrified, and every child being exposed, and they do not disaggregate which burns come from cooking. We therefore do not want to overstate a problem that may not be there in any significance.</p> <p>There is in the longer term a threat from energy storage. Lithium Iron Phosphate batteries can overheat and catch fire, and in some very rare cases even explode. This will be of concern as energy storage transitions from lead acid chemistries to Lithium chemistries. It should be noted though that Lithium requires less physical maintenance than the older lead acid batteries and has less opportunities for minor burns from the acid liquid. Batteries are becoming much safer.</p> <p>While these injuries are not trivial to the people involved, the numerical count is extremely small compared to the history of biomass, women and health.</p>

¹⁴⁹ <https://www.nfpa.org/News-and-Research/Publications-and-media/NFPA-Journal/2018/November-December-2018/Features/Shantytowns> "Wallacedene as part of a government effort begun in the 1990s to provide informal settlements with legal electrical power, also poses dangers. Data from the Cape Town government shows electrification in informal settlements like Wallacedene has coincided with a 335 percent jump in electrical fires in these areas, many tied to overloaded circuits as residents cram appliances—refrigerators, stoves, and, apparently, televisions and satellite dishes—into small spaces".

<p>improved gendered time</p> 	<p>Early feedback from women transitioning from biomass to electricity in Tanzania emphasizes the savings in time. The controllability of modern energy cooking enables the cook to shorten the time cooking, and particularly in the case of electrical based ‘multi-cookers’ to “cook without attention”. Women in trials in Tanzania, Zambia and Kenya all valued that they could get on with other things. When using the electrical pressure cooker, they particularly note that they can start the cooking process and leave it unsupervised. Where households have an electrical supply, there is no time required for gathering the fuel. They may have to take time to pay the utility bill, but this is minimal market time, and with the advent of mobile money and other digital mechanisms, then even a physical trip to the office of the utility may not be required. In 2016, the average household in USA spent 8 minutes interacting with their utility digitally and only 11 minutes if they had to deal with a person.¹⁵⁰</p> <p>We have noted that EPCs can cook food in a quicker time and do not need supervision. The electric cooking is also kinder to pots and pans than biomass enabling less time to be spent on cleaning the pots.</p> <p>The possibilities for freed time could enable the woman to devote more effort to livelihood creation or to personal development, education, leisure time etc.</p>	<p>There are two possibilities here, neither of which has solid research for us to comment on. One is that there is qualitative data that suggests some women value the time gathering fuelwood. It is a time of being out the house and being sociable with other women. There are also possible loss of jobs in the charcoal or wood value chains which might greatly affect some women. With any release of time, there is also the threat that the ‘spare time’ is used for further unpaid drudgery, and the expectations of the family for the woman may substitute the saved time that was sitting watching the pot with worse menial dirty jobs.</p>
<p>reduced gendered violence</p> 	<p>Electricity does not prevent all burning of food, but it does reduce the incidence. Appliances like EPCs often have cut off thermo couples that prevent cooking when dry.</p> <p>Again, the lack of need to collect fuel or go to the market further reduces the incidence of external violence on the woman.</p> <p>As stated in the previous sections, there is an interesting correlation between the advent of modern energy and clean cooking, and a change in attitude to domestic violence.</p>	<p>The caution is that such a technocentric view may not affect the core problem. Food and cooking is known to be a trigger, but the roots of the attitudes may remain. It may just transfer the problem and transfer the events to other triggers. Indeed, perhaps collecting wood or shopping for fuel is time out of the home which may reduce tensions and allow women more independence.</p> <p>The other feature of the food trigger is the taste. Some men may like ‘smokey’ taste and feel that the EPC cooked meal is not ‘good enough’. It should be noted though that in 5 choice modelling surveys, the myth that</p>

¹⁵⁰ <https://www.greentechmedia.com/articles/read/customers-spend-8-minutes-a-year-interacting-online-with-their-utility#gs.mpuidu>

		smokey taste is all in all was not confirmed. 151 152 153
<p>improved environment</p> 	<p>The reduction in consumption of biomass will have its benefits on the environment. Displacing charcoal in urban centres could have more of an impact on forest preservation than even rural woodfuel use. A household uses approximately half a tonne of wood per year if they have a wood stove, while a typical charcoal user consumes one tonne of wood per year because of all the conversion processes. The environment will of course benefit from reduced air pollution, particularly in densely populated neighborhoods. And the biomass fuels are often transported, again particularly in urban centres, and the reduction of transportation fumes would contribute to the environment.</p> <p>Globally for climate change, the exact contribution will depend on where the electricity comes from. A coal fired power station (as found in India or China) does emit significant emissions. However, even these stations will be improved in the coming decade and carbon capture may mitigate their contribution. More importantly electricity generation is increasingly from renewable energy technology. The cost of RETs are going down all the time, and they also can be installed in much shorter project time frames than large power stations. RETS encourage a decentralisation in both grid and off-grid power generation, and this is discussed below as a key strategy for the Covid recovery plans.</p>	<p>The impact on the environment depends of course on where the electricity is generated. This will be discussed in more detail below under climate change; however, some will argue that the generating unit can have its own significant environmental impact. Much of East Africa supplies are from Hydro, and the environmental impact of hydro is a much discussed subject. The issues include the impact on land use, wildlife and life cycle impacts (concrete is a particularly bad material when considered in the light of climate change emissions)¹⁵⁴. Many would argue these environmental impacts are still significantly less than nuclear energy and some would argue they are more than biomass collection – the debate rages. From this intersectional papers point of view, while the environmental impact of the generation is important, the disposal of electrical appliances should also be considered. Every year an estimated 2 million tonnes of WEEE items are discarded by householders and companies in the UK. WEEE includes most products that have a plug or need a battery¹⁵⁵. Large household appliances (e.g. ovens, fridges, washing machines) currently make up over 40% of WEEE, a cooker is 89% metal and about 6% glass. While a simple cooker does not have rare or poisonous metals, it is possible that the digital control systems that are emerging as a key to making electricity access viable in poor communities, will likely have such. The exact treatment of WEEE can vary enormously according to the category of WEEE and technology that is used, and it will be important for recycling provision grow with the uptake of electrical cooking.</p>
Urban contexts	Of course, governments prioritise urban environments for electrification. Streetlights, businesses, households, the dense city environment makes grid connections important.	It is often thought that although urban households are connected, they have poor quality supply of electricity. While there are cases where people have less than 4 hours a day of use, if we consider Ethiopia, we find

¹⁵¹ <https://mecs.org.uk/wp-content/uploads/2019/10/eCook-Tanzania-DCE-Working-Paper-23-10-19-JL-2-COMPRESSED.pdf>

¹⁵² <https://mecs.org.uk/wp-content/uploads/2019/10/eCook-Zambia-Choice-Modelling-JL-17-10-19.pdf>

¹⁵³ <https://mecs.org.uk/wp-content/uploads/2019/09/MECS-Discrete-Choice-Analysis-Ghana.pdf>

¹⁵⁴ https://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-hydroelectric-power.html

¹⁵⁵ <http://www.hse.gov.uk/waste/waste-electrical.htm>


	<p>But the disassociation of clean cooking from electrification has resulted in situations like Kampala, where 95% of households are connected, and yet 70% are using charcoal as their primary fuel, or Kigali where 77% are connected and 63% use charcoal and 34% use wood!¹⁵⁶</p>	<p>that even those with poor quality still use it to partially cook their food.¹⁵⁷ There are also complications (cautions) in how the connections are made – with some taking second-hand offtakes from their landlord, and perhaps paying a fixed fee for their use (which then often makes the landlord say they should not use it for cooking). But these current complications can all be addressed in a well thought out Covid recovery plan.</p>
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Figure 22 adapts Sola's chain of effects, to show the virtuous possibilities and knock on effects on improved food security.

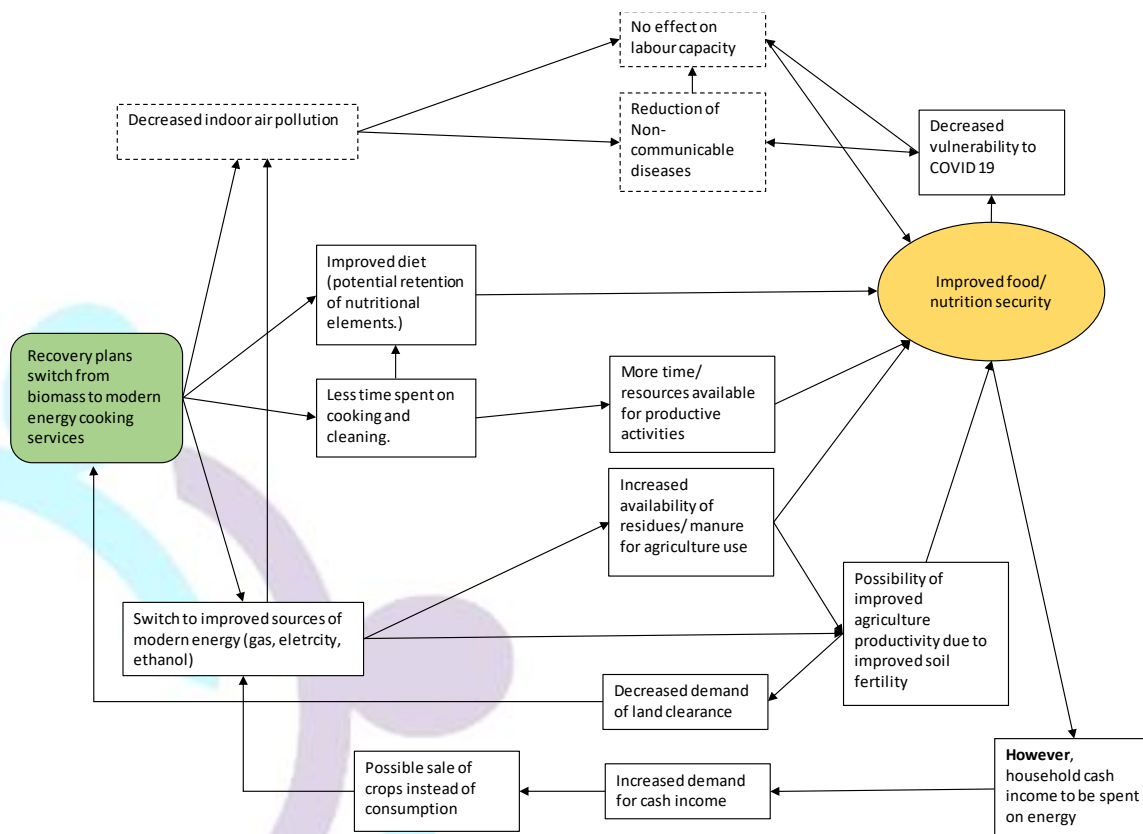


Figure 23 The virtuous influence of switching from biomass cooking to electric cooking. Derived from Sola et al 2016 (see above)

¹⁵⁶ <http://documents.worldbank.org/curated/en/406341533065364544/pdf/Rwanda-Beyond-connections-energy-access-diagnostic-report-based-on-the-multi-tier-framework.pdf>

¹⁵⁷ <https://mecs.org.uk/wp-content/uploads/2020/04/Ethiopia-Cooking-transitions-31032020.pdf>

6.2.3 Let's be real about the problems

So, what then are the barriers to cooking with electricity? Why is it that 3 billion cook with biomass and only 1 billion don't have electricity? This implies that there are 2 billion who have a basic use of electricity but do not cook with it. Why is that?

6.2.3.1 *There are 800 million who don't have access*

While we are pointing at the 2 billion that do have access and still cook with biomass, let's be real and acknowledge that there are some 800 million that don't have access (of which about 570 million are in Sub Saharan Africa). Progress will be made, but not at a pace that will get us to SDG7 by 2030, unless something more happens. The global electrification rate rose from 83 per cent in 2010 to 87 per cent in 2015, with the increase accelerating to reach 89 per cent in 2017.¹⁵⁸ There are multiple barriers to extending the reach of the grid to remote rural areas, but the advent of affordable off-grid is changing many governments approach – and the idea of decentralised electricity generation matcher to decentralize governance is explored inaw section below as a key strategy for Covid recovery.

6.2.3.2 *Some people have inadequate access*

The new recent initiative from the ESMAP World Bank and others on a multitier approach to cooking is an extension of their approach to multitier consideration of household electricity. It is all very well to say that people have a connection to electricity, but how strong is that connection and how useful is it? The Multi-Tier approach to electricity in households considers 7 parameters, as illustrated in figure 19.

HOW IS ENERGY ACCESS MEASURED

MULTI-TIER MATRIX MEASURING ACCESS TO HOUSEHOLD ELECTRICITY

	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Capacity	No electricity	1-50W	50-500W	500-2000W	>2000W	
Duration	<4hrs	4-8hrs		8-16hrs	16-22hrs	>22hrs
Reliability	Unscheduled outages				No unscheduled outages	
Quality	Low quality			Good quality		
Affordability	Not affordable		Affordable			
Legality	Not legal			Legal		
Health & Safety	Not convenient				Convenient	

Figure 24 The multi-tier approach to household electricity ESMAP World Bank¹⁵⁹

The approach attempts to move away from a 'binary' assessment. Most national surveys ask, 'What is your primary fuel for cooking'. Based on that question the use of electricity is minimal. However, there is considerable partial use, and the advent of the energy efficient appliances such as the electric pressure cooker can expand that use through the Covid recovery plan. Data from Ethiopia (Scott et al 2019¹⁶⁰) shows that even

¹⁵⁸ <https://sustainabledevelopment.un.org/sdg7>

¹⁵⁹ http://www.esmap.org/sites/esmap.org/files/DocumentLibrary/Multi-tier%20BBL_Feb19_Final_no%20annex.pdf

¹⁶⁰ <https://mecs.org.uk/wp-content/uploads/2020/04/Ethiopia-Cooking-transitions-31032020.pdf>

among households with fewer than 4 hours of electricity available between 6 p.m. and 10 p.m. (i.e. low Availability (Duration) of electricity supply), 50% cook with electricity in some way. The same is true when considering blackouts - among households that experience 15 or more blackouts a week (in the worst month), 53% use electricity for cooking in some way.

6.2.3.3 Affordability is a relative term.

It is unlikely that modern energy cooking will be applied to rural locations that have plenty of nearby firewood. In such cases, the time taken to collect wood is rarely monetised, and swapping it for cash payments for electricity (or LPG) is unlikely to occur. Therefore, it could be an overclaim to state that shifting to modern energy might save women many hours of collecting wood.

However, we have seen that in terms of gendered time, fuel collection is only applicable to certain rural contexts. Actually, fuel purchase in urban Ghana situations takes as much (average) time as rural collection, and the time for preparing the stove and cooking is about 3 to 4 times the time spent on collecting.

So, what then is affordability? In urban centres, electricity in an energy efficient appliance can directly compete with alternative fuels, but also saves the time (which could be assigned a monetary value).

In rural locations where deforestation has occurred, and the threat of degraded environment is ever present, women make a note of such and make qualitative statements about a willingness to pay to save the ever increasing journey time to collect wood. Whether such stated WTP would translate into actionable cash expenditure is a different matter. Cash expenditure is often controlled by the male of the household, and whether they would be willing to pay out to save their wives time in fuel collecting will likely depend on whether they think the household can gain economic benefit from her saved time. If extra hours on the farm, or a cottage industry could be undertaken, then the extra income might offset the expenditure.

So modern energy cooking services are most likely to occur within urban and peri urban societies, where modern energy distribution is relatively easy and real expenditure is made on traditional fuels. Charcoal tends to be more expensive in urban areas and is a real cash outgoing from the household. Swapping that expenditure for modern energy will likely sit easier with the intrahousehold decision making (than the negotiation in rural households where real expenditure on modern energy is being swapped for women's time). However, given that the expenditure on one fuel over the other is comparable, the shift to modern energy can nevertheless save women's time in 'fuel collecting'. Many very poor households cannot afford to stockpile charcoal, and therefore make many small purchases every few days (even daily). Smart metering which allows for small top ups would enable this sort of cash flow – small expenditures on a regular basis.

6.2.3.4 Reliability is a key term

Grids are becoming stronger and more reliable, the reliability of grid electricity in urban East Africa is now relatively high. For example, Zambia which is often said to have blackouts, actually only has 5 service interruptions experienced by a customer in a year, although they total an average of 50hrs average total duration of outages over the course of a year for each customer served. Kenya has slightly more frequent SAIFI at 13/yr and they average 60hrs/yr SAIDI, and Tanzania has even more SAIFI 47/yr although they have a lower average duration at 21hrs/yr.

THE PROBLEM

The problem of cooking with electricity can be:-



NO ACCESS OR INSUFFICIENT ACCESS

- rural households don't have it or the supply is very weak!



BURNT OUT WIRING

- drawing high power for cooking through small wires overloads and burns the wiring



BLACK OUTS

- load shedding either planned or unplanned means the household cannot cook when it wants.



LOW VOLTAGE

- we have measured as low as 40V on a national grid that was meant to be 220V, meaning that cooking equipment doesn't work

Figure 26 Cooking with electricity problems (from Infographic 2018)

However, there remains certain challenges even when the electricity is on. Attempting to draw high power through weak infrastructure can cause problems. We have previously argued that since energy storage is becoming cheaper through the learning curve, that trickle charging a battery overcomes many of the problems of weak grids and is still cost effective^{161 162 163}. High power for cooking activities could cause problems where load limitations are in place (weak transformer, or transmission lines). Mitigating the high power on the infrastructure and networks is possible through smart use of appliances, ensuring that they come on in an asymmetric way. However, that does not necessarily address lower voltages. Lower voltage, which is common on many of these weaker systems, reduces the power used by the appliance and cooking can take longer than expected – this needs to be

taken into account. There is also the challenge of weak local wiring – often wiring is not up to code and is a fragile system that can do lights and TV. Drawing 1kw for cooking even briefly creates currents that can overload the fuses and the wiring causing brown outs.

While voltage stabilization by local equipment is possible, we believe that an energy storage approach is a good way of overcoming this problem and will become increasingly affordable. Trickle charging a battery can be done with small current which even weak wiring can cope with, and which is not so sensitive to time of use. It also means that people can use electricity in the night, mitigating peak loads on the whole system, and ensuring that people can cook when they want.

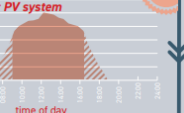
Drawing from the battery for the cooking event, means the household can still cook even if there is a service interruption. Having said that, if the average duration is 50 hours, then a battery is unlikely to be sized to cook nearly three days of meals, so some blackouts would not be overcome. However, it is important to remember that there are only 5 events per year (in a country like Zambia), and in Tanzania where the average is 21hrs (i.e. two meals) a battery may bridge that gap.

THE SOLUTION

Solve these problems by trickle charging a battery, cook when you want, charge whenever power is available

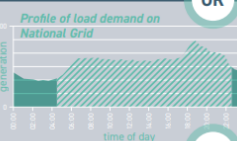
TRICKLE CHARGE the battery from Solar PV during the day when the sun shines

Daily distribution of energy from a Solar PV system



OR

TRICKLE CHARGE from national grid during the night when there is spare capacity



OR

TRICKLE CHARGE from other sources during the day & night



Hydro grids
surplus energy particularly at night



Wind Power
energy available when the wind blows



Any micro or mini grid

For utilities and IPPs, this can mean more revenue and a more effectively used power system.

Figure 25 Cooking with electricity solutions of energy storage (from Infographic 2018)

¹⁶¹ Batchelor, S. 2013. "Is It Time for Solar Electric Cooking for Africa?" Gamos Concept Note, May 2013, Reading, UK. www.gamos.org%2Fimages%2Fdocuments%2FIs%2520it%2520time%2520for%2520solar%2520electric%2520cooking%2520One%2520page%252018062013.pdf

¹⁶² Batchelor 2015. "Solar Electric Cooking in Africa in 2020: A Synthesis of the Possibilities." Evidence on Demand (prepared at the request of the UK Department for International Development). https://doi.org/10.12774/eod_cr.december2015.batchelors.

¹⁶³ https://www.researchgate.net/publication/298722923_Africa_cooking_with_electricity_ACE

Nevertheless, what remains more important is that the battery approach can overcome the stresses on weak grids in terms of mitigating high currents caused by high power appliances. Leary et al 2020¹⁶⁴ discusses in detail the possibilities of energy storage, focusing on case studies that illustrate the cost perspective and illustrating how such an approach is cost effective (when compared to other fuel options).

6.2.3.5 *Generating capacity might not yet be enough?*

This is an interesting real world problem that is very situational. We think that policy makers have until recently felt that there just wasn't enough generating capacity to even consider cooking. An exception to this can be found in say Zambia, who did indeed encourage their population to cook with electricity (from 2000 onwards), only to find that droughts reduced capacity, and increased load shedding to try to manage the situation¹⁶⁵. However, that cooking demand was based on inefficient electric hotplates. Introducing energy efficient appliances would enable households to cook even with existing generating capacity (depending on what the copper mines consume).

In contrast, Uganda has increased its capacity, and now has a surplus over existing demand. Enabling consumers to include energy efficient cooking appliances could soak up that surplus while giving the utility a return on their investment. Uganda now has 950 MW (RMI 2020) generating capacity the majority of which (93%) is renewable technologies (mainly Hydro). What is more, Uganda is planning another 1,900 MW of capacity ready for 2030¹⁶⁶. Tanzania was approximately 1,500 MW in 2017¹⁶⁷ and has another 1,600 MW planned¹⁶⁸ with the government's hoping to get investment to get to 10,000 MW by 2025¹⁶⁹. Africa has 80 GW of new electricity capacity under construction, while there are moves (pre-virus) to mobilise investment for at least 300 GW of renewable energy generation by 2030¹⁷⁰.

This increase in generating capacity does not mean that the issues of transmission, infrastructure, access, reliability have been solved, nor that there aren't management issues within the private and public sector. However, it does suggest that generating capacity in some countries is no longer a limiting barrier. Indeed, having invested in increased generating capacity, most countries need to get revenue for the extra, in order to pay back the loans and investment. Introducing energy efficient cooking to households connected, is a way of obtaining solid regular revenue.

Indeed, a similar aspect applies to mini grids (and other off-grid technologies). There are now an increasing number of strategies that include mini grids and the World Bank suggest that it could address the needs of half a billion people¹⁷¹. However, a common problem is that developers invest in mini grids only to find that the demand is less than they hoped for. There is significant discussion about how mini grids are unprofitable and require a productive use load to ensure that enough of the generating capacity is used to justify the investment. Recent research has shown that introducing energy efficient cooking appliances can stimulate greater demand

¹⁶⁴ Forthcoming Leary, Leach, Batchelor, Scott, Brown Battery-supported eCooking: a transformative opportunity for 2.6 billion people who still cook with biomass Draft submitted Energy Policy July 2020

¹⁶⁵ <https://www.circleofblue.org/2015/world/zambia-electricity-shortage-highlights-africas-hydropower-shortfalls/>

¹⁶⁶ Power Africa 2018. "Power Africa in Uganda." 2018. <https://www.usaid.gov/powerafrica/uganda>.

¹⁶⁷ EWURA. 2017. "Annual Report for the Year Ended 30th June 2016." Vol. 255. Dar es Salaam, Tanzania. http://www.kplc.co.ke/content/item/2255/2016_2017-full-annual-report-for-the-year-ended-30th-june-2017

¹⁶⁸ Eberhard, Anton, Katharine Gratwick, and Laban Kariuki. 2018. "A Review of Private Investment in Tanzania's Power Generation Sector." *Journal of Energy in Southern Africa* 29 (2): 1–11. <https://doi.org/10.17159/2413-3051/2018/v29i2a4389>.

¹⁶⁹ EEG. 2016. "Tanzania Energy Sector Overview." Energy for Economic Growth Research Programme.

¹⁷⁰ Africa Renewable Energy Initiative (AREI) is an Africa-led initiative which aims accelerate and scale up the harnessing of the continents renewable energy potential.

¹⁷¹ <https://www.worldbank.org/en/news/press-release/2019/06/25/mini-grids-have-potential-to-bring-electricity-to-half-a-billion-people>

of the mini grid and increase profitability. With low demand there is a need to set the tariff high to recoup investment. With higher demand the tariff can be set lower – meaning that it is very much a ‘win-win’ with developers gaining more income, and households saving on expense. In Covid recovery plans, introducing renewable energy generating capacity and linking it with energy efficient appliances can address the intersection of the CHEEG issues.

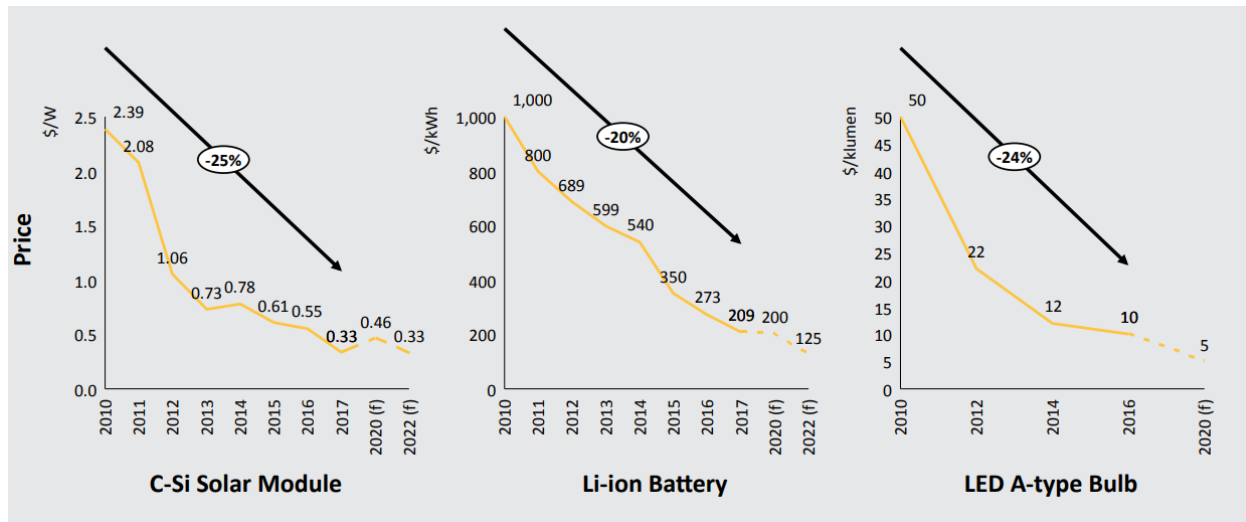


Figure 27 Cost trends for PV modules, Li-ion battery storage and for comparison – LED bulbs.¹⁷²

The original proposition for reconsidering the price point of electricity for cooking was that Solar PV prices had been dropping for more than 3 decades, and therefore the main author asked the question as to whether Solar PV based cooking was cost effective. The answer was not in 2012, but possibly by 2020. The price drop of Solar PV is based on the learning curve. Equally important, the price of energy storage was also dropping, and it was the combination of these two that started the research thread. Figure 26 illustrates the learning curves for PV modules, lithium based batteries and for comparison the LED light bulb. As one can see, each has an approximation to a -20% learning curve. The earliest proposition by ourselves focused on hotplates and has been repeated here in this paper many times, the idea of cooking with electricity cost effectively is very much dependent on an energy efficient appliance. While pressure cookers have been around for several decades, the mass market appeal of electric pressure cookers (in developed economies) only really began in about 2009, with the market leader Instant Pot experiencing a hockey stick curve of sales from 2010 to 2020. In the latter half of the decade other players saw the potential of the EPC, and there are now myriad brands and models, with a wide range of prices. The learning curve for EPCs is about -15% and they too will likely decrease further in price or gain new features that make it easier and more effective to cook. (We are not sure they will gain further efficiency, but the cost of the basic appliance will continue to drop, and the cost of innovations such as the air fryer lid, which gives a wider capacity for meals, will likely be folded into a standard retail price).

Stand-alone solar home systems have now reached about 100 million households; however, they tend to be used for lights and low power appliances such as TV and mobile phone charging¹⁷³. To date the demand for such systems has been wherever the grid has not yet arrived or where the household is in a remote location. With the extension of the grid, and the advent of more robust mini grids, the demand for solar home systems is likely to be more towards the truly remote households. For instance, Bangladesh has 4 million SHS, and yet the grid is now reaching over half of those people – leaving the option for the householder to keep the unit as a

¹⁷² https://www.lightingglobal.org/wp-content/uploads/2018/03/2018_Off_Grid_Solar_Market_Trends_Report_Full.pdf

¹⁷³ <https://www.renewableenergyworld.com/2016/03/03/almost-100-million-homes-may-run-only-on-solar-by-2020/#gref>

backup or to mesh network it into the grid¹⁷⁴. Rural Ethiopia on the other hand will likely have a consistent demand for solar lanterns¹⁷⁵.

The challenge here is that remote communities often can get their cooking fuel for limited expenditure and may not value the time saved by the women – hence our emphasis on the urban locations first for the CHEEG Covid recovery plan. Leary et al 2020¹⁷⁶ does suggest that there are locations where solar home systems could be cost effective – again the emphasis is on energy efficient appliances that have changed the balance of costs leading to smaller PV arrays for the same cooked meals. (Having said that, there is significant research on Solar PV stand-alone systems that use thermal storage for the cooking, and the cost of these systems is reduced even further than using chemical batteries – and these systems may have their own market).

Where the solar home system industry has strongly contributed to the potential CHEEG Covid recovery plans are that they have in place a network of micro credit lenders, such that the capex for an energy efficient appliance could be accessed (we discuss this further below).

6.3 Include LPG in the toolkit of responses where appropriate?

In 2013, before COVID 19 and while the concern for climate change was still ramping up, the World LPG Association and SE4All announced the goal to transition one billion people from traditional fuels to LPG¹⁷⁷. “To secure this, they agreed to support a multi-stakeholder partnership that would build on best practices and sustainable business models in order to overcome the multitude of policy, market regulation, business environment, and local financing bottlenecks inhibiting the ability of governments and the private sector to meet the need for LPG”¹⁷⁸.

When we consider how modern energy might fill household needs for cooking, LPG has been presented as a transition fuel. It is of course a fossil fuel, although most proponents would argue that its combined benefits when compared to biomass cooking outweigh the negative (or at least questionable points) of LPG. In this section we consider the intersection of the CHEEG nexus with LPG and COVID 19.

6.3.1 The quick sales pitch on LPG

LPG is indeed a clean-burning, efficient, versatile and portable fuel from a kitchen point of view. Since it is produced as a by-product of natural gas extraction and crude oil refining to use it seems better than flaring it. Likewise, it is the case that LPG produces less air pollutants than kerosene, wood or coal. LPG emits 50% less pollutants than coal but perhaps more importantly it has considerably less black carbon emissions than biomass. In theory, with a suitable supply chain, it can be transported and so it can be made available even in rural areas – IF the supply chain is in place.

It provides a clean cooking experience in terms of household air pollution and soot on pots and pans. It can be cost effective in comparison with charcoal particularly in urban conurbations. It is thought to be too expensive for very long cooking (such as boiling beans for several hours), and many users revert to charcoal for their ‘long cooked meals’. However, it is quick and convenient for ‘short cooked meals’ such as rice, stir fry and chapati.

¹⁷⁴ <https://www.pv-magazine.com/2020/01/06/grid-connected-solar-outpacing-remote-installations-in-bangladesh/>

¹⁷⁵ <https://www.worldbank.org/en/news/feature/2016/08/15/off-grid-solar-lighting-up-ethiopia>



¹⁷⁶ Forthcoming Leary, Leach, Batchelor, Scott, Brown Battery-supported eCooking: a transformative opportunity for 2.6 billion people who still cook with biomass Draft submitted Energy Policy July 2020

¹⁷⁷ <https://www.wlpga.org/initiatives/cooking-for-life/the-campaign/>

¹⁷⁸ <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

6.3.2 The benefits and flaws of the gender LPG intersection

So, having stated LPGs headline advantages over biomass cooking let us consider our gender equity, modern energy access and COVID 19 intersection.

LPG and	Benefits	Cautions
<p>improved gendered health</p> 	<p>A number of research studies clearly show that when LPG is used as the primary stove there is a significant reduction in household air pollution^{179 180 181}. These reductions in emissions and particulate matter with LPG use have been associated with decreases in respiratory and other infections.¹⁸² Smith, 2012¹⁸³ showed that compared to fan stoves, chimney/rocket, simple improved stoves and open fires, LPG was the fuel whose exposure-response assessments were below the critical level of 10µg per m3. Naeher, et al¹⁸⁴, 2000 comparing open fires, plancha (biomass) stoves and LPG stoves showed that LPG has lowest emissions of PM2.5, PM10 and Carbon Monoxide.</p> <p>The clean stack of LPG and electricity has been shown to be a very cost effective proposition.</p>	<p>Of course, fuel stacking plays a role in the use of LPG. It is common for people to have multiple stoves and use them for different parts of the meal. For instance, cooking for a long cook such as beans in Kenya is considered too expensive on LPG, and so urban households cook the beans on a charcoal stove. The challenge here is that partial use of biomass still keeps the household air pollution in the danger zone (and this is true for all modern energy use).</p> <p>Having a clean stove (whether LPG or electricity) as part of the fuel stacking agenda does not necessarily reduce household air pollution¹⁶⁸. LPG is said to be expensive for long cooking foods, and it is common that it is used for quick foods, but charcoal is still used for long cooking such as beans, then the household air pollution remains above WHO recommended levels. This is a common pattern of use for LPG, especially among lower-income households, as a complementary fuel for fast cooking.</p>
<p>improved gendered time</p> 	<p>Data is very scarce and anecdotal on this – systematic review on the time issue found only two valid studies both for biogas. It found savings of: “The first surveyed the female head of household (141 using biogas and 58 using biomass) and reported 1.2 h saved per day collecting fuel and 0.7h saved cooking, resulting in a combined 28.9 days saved over an entire year. The second surveyed the head of household (37 using biogas and 68 using biomass, 13% female) and reported 1.5 h saved per day</p>	<p>While LPG avoids the time normally associated with collecting fuelwood, it nevertheless still takes time for the market collection. Newer forms of LPG pay as you go, offer a delivery service, where remote monitoring can replace the cylinder in a timely way, but the majority of people still need to take their cylinder to the local market. While 6kg cylinders can be carried relatively easily, 13kg plus cylinders often need some transport – bicycle or motorised. This suggests that the male of the household often does the cylinder replacement</p> <p>A survey of time taken to collect LPG could not be identified.</p>

¹⁷⁹ Ekouevi, Koffi; Tuntivate, Voravate. 2012. Household energy access for cooking and heating : lessons learned and the way forward (English). A World Bank study. Washington, DC: World Bank.
<http://documents.worldbank.org/curated/en/277861468346440968/Household-energy-access-for-cooking-and-heating-lessons-learned-and-the-way-forward>



¹⁸⁰ <https://www.sciencedirect.com/science/article/abs/pii/S0301421511002047>

¹⁸¹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241308/>

¹⁸² <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3801460/>

¹⁸³ <http://static.squarespace.com/static/53856e1ee4b00c6f1fc1f602/538570c1e4b071a53f15e518/538570d9e4b071a53f15ea04/1401254105947/NIHtraining2012.pdf?format=original>

¹⁸⁴ <https://www.nature.com/articles/7500113.pdf>

	<p>collecting fuel, or 22.8 days saved over a year"¹⁸⁵</p> <p>However, LPG is a controllable fuel and reduces time in stove lighting and fire tending (as does electricity), and in qualitative interviews time saving is often mentioned^{186 187 188}</p> <p>At a basic level Savings of 12% in cooking time in lab tests have been found for switching from traditional cooking to LPG stoves¹⁸⁹.</p> <p>The idea that LPG is "clean" can be ranked above "fast" and "cost-effective" according to one household survey of LPG adopters¹⁹⁰. While as acknowledged above, soot is time-consuming to clean from pots and the kitchen environment which does not happen with LPG, leading to reduced clear up time.</p>	
<p>reduced gendered violence</p> 		<p>There are no particular differentials between cooking on biomass and LPG in terms of burning food although LPG has a greater controllability than most biomass stoves. It still needs supervision, and the possibility of being distracted by children or other work and letting the food dry out is still there. This is in contrast to the potential automation of electric cooking.</p> <p>Same caveats as in relation to biomass</p>
<p>improved environment</p> 	<p>Use of LPG can disrupt the charcoal trade and as discussed above, a family using charcoal in an urban environment is using twice the wood that rural users use. The deforestation can be mitigated by substituting LPG for charcoal.</p>	<p>LPG requires a value chain and as such includes transportation. However, this still tends to be less than biomass value chains.</p>
<p>reduced Climate Change</p>	<p>Regarding climate change Biomass burning typically releases 19 g/MJ-d CO per meal, 19 times the emissions</p>	<p>LPG is a fossil fuel, and as such contributes to global emissions.</p> <p>As the trade organisation for LPG states in its promotional headlines "The carbon footprint of</p>

¹⁸⁵ <https://www.mdpi.com/1660-4601/16/13/2277>


¹⁸⁶ <https://www.gov.uk/dfid-research-outputs/smoke-health-and-household-energy-volume-2-researching-pathways-to-scaling-up-sustainable-and-effective-kitchen-smoke-alleviation>

¹⁸⁷ Budya, Hanung & Yasir Arofah, Muhammad, 2011. "Providing cleaner energy access in Indonesia through the megaproject of kerosene conversion to LPG," Energy Policy, Elsevier, vol. 39(12), pages 7575-7586.

¹⁸⁸ <https://openknowledge.worldbank.org/bitstream/handle/10986/18063/477330ESMAP0no10Box338864B01PUBLIC1.pdf;sequence=1>

¹⁸⁹ http://berkeleyair.com/wp-content/publications/SPT_Inventory_Report_v3_0.pdf

¹⁹⁰ <https://www.sciencedirect.com/science/article/abs/pii/S0301421513011282>

	<p>of LPG, which releases only 1.0 g/MJ-d CO¹⁹¹</p> <p>More importantly LPG does not create black carbon emissions, and black carbon is a significant short lived climate forcing agent.</p>	<p>LPG is 50% lower than coal¹⁹².” And “In the US, using LPG rather than electricity for space heating can reduce CO2 emissions by up to 54%.” While both these statements may be true, the benchmark of coal undermines the argument (30% of US electricity still comes from coal). They also use coal as the benchmark for comparing cooking from electricity citing that “in India, for example, LPG emits 60% fewer GHGs than electric coil cook tops” perhaps neglecting to point out that 75% of electricity is provided by coal. They also state that LPG is also among the lowest carbon-emitting fuel sources for cooking in many regions of the world, giving 50% fewer emissions than some biomass stoves, and 19% fewer GHGs than kerosene stoves.</p>
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6.3.3 Let's be real about the problems

However, there are obstacles to wider LPG use in developing countries. These are said mainly to be affordability, availability and perceptions of safety^{193 194 195}.

6.3.3.1 Affordability is a relative term and Reliability is a key term.

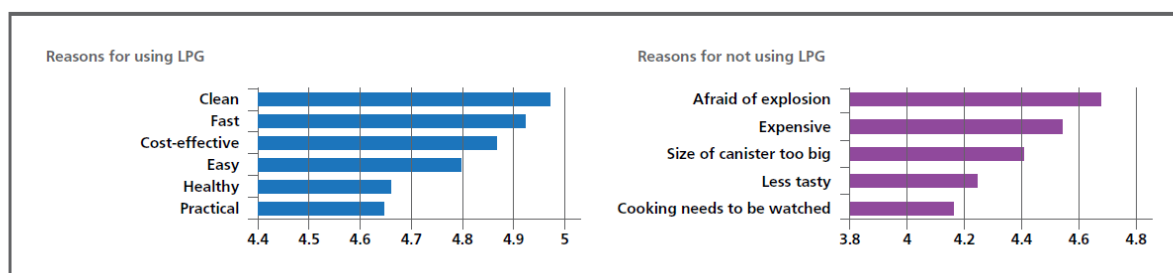


Figure 28 Reasons for using and not using LPG Indonesia¹⁹⁶

In Indonesia the main reasons given by women for not switching concerned fears of explosion and **expense**. Such responses are said to be able to be overcome by educational awareness programmes. A recent study on an LPG access programme in Ghana found only 5% of stoves still in use after initial access. They gave reason such as travelling up to an average of 24 km to the nearest district capital to refill their cylinders. This increases the refill cost on respondents, transportation costs and the considerable time in transit.

¹⁹¹ <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

¹⁹² <https://www.wlpga.org/about-lpg/lpg-society/climate-change/>

¹⁹³ <https://openknowledge.worldbank.org/bitstream/handle/10986/18293/674520NWP00PUB0084180LPG0Report0Web.pdf?sequence=1>

¹⁹⁴ <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

¹⁹⁵ <https://link.springer.com/article/10.1007/s10393-018-1351-4>

¹⁹⁶ <https://research.vu.nl/en/publications/energy-poverty-reduction-by-fuel-switching-impact-evaluation-of-t>

“What is preventing us from using the LPG always is that we do not have gas filling station here...unlike town folks who can walk for refilling, rural folks have to pay for transportation...” (FGD, female beneficiary)

“One bad thing about the LPG is that it is deadly; because I have seen the Cylinder blast to kill someone in Accra. So I am really scared of it; I would prefer to go and carry firewood from the farm” (FGD, male beneficiary)

“The reason why I use both is that if you leave it in the care of a child, he/she will use it roughly and it can burn your house” (FGD, female beneficiary)

All quotes above from ¹⁹⁷ Puzzolo et al (2020) summarise the challenge ¹⁹⁸

“From an end-user perspective, there are a number of potential barriers in terms of both maximising adoption and sustained use of LPG well documented in the literature. These include (i) the initial capital costs for acquiring the consumer LPG equipment, (ii) affordability of LPG cylinder refills for some lower-income households (for sustained use of the fuel over time), (iii) convenient access to, and consistent availability of, refilled cylinders located within a reasonable travel time/distance of the consumer (or via home delivery), (iv) awareness of the potential benefits of LPG over other fuels for cooking (e.g. time, health and cost savings), (v) concerns over safety and (vi) cultural factors such as traditional values and perceptions (e.g. preferring the taste of food cooked over wood or charcoal).”

The relative cost of LPG will depend on the cooking culture, the situation (rural urban) and many other factors. Barnes and Openshaw¹⁹⁹ used global data to generate a generalised cost comparison. They show that LPG is fairly comparable in cooking a single meal to charcoal and electricity on a hotplate (i.e. and inefficient electrical appliance). This remains true according to the recent MECS research in Nairobi.

LPG has to date been mainly used by the upper half of the income groups in low- and lower-middle income countries and especially urban and suburban households²⁰⁰. Distribution systems tend to need a lot of customers within relatively easy reach, although this factor need not preclude the urban poor. Indonesia, Vietnam, Thailand, Brazil, Senegal, India, Ghana and Morocco have policies promoting LPG infrastructure, pricing and equipment packages, making LPG accessible to middle and sometimes lower income households in urban and suburban areas. “Higher-income households can help build up the LPG infrastructure needed to reduce costs, and provide awareness building, so that lower income households may also eventually be able to consider the LPG cooking option. (Energia 2014²⁰¹)

There is a lot of recent work looking at how LPG can be more effectively targeted at the poor combinations of fiscal incentives, subsidies, and market adjustments. However, such actions are difficult to judge. Should subsidies just be for the poor or for everyone? How long should it last?²⁰²

“While the degree to which commercial LPG microfinance is diffused is not fully known (especially in regions with more established LPG markets such as Latin America or Asia), a number of efforts have been documented. These include projects that have registered for Gold Standard carbon credits such as the Darfur Low Smoke Stoves Project in Sudan or the microfranchised LPG distribution projects by Entrepreneurs du Monde in Burkina

¹⁹⁷ <https://link.springer.com/article/10.1007/s10393-018-1369-7>

¹⁹⁸ https://mecs.org.uk/wp-content/uploads/2020/02/MECS-LPG-Briefing-Paper_Jan-2020.pdf

¹⁹⁹ <https://www.energyfordevelopment.com/2010/04/comparative-cooking-cost.html>

²⁰⁰ <http://documents.worldbank.org/curated/en/955941468269402062/pdf/WPS5731.pdf>

²⁰¹ <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

²⁰² <https://www.sciencedirect.com/science/article/pii/S097308261830262X>

Faso and Haiti , or other initiatives such as the Bottled Gas for Better Life initiative by the Global LPG Partnership in Cameroon and Kenya .” – Puzzolo et al (2020) – MECS briefing paper²⁰³

6.3.3.2 LPG and safety

LPG is flammable. Accidents rarely occur but they are common enough to put people off. They often get reported in newspapers, and so their presence can seem more than they are. There is a fear that LPG cylinders might explode. There are more expensive composite cylinders that do not explode, but these have not yet been widely adopted. In focus groups in South Africa, LPG was widely disliked for its safety aspect²⁰⁴. In a market survey of 400 households in Pemba, Mozambique, 79% believed LPG to be toxic, explosive or dangerous leading to significant questions about the Vidagas programme^{205 206}.

Energia 2014²⁰⁷ note that *“LPG is potentially hazardous and uncontrolled releases of LPG can have serious consequences in fire and explosion. However, the technology for safe use of LPG is well known and risks can be controlled through proper regulation and use. Unfortunately, this is often lacking in many developing countries.”*

They go on to quote from a 2012 study that found that in India, 82% of the victims of cooking gas explosions are women²⁰⁸. They say that as use of LPG has increased recently in the country the researchers found that most burns (70%) resulted from a gas leak, and 25% were due to cooking negligence. According to the researchers a major risk factor was constrained living conditions of a single room dwelling of low-middle income households. Almost all burns from LPG were caused by either ill-fitting or cracked rubber tube or stove valve, or floor level cooking²⁰⁹. Similar findings of preventable burn accidents come from Turkey²¹⁰. Substandard cylinders, old valves, worn-out regulators are also identified as causes.

A lot depends on safety checks. All cylinders have a code showing the ‘check by’ date. Illegal fillings of cylinders are a top priority for most government to crack down on. WLPGA and Energia report that cylinder ownership and refill arrangements have significant effects on LPG safety and the incentives for any given company to repair and replace cylinders. Given the number of LPG conversion packages distributed, the number of accidents is relatively very small, but their impact on public opinion is considerable because of the media coverage²¹¹.

According to Energia 2014²¹², “Women’s fears about using LPG are not misplaced, given the lack of regulation and absence of enforcement of safety standards in many countries.”

Inconveniences of LPG have also been reported as well. Cylinders can run out of gas while in the middle of cooking or showering, and there is not always a backup cylinder on hand.

²⁰³ https://mecs.org.uk/wp-content/uploads/2020/02/MECS-LPG-Briefing-Paper_Jan-2020.pdf

²⁰⁴ https://open.uct.ac.za/bitstream/handle/11427/16879/Tait_Investigating_current_2013.pdf

²⁰⁵ http://growinginclusivemarkets.org/media/cases/Mozambique_VidaGas_Summary.pdf

²⁰⁶

https://www.researchgate.net/publication/280180800_VidaGas_Delivering_better_health_to_Northern_Mozambique_with_LPG

²⁰⁷ <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

²⁰⁸ <https://timesofindia.indiatimes.com/city/chennai/LPG-cylinder-is-a-ticking-bomb-in-state/articleshow/14683460.cms>

²⁰⁹ <https://pubmed.ncbi.nlm.nih.gov/21507577/>

²¹⁰ <https://pubmed.ncbi.nlm.nih.gov/23799481/>

²¹¹ <https://ideas.repec.org/a/eee/enepol/v39y2011i12p7575-7586.html>

²¹² <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

6.3.3.3 *There are millions who don't have access and some people have inadequate access*

According to the MECS LPG brief the International Energy Agency (IEA) estimates that over 2.5 billion people use LPG for some or all of their cooking requirements in resource-poor settings plus many more in high-income countries.^{213 214} They suggest that about half of the 2.8 billion who don't yet predominantly use clean cooking could usefully use LPG for more of their cooking (– fuel stacking means that many of the 2.5 billion they cite use LPG for **some** (or all) of their cooking – they have answered the national survey question 'what is your primary cooking fuel', and research shows that many of those who answer LPG revert to biomass for about 40% of their cooking). However, in the same way that there are 800 million who don't have electricity, one of the reasons that a majority of the 2.8 don't use LPG is that the supply chains are not in place. When large scale programmes are implemented such as in Indonesia and India, they are touted as significant breakthroughs.

They are newsworthy because they take a lot of political commitment, the right pricing and the placing of a viable and extensive supply chain. In the same way that many in Africa do not have access to reliable electricity, so too many of those same people do not have access to regular reliable supplies of LPG. The gas station is too far away! PAYG and delivery of the cylinder may address this, but in the short term these system are predominantly in the urban areas. Setting up supply chains of regular reliable gas requires networks and infrastructure, and while such infrastructure is perhaps more agile than electricity, it is not that much easier. Transportation of the supply needs to be in place – on a regular basis. In contrast to electricity where once things are in place the local access of the fuel is simplified, the supply of LPG is a commitment that governments and private sector would be making for decades.

6.4 LPG and electricity – a comparison

Adapted from Smith Rogers and Cowling 2005 who compared LPG with Kerosene the table below summarise the characteristics of LPG and electricity compared to biomass cooking.

	LPG	Electricity
Ease of use of cooking appliance	The controllability of LPG makes for easy use.	Energy efficient appliances need some forethought, while energy inefficient appliances such as hotplates and induction stoves are comparable to LPG.
Safety	People's perception is that LPG is not safe. Illegal refilling without safety checks can indeed create threats. Cylinders caught in a general fire can explode.	Electrical shocks depend on safety features being installed to code. Quality appliances are required to prevent children touching wires. Sometimes hot surfaces can be misunderstood by children.
Ease of transport	Sizes of cylinders vary and there has to be a trade-off between many trips from the market with a light cylinder or fewer trips with a heavy cylinder. Pay as you go with delivery refills is attractive.	After connection electricity is available at the house. No transport is necessary. Payment to the utility may require a visit to their offices, although agents collecting payments and mobile money are reducing the need for 'office visits'.
Health damaging air	The health effects compared to biomass are negligible. LPG is a tier 5 stove.	The health effects compared to biomass are negligible. Electricity is a tier 5 stove.
Greenhouse pollutants	Currently LPG is a fossil fuel. BioLPG is possible and emerging. Pollutants are said to be less than biomass cooking (particularly with its black carbon)	Depends on the source of electricity. Coal fired power stations create more pollutants than biomass or LPG. However significant pressure to 'clean up coal' means that even coal fired power stations will gradually increase efficiencies and capture carbon pollutants. Where electricity is from renewable energy sources, the

²¹³ https://mecs.org.uk/wp-content/uploads/2020/02/MECS-LPG-Briefing-Paper_Jan-2020.pdf

²¹⁴ <https://www.iea.org/reports/energy-access-outlook-2017>

		greenhouse contribution is significantly less than biomass and LPG.
Dependence on centralized networks	LPG is dependent on global supply chains and fuel prices.	Electricity is dependent on the local infrastructure, which is often centrally managed. It is likely to become more decentralized in the future, and Solar Home Systems or Mini Grids already create an enabled environment of decentralization. However, the household is still dependent on the network – and if it fails everyone experiences problems.
Impact on women's time	LPG release women's time from biomass collection, although the purchase of LPG is perhaps comparable to the purchase of biomass except where PAYG delivery is in place. LPG reduces start up times for cooking but does not reduce cooking time.	Electricity releases women's time from collecting fuel, from starting up the cooking processes, release 'supervision of the cooking' time, through devices like rice cookers, and even reduces the cooking time through energy efficient devices like electric pressure cookers.
Impact on demand for children's time	LPG does not demand children's time like biomass cooking. Children can assist with the cooking if they wish.	Electricity does not demand children's time like biomass cooking. Children can assist with the cooking if they wish.
Local ecosystem	LPG offsets biomass collection, and potentially reduces deforestation.	Electricity offsets biomass collection, and potentially reduces deforestation.
Daily cost at household level	In urban situations, LPG is often a similar order of cost to sold biomass (charcoal). In rural areas LPG tends to cost more than partly purchased, partly collected biomass.	In urban situations, electricity with an energy efficient appliance is often about one fifth of the cost of sold biomass (charcoal). In rural areas electricity with an energy efficient appliance tends to cost about the same as partly purchased, partly collected biomass. With off-grid sources, tariffs tend to be higher but even then, case studies are showing it is of the same order as the purchase of biomass fuels.
Capital cost at household level	Investment in the cylinder can be covered by the supplier, but as a whole they are more than biomass stoves. Stove appliances are of the same order as advanced biomass stoves.	Investment in connection to the grid is a significant expense. This is all the more 'unattractive' if the connection is going to be used for just lighting (and a TV). Nevertheless, connections are being taken up and millions have been connected in the last few years. Use of the electricity connection for cooking spreads the capital cost effect over a more demanding fuel consumption and with use of an energy efficient appliance costs can be recovered within 12 months (assuming a credit facility was made available to cover the initial outlay).
Impact on balance of payments	LPG as a fossil fuel will likely put pressure on the balance of payments. BioLPG could be a local industry.	Fossil fuel generation of electricity could put pressure on the balance of payments. Renewable energy will likely be based on loans, and it too could put pressure on the balance of payments.

Originally, this paper had a section on other fuels. While they could contribute to the CHEEG Covid recovery plans, they are not central to our proposition, and therefore we have annexed the section:-

[Annex Consider other fuels for 'modern energy cooking services'](#)

6.5 Identify transition finance

How can these recovery plans be financed? How does the world with its shrinking economy find the upfront capital to enable these billions of biomass users to transition to modern energy?

While the purchase of a \$50 electric pressure cooker (or a \$50 LPG gas cylinder – example \$36 for 6 kg, \$63 for 13kg Kenya²¹⁵) is actually within reach of many households in the main urban centres such as Kampala, the reason it EPC take up in Uganda hasn't happened yet is the absence of awareness, the absence of supply chains and distributors and the absence of financial incentives.



In the CHEEG Covid recovery plans, where will the finance come from for raising awareness, enabling supply chains and incentivising the delivery infrastructure

So where will the finance come from for the adoption of ambitious recovery plans that enable moving biomass users to modern energy cooking services at significant scale. While \$4 billion a year was the estimated finance need to get everyone using improved biomass cookstoves by the year 2030, some have put the figure at much higher. Remember this public investment would redirect over \$100 billion a year spent on polluting fuels into modern energy.

This number may seem high, but there are two things to consider here. First is that the significant portion of this is redirecting expenditure by households. It is part of the economy. Second, with political will, governments have found billions to pay for the effects of Covid. The UK is said to have spent nearly £300b this financial year²¹⁶, and somehow the world found \$9 Trillion in supportive actions²¹⁷. If we took the deaths from biomass cooking seriously, we could find the money. Having said that – in terms of Covid recovery the use of that borrowed 9 trillion will of course reduce the amount of money governments think they have. It is also worth reminding ourselves that of that \$100 billion redirected consumer expenditure, the savings alone pay back an EPC in 4 months. The savings in rural areas, would pay back an EPC in 10 months, and pay back a solar home system in 4 years.²¹⁸

Let us consider the necessary investment in the light of COVID 19.

We made 3 assumptions about COVID 19:-

- **The virus causes death by co-morbidity**
- **There is a lack of health facilities and equipment**
- **Economies will be damaged by a global downturn due to the virus**

To start with the latter. \$400b public investment over the ten years to enable everyone to access modern energy cooking may seem out of reach. But consider that Governments in developed economies have already spent a lot of money propping up their economies. In the UK, approximately 17% of all wages have been paid by the government during the last month. They are currently discussing quantitative easing to increase the money supply, at between £100 billion and £300 billion. The EU raised pledges for a \$8 billion vaccine fund in one day. More than **\$16 Trillion** was wiped off the global stock market in 52 days at the start of the virus, and

²¹⁵ <https://www.total.co.ke/products/total-gas/total-gas-prices-cylinders-accessories>

²¹⁶ <https://www.bbc.co.uk/news/business-52663523>

²¹⁷ <https://blogs.imf.org/2020/05/20/tracking-the-9-trillion-global-fiscal-support-to-fight-covid-19/>

²¹⁸

even a single company like Tesla can lose \$14 billion in one day due to an injudicious tweet by its founder Elon Musk.

The point is that these numbers are about global priorities. The Clean Cooking Fund is currently raising \$500 million (a process started before the virus and not associated as such with recovery plans) and expects to leverage \$2 billion by results based finance. At the same time Uganda is about to take an IDA loan for \$400 million for grid extension. Projected investment in renewable energy (pre virus) was \$28 billion a year, although the Paris agreement on climate change required a higher level of investment.

Pledges are made and not kept; money is wasted in inefficient programming²¹⁹. What do all these numbers mean in reality? Does the existence of models that suggest the world needs \$30 billion a year (public finance) to transition biomass users to modern energy cooking services mean that such a transition is nothing more than a pipe dream? Or is it possible that recovery plans focused on such objectives can leverage existing investments, identify new strategies and access increased investment by presenting plans that address realities.

This where the first and second assumptions come into play. By reducing NCDs, each government will reduce the comorbidity of the virus for years to come, and as a consequence reduce the pressure on the health system. Finance allocated to transitioning the population from biomass to modern energy cooking, would not just meet narrow energy objectives but would more importantly contribute significantly to (i) improving the health of the nation, (ii) the National Determined Contributions (NDC) in the prevention of climate change, and (iii) to strengthening the economy by strengthening the formal economic sector of energy provision.

Regarding the latter by building back better and balancing the gender inequity of unpaid work, several trillion could be released into the economy. McKinsey (2015)²²⁰ calculated that \$12 trillion could be added to global GDP by 2025 by advancing women's equality. The point being –CHEEG Covid recovery plans could rapidly justify transition finance by economic gains.

As is the case with all large-scale investments, the sustainability and chances of success are fundamentally a question of both political commitment (above all to the commitment of finance whether be government per se or donors) and to the construction of enabling environments – where investors can be confident that resources committed will be used for the purposes stated, will generate anticipated returns and private sector actors can be reassured of the ease of doing business and stability. All these factors will affect the efficacy of the recovery plans – what we are suggesting is that recovery plans in these enabling contexts that focus on significantly accelerating the transition from biomass to modern energy give significant returns in alleviating NCDs, alleviating pressure on health care systems, providing women's empowerment, releasing time for women to strengthen home care systems and to strengthen their contributions to the economy and providing a basis for a formal economic sector that can get returns while still reducing household expenditure (in urban locations).

6.5.1 Let's be real about the synergies

Integrating the investment in electricity with a view on clean cooking can deliver leveraging of investment finance, leveraging of value chains and leveraging of household finance.

²¹⁹ <https://www.seforall.org/energizing-finance>

²²⁰ https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Employment%20and%20Growth/How%20advancing%20womens%20equality%20can%20add%2012%20trillion%20to%20global%20growth/MGI%20Power%20of%20parity_Full%20report_September%202015.pdf

6.5.1.1 *leveraging of investment finance*

We don't know what funds will be available after the Covid first wave. We do know that there will be a global recession and finance will be challenging

In the recent past the separation of clean cooking from the electricity sector has led to a disparity in investment. As has been said that the total investment in clean cooking for the last 10 years (in developing countries) is of the order of \$40m per year (2017)²²¹ while what used to be needed was said to be of the order of \$4b per year. However, with the increasing awareness of the failures of the clean cooking sector, there are increasing calls for more investment. While the call for public investment is important, it is also worth noting that if 40% of the 3 billion are paying a median of \$10 a month for their polluting fuel²²², that 'investment' by households in fuel costs of over \$100 billion in ten years can be a trillion drawn into the formal modern energy sector between now and 2030.

'Meanwhile' investment in electrical generation has been of the order \$27b for the last 10 years. Large private industries are available in the electricity sector (Generating, Transmission, Distribution) while the clean cooking sector tends to be characterised by small and nascent organisations that are too small to access larger financial instruments. Pre-virus the MECS programme argued for a new approach that had a 'single investment strategy', incorporating clean cooking into the growth of the electrification sector and renewable energy technology for grid and off-grid development. By doing that the various financial instruments can encourage both growth of renewable energy and utilization of this energy for clean cooking. This becomes even more essential as the investment climate is stressed by the Covid shock and accessing renewable energy investments for 'build back better' inclusive of consideration of clean cooking has an opportunity to leverage long-term loans, guarantees, and project bonds.

An example the authors often use is the investment in the Turkana wind farm in Kenya. The Lake Turkana Wind Power consortium (LTWP) completed in July 2019 is 300 MW of low-cost electrical power fed into the KPLC national network. It had a cost of USD 800 million and is said to be the largest single private investment in Kenya's history. Consider if through a provision of say \$20m for appliances and loan or service arrangements with consumers, the developers could have served 200,000 (urban) households with energy for cooking, mitigated even more environmental impact by substituting for urban charcoal use and helped the economy further. At 2.5% of the total project cost, the single investment would have tackled clean cooking in a previously unthought of scale. This may not be the best example but it illustrates how expanding the planning to include customer services could have reassured the investors that the generating power would be utilised. Indeed, in a more general view, we have already shown that Kenya has plans to double its generating capacity by 2022²²³, and the argument here is that by including planning for clean cooking in the planning for electricity, the revenue returns for investment are more reassured. Previous planning expected to create 6.5 million jobs, many of which were dependent on the tourist industry. Such industry is possibly now going to be decimated by the effects of the virus. In contrast to the coming and going of tourists, households always need to eat, and revenue from electric cooking is not dependent on international travel but on being cost competitive with alternative

²²¹ <https://www.reuters.com/article/us-global-pollution-health/dirty-fuels-kill-millions-as-investment-in-clean-cooking-runs-short-idUSKBN1XW1FC#:~:text=Total%20investment%20in%20clean%20cooking,options%20of%20cooking%20by%202030.>

²²² [https://assets.publishing.service.gov.uk/media/57a08975ed915d3cfd00025a/Solar_Electric_Cooking_Synthesis_Report.p](https://assets.publishing.service.gov.uk/media/57a08975ed915d3cfd00025a/Solar_Electric_Cooking_Synthesis_Report.pdf)
[df](https://assets.publishing.service.gov.uk/media/57a08975ed915d3cfd00025a/Solar_Electric_Cooking_Synthesis_Report.pdf)

²²³ <https://www.bloomberg.com/news/articles/2019-09-12/kenya-plans-to-double-power-generation-by-2022-as-economy-grows>

fuels. Given that charcoal prices are rising, and that energy efficient appliances are proving to be very cost effective, such competitiveness is slightly more predictable than the income from tourism.

Since a common comment by utilities and mini grid developers is that connected households in rural areas only use small amount of electricity (for light and TV), the inclusion of cooking would make the returns on improving access and grid extension more viable.^{224 225 226} It is perhaps worth noting that ESMAP²²⁷ estimates that mini-grids could cost-effectively supply half a billion people in Africa and Asia with electricity, with an investment of \$12 billion. This is general investment in electricity and is not specified as 'clean cooking' and yet it can be leveraged. It can become a part of the estimated 40 billion high end estimate of transitioning all people to Tier 4 and 5 cooking.

6.5.1.2 *Leveraging of the value chain already in place*

The example assumes that utilities pivot to become service industries. One can see this in the water industry, and in the off-grid sector. There is no reason why national utilities could not offer their energy as a service.

The future utility model be integrated service delivery model recognizing the practical needs of customers, the capital expenditure of customer on appliances and placing a different value in their relationship with the customers. This could stimulate demand more organically and include a range of productive use and consumer appliances according to customer demand. Utilities may choose to offer electric appliances as part of a special promotion and bundling with existing services offering on-bill financing, amortizing the cost through utility bills similar to PAYG companies. Cooking as a service would constitute such a VAS and perhaps a change in a utilities culture as integrating electric cooking means the utility would have to efficient and agile.

Utilities with flexible metering and detailed data on load profiles could offer discounted tariffs during off peak times when there is surplus power in the system to encourage usage at these times in order to smooth out the load profile. While collecting additional revenue due to increased demand which could help the financial position, ending peak loadings by smart distribution could prevent a return of load shedding. Energy storage and smart charge controllers are likely to play a key role in this business model.

The suggestion here is that utilities adopt a pay-as-you-go model, which has been well established in the off-grid sector. Leveraging digital consumer financing by using remote monitoring to assess use and charge on a pay by use basis can enhance the affordability of their products and services. Off-grid PAYG customers typically make payments via mobile money or an agent-based energy credit model (e.g., scratch cards). PAYG solar companies seek to provide energy services focused on lighting are at a price point that is less than, or equal to, consumers' current spending on kerosene, candles, batteries, etc. There has to be quality after sales service, since a user's ongoing payments are tied to the system continuing to function. PAYG providers can take one of two approaches to financing the system to the consumer: Lease-to-own – the consumer pays a fixed fee at a set interval until the total value of the system plus financing is paid off, at which point, they become the owner of the equipment and Fee-for-service – similar to a utility model, the consumer pays for the service for the duration of the contract, which is typically long term. It would seem obvious that the utility should do the latter.

²²⁴ <http://documents.worldbank.org/curated/en/364571494517675149/pdf/114841-REVISED-JUNE12-FINAL-SEAR-web-REV-optimized.pdf>

²²⁵ https://www.cairn.info/load_pdf.php?ID_ARTICLE=EDD_HS03_0077&download=1

²²⁶ <https://www.mdpi.com/2071-1050/12/5/1793/pdf>

²²⁷ <https://openknowledge.worldbank.org/bitstream/handle/10986/31926/Mini-Grids-for-Half-a-Billion-People-Market-Outlook-and-Handbook-for-Decision-Makers-Executive-Summary.pdf>

It may be important to note that fee for service on appliances was the way many developed economies enabled an emerging consumer class to get appliance addicted^{228 229}.

In terms of lease to own, most PAYG repayment horizons for complete off grid systems (Solar Home lighting, TV and other low power energy services) typically sits at 1-2 years. For grid electricity, the electric pressure cooker could be a lot less – given that the device costs around \$50 retail. (Off-grid home solar home systems on PAYG Lease to own would be around 4 to 5 years for repayment – but our CHEEG Covid recovery plans focus on the redesign of urban power systems, and the credit facility needed may only be required for the appliance.)

By including the service in the invoicing for the electricity, the utility has the leverage of cutting a household off if they default on payments.

Of course, utilities currently are not set up to offer services on appliances. The existing value chain is more based on retail outlets. Even here, there are possibilities in the recovery plan to leverage the existing infrastructure. Using the more decentralized distribution approach through distributor retailer network might be easier and more agile than converting a utility from electricity delivery to service delivery. Those selling fast-moving consumer goods can employ more typical marketing strategies and may help reach more consumers, but also may carry with it higher margins along the distribution and retail value chain. The bulk purchases (economies of scale) that the utility could employ may reduce costs in the longer term.

Appliance chains already exist in many LMIC countries. For instance, over the last six months of 2019 in Kenya, the top 5 importers alone brought a total of 12 million USD worth of electrical cooking related appliances into the country. Over this period a total of 330,000 kettles were imported, clearly the most popular electrical cooking appliance, followed by ovens/cookers (74,000) and microwaves (63,000).²³⁰ Appliances are often considered part of retail process, and therefore utilities that plan customer connections may not consider the supply side and value chain of appliances. Hence, supplying and financing electric appliances, creating a supporting industry of return and repair, and making consumers aware of the benefits of such appliances needs planning and coordination among different actors in the value chain.

The retail approach would require mechanisms for households to gain access to credit facilities, but these are often widespread. Saving and Credit organisations are abundant in most LMICs. The challenge would be for the CHEEG Covid recovery plan to include provision for cooking specific loans.

CHEEG Covid recovery plans should also prioritise roles for women in the value chain. Again, leveraging peer-to-peer delivery models works well when staffed by women. The model relies on word of mouth and capitalises on the fact that trust and familiarity between the sales representatives and the consumers (family, friends and acquaintances) and is said to be more persuasive than conventional sales methods. An example of this model is Solar Sister²³¹, an organization which recruits, trains and mentors the sales reps, who are expected to invest their own capital to buy the products and then resell them, firstly to family members and friends, then as their circle expands, to friends of friends and finally their community at large. A similar example is Bidhaa Sasa²³² which has recently piloted electric pressure cookers in their work.

Demonstrations seem to be a key particularly when introducing new cooking equipment. The peer-to-peer business model is a sales agents that can also offer after-sales services, supplying specialist parts such as sealing

²²⁸ <https://www.youtube.com/watch?v=k7ZvAQnjVSc>

²²⁹ <https://mancunian1001.wordpress.com/2020/03/26/great-service-great-sets-remembering-the-tv-rental-shop-the-lost-precinct/>

²³⁰ Seair Exim Solutions, 2020, Market Intelligence import data, Kenya (Analysed by authors)

²³¹ <https://solarsister.org/>

²³² <https://www.bidhaa.co.ke/>

rings for pressure cookers and offering friendly advice on how to make the tastiest meals with this new equipment. Successfully leveraging existing social media communities (through both physical and digital channels) could greatly expand the scalability of the peer-to-peer business model as a marketing strategy for electric cooking. Cooking-themed Facebook groups in East Africa with over 2 million users²³³ and local food bloggers²³⁴ regularly receive hundreds of thousands of hits on their video recipes on YouTube.

6.6 Use lifeline tariffs to ensure inclusion of the poor.

A rapid acceleration in the spread of Modern Energy Cooking Services needs to be accompanied by measures that ensure that this access is made available to the poorest and most marginalized social sectors. For the accelerated transition to Tier Five stoves via bringing together electrification and clean cooking objectives to be realised and delivered in such a way that addresses the needs of the poorest sectors in society as well as more affluent groups, some kind of cross-subsidisation or lifeline tariff will need to be incorporated²³⁵.

We see this in India already implementing significant subsidies. In their case a large unconditional cash transfer links the purchase of a gas cylinder to a cash transfer to the purchasers bank account. Households place an order for LPG with their gas distributor, receive an amount equivalent to the current subsidy amount via electronic transfer to their bank account, then pay the full unsubsidized price for the cylinder in cash on collection or delivery.²³⁶ This replaces the previous system that subsidised the price the consumer paid at the place of purchase. This is not an insignificant amount of subsidy – approximately \$2b per year.

There are challenges in providing long standing subsidies to LPG, and while this may be applicable for a rapid economic recovery plan, it is best avoided for the long term. In contrast to LPG subsidies which often come from the national purse, lifeline tariffs are a cross subsidy within the utility. Tiered tariffs charge users with higher consumption a slight premium which is then used to offer the reduced lifeline rate. A lifeline tariff is in place in most countries so new legislation would not be needed (except perhaps within the off-grid sector). The lifeline tariff is a reduced rate for the first 20 to 100kWh of electricity consumption. Since poor households connected to the grid currently use only about 20kWh per month, and since three meals a day can be cooked on 30kWh a month, a lifeline tariff of 50kWh effectively supports poorer households to cook with electricity. The paper describes how households will likely switch payments from polluting fuels to electricity, and with energy efficient appliances even without the lower tariffs, households will likely save on their monthly expenditure. This growth in electricity use strengthens the utility delivering the electricity (either grid or off-grid)²³⁷.



²³³ <https://www.facebook.com/groups/384859444982267/>

²³⁴ https://www.instagram.com/jikoni_magic/

²³⁵ <https://cafod.org.uk/content/download/47371/574141/version/2/file/Energy%20Safety%20Nets%20Working%20Paper%201018.pdf>

²³⁶ <https://www.iisd.org/library/ghost-savings-understanding-fiscal-impacts-indias-lpg-subsidy>

²³⁷ There is a significant imbalance between the use of lifeline tariffs on grid provision and the full cost recovery expected from the off-grid sector. Analysis have long realised the need to subsidise the urban poor's access to electricity, why is the same case not made for the off-grid sector. The development of electric cooking makes this imbalance an even bigger injustice to confront.

One of the advantages of lifeline tariffs on the grid over subsidies on LPG is the ease with which they are administered, and the difficulty in cheating them. As briefly discussed above, India has now switched from subsidizing the LPG directly through retailers, to giving a ‘cashback’ to households. There are cases where subsidies have been abused, for example in the case of Ghana “ the purpose of the LPG subsidy was defeated when taxis and other commercial vehicles switched to LPG fuel because of the price difference between LPG and other transport fuels such as petrol.”²³⁸ Because the electricity is being measured anyway, and because the tariff applies to the first units of use, it is difficult to game the system. One disadvantage of the lifeline tariff is where landlords are offering a secondary supply to their tenants. The two households then only have the same lifeline as a single household.

Nevertheless, lifeline tariffs are a realistic way of ensuring inclusion of the poor as long as other factors (access, reliability, sustainability of supply) are in place.

6.7 Balance increased tax collection with lifeline tariffs

It may seem at odds to discuss taxation within a piece on the CHEEG nexus and COVID 19, but the specific challenge here sits in the context of the broader needs facing LMICs in terms of financing their commitments under the Sustainable Development Goals.

We argue that the shift from biomass cooking to modern energy cooking services, in some respects reflects the shift in economies from analogue to digital, and we can learn from mobile money. Indeed, in the business case for the MECS programme, the intention and aspiration is compared to the creation of mobile money^{239 240}. This does not refer to the possibilities that the digital economy opens up in terms of remote monitoring of cooking consumption (pay as you go options) where mobile money can be a conduit for micro payments, but rather in this section the ideas relate to taxation which were drawn upon strongly in the development of mobile money and are potentially mirrored in the bringing to fruition of the COVID 19 recovery plans discussed above.

In a cash society it is difficult for governments to collect tax. When people only have cash and do not have bank accounts, there is no paper trail for determining tax nor, and this is important for the poor, their credit worthiness. When mobile money came into play, it generated ‘paper’ (digital) trails that enabled the plumber to show a credit agency that they had regular business and that, even though they didn’t have property assets, they were a viable business.²⁴¹ This contrasted with the plumbers cash work, which gave him no evidence to access credit, and limited the ability of the government to tax him or her.

To some this ‘paper trail’ disruptive – there were many complaints that transactions that previously avoided Value Added Tax were now potentially taxed through the mobile money system.

If the CHEEG strategy outlined above is put into place, that too could be an outcome. The cash economy of charcoal could be replaced by larger companies providing modern energy and knowing the consumption of customers. In most economies expenditure on energy either does not incur VAT or incurs a limited amount.



²³⁸ <https://www.sciencedirect.com/science/article/pii/S097308261830262X>

²³⁹ Two birds

²⁴⁰ <https://bulletin.ids.ac.uk/index.php/idsbo/article/view/286/PDF>

²⁴¹

Nevertheless, where the charcoal economy delivered almost no official tax to the treasury, the possibilities of a limited VAT would deliver some.

However, potentially more significant than consumer contributions was the corporation tax the mobile money operators would have to pay. Millions of mototaxi rides that previously were invisible to the government, were now paid for through a system where one investigation could see that the corporation had made a profit on each transaction and potentially that profit could be taxed at a single source.

We use the words ‘potentially’ because it is a scandal of the world that corporations and billionaires do not pay their fair share of tax.²⁴² Financial instruments enable them to pay less tax per dollar than the poor. This is particularly true of resource rich industries such as mining activities, but also true of the emerging digital economy and the financial sector itself^{243 244}



The world is unfair, and inequality is rife and the way in which the global financial system operates imposes limitations on state spending against developmental objectives. As stated in a recent review of UK aid’s contribution to tackling tax avoidance and evasion carried out by the Independent Commission for Aid Impact. “The estimated revenue losses from tax avoidance by multinationals accounts for a higher share of GDP in developing countries than in OECD countries, owing to their greater reliance on corporation tax. UNCTAD estimates that multinational corporations shift over £300 billion²⁴⁵ away from developing countries each year. While the figures are controversial, the G20 itself has acknowledged that the damage caused by tax havens and non-cooperative jurisdictions is particularly important for least developed countries.”²⁴⁶

We cannot of course solve any of this by the COVID recovery plans outlined above. But we can build into those plans equity and financial sustainability that are built upon an effective understanding of that reality.

As said, almost all countries have a lifeline tariff on their electricity. In the short term utilities may not be able to maintain the balance between lifeline tariff users and premium customers particularly as the Covid recession reduces energy consumption in manufacturing industries. Nevertheless, the long-term commitment to utilities and their infrastructure are a solid stable ground for recovery strategies. In the immediate, a growth in use of the lifeline level of consumption may stretch the utilities finances, and they may need support from the treasury, but in the longer term it lays the foundation for a sustained infrastructure and business – resulting in the longer term to profitability. It would be a mistake to remove lifeline tariffs to avoid treasury interventions in balancing the utilities books in the short term. Leaving them in place will lead to long term profitability as consumers fund and grow electricity infrastructure.

Even with the lifeline tariff, bringing the informal expenditure of households on polluting fuels into the formal sector of electricity (and LPG) provision, offers an opportunity for tax revenue collection to replenish the

²⁴² <https://onlinelibrary.wiley.com/doi/full/10.1111/1758-5899.12379>

²⁴³ Overesch, Michael and Wolff, Hubertus, Financial Transparency to the Rescue: Effects of Country-by-Country Reporting in the EU Banking Sector on Tax Avoidance (February 8, 2019). Available at SSRN: <https://ssrn.com/abstract=3075784> or <http://dx.doi.org/10.2139/ssrn.3075784>

²⁴⁴ <https://www.sciencedirect.com/science/article/pii/S0378426616300206>

²⁴⁵ Remember, this is the amount said to be needed to transition the entire world away from biomass (over a ten year period)

²⁴⁶ <https://icai.independent.gov.uk/wp-content/uploads/ICAI-Review-UK-aids-contribution-to-tackling-tax-avoidance-and-evasion.pdf>

treasury finances. With a global economic recession, governments will need support to find the resources to undertake and maintain broader recovery plans. The evidence from previous global recessions is that there may well be a sharp decline in international donor support, and many countries will suffer economic setbacks from the lack of tourism and the lack of international remittances. To address this, governments should put in place strong measures to ensure that corporation tax is paid. If, as we suggest, electricity utilities and LPG distributors benefit from an increased uptake of modern energy cooking services (over the longer term) then it will be crucially important that they pay their fair share of tax revenue. The formality of these industries has advantages over the charcoal economy which is so dispersed that effective tax collection is difficult. By making expense on cooking a formal expenditure to an institution (utility), the government has more opportunity to collect tax revenue without penalizing the poor²⁴⁷. Addressing the question of corporation and multinational tax will be important.

As discussed above, in theory, if the expenditure on biomass fuel is transitioned to modern energy, the modern energy sector would gain over \$100 Billion a year for the next 10 years²⁴⁸. That £1 trillion was previously spent in the local economy on charcoal and wood (and dung), and the sellers were barely taxed. If that revenue flows through corporations and utilities, and IF they pay a fair share of their taxes, then governments will see an increase in their finances, and will be able to use the tax on corporation profit (made from the middle class and wealthy), to sustain the lifeline tariffs.

It is important to note that the \$100 billion per year is already being spent by households on their biomass cooking fuel – this is not talking about new expenditure per se, rather it is talking about the formalization of that expenditure. Indeed COVID 19 will shrink economies, and government resources will also shrink. But the reshaping of the flows of money from dispersed cash payments, to infrastructure held and run by the formal private sector opens the possibility of ensuring that profit making corporations are ‘good nation builders’ who pay their taxes!

It is also important, however, to note that this process of formalization has winners and losers. Clearly if expenditure is transferred from biomass to electricity and LPG then this will benefit the variously sized enterprises which work in those sectors (both on and off-grid in the case of electricity) to the detriment of those working within the biomass sector.

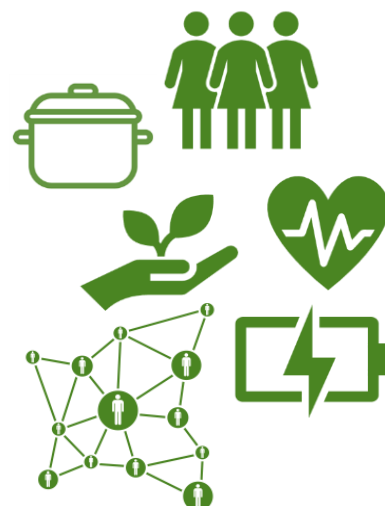
²⁴⁷ although we recognise that rapid transitions away from charcoal will require support for those currently involved in the industry

²⁴⁸

https://assets.publishing.service.gov.uk/media/57a08975ed915d3cfd00025a/Solar_Electric_Cooking_Synthesis_Report.pdf

6.8 Strengthen decentralised energy and governance systems

The emphasis above on the formal energy infrastructure should not be confused with any ignorance of the current inefficiencies in the national grid systems. Africa's highly centralised energy systems often benefit the rich and bypass the poor and are underpowered, inefficient and unequal.²⁴⁹ However, the dominant highly centralised models of energy production and supply are gradually being challenged globally and these recovery plans are an opportunity to accelerate this. There are calls for Virus recovery plans to be focused on Green economy approaches – and this strengthens the intersection of the CHEEG nexus.



The ability of more decentralised approaches to energy generation to accelerate low carbon transitions, to exert greater consumer control over energy consumption, to reduce system-wide losses, to make use of smaller-scale locally-available renewable resources and accelerate the development of new energy generation and other technologies that can make our use of energy cheaper, cleaner and more efficient, are key to Green virus recovery plans (e.g. connecting to government commitments to the promotion of Climate Compatible Growth). In developing economies, the potential roles of more decentralised approaches in expanding access, increasing overall supply and making energy systems more reliable are of course much more key to the debate. Decentralised energy generation can sometimes mean adding energy into the grid, sometimes a stand-alone off-grid (mini grids) or even home system, and sometimes various shapes and forms of combined heat and power. The scale varies, and so the political influence varies.

Distributed energy systems are key to addressing SSA energy access issues. UN Secretary-General, Kofi Annan²⁵⁰ described the energy-sector bottlenecks and power shortages as costing the region 2–4 per cent of GDP annually, undermining sustainable economic growth, jobs and investment. They also reinforce poverty, especially for women and people in rural areas. Africa's poorest people are paying among the world's highest prices for energy.

By putting energy production in the hands of small but formal producers, rather than a few big national/international companies or a centralised state utility, it supports a form of 'democratisation of energy' that a growing number of observers argue will promote local democracy.

"The inherently "decentralizable" quality of solar PV technologies can act at multiple scales that dovetail into multiple energy possibilities in a way that centralized provision is unable to. The widespread deployment of solar PV can also alleviate local, regional and national dependency on expensive fossil fuels. All forms of distributed energy, but particularly solar PV in SSA, exploit the idea of multiple scalar possibilities for energy supply."²⁵¹

Local people/communities can in some cases gain direct control over how they generate their own energy and what they then do with it and in other cases gain a much greater say over how energy is distributed and how it is governed²⁵². Greater democratisation is closely linked to opportunities for greater choice and flexibility. However even at the level of a mini grid, developers or community initiatives have frequently been characterised by unequal decision-making processes and operational difficulties with a lack of participative management

²⁴⁹ <https://link.springer.com/article/10.1007/s13412-020-00608-7>

²⁵⁰ Africa Progress Panel 2015: 8

²⁵¹ <https://link.springer.com/article/10.1007/s13412-020-00608-7>

²⁵² <http://sro.sussex.ac.uk/id/eprint/53156/>

practices. Much of the shift to decentralised energy changes some of the location of the political economic inefficiencies but does not fundamentally remove such barriers.

Despite these limitations, decentralised energy holds promise in 5 areas.

Transmission efficiency:- There is an assumption that a decentralised system will be inherently more efficient and therefore more sustainable. The flexibility in such systems will enable societies to meet the challenge of responding to global climate change and other sustainability objectives. There will be savings in avoiding transmission and distribution costs, generating electricity which can be used locally.

Increased Access:- At the heart of SDG7 and modern energy, is the idea to ensure access to modern energy for all by 2030. In larger centralised grid systems, the only way of accessing electricity comes from obtaining a connection to the grid. If the resources are not there to extend the national infrastructure then there is no access to the grid. Rent seeking from the major players is a significant barrier to extending the grid – the connection charge can be inflated with no competitive alternative available. On the other hand, off-grid solutions don't have these complexities, particularly those in very remote locations where extending the grid would be very costly. We will not discuss this in detail here, as it is covered in many other MECS publications, however we note it in the context of a changing political economy.

There is also the concept of prosumers. With the advent of solar PV panels of household rooftops, and the changes required with electric vehicles, the 'one way direction' of a utility is changing. It used to be that the utility generated the electricity and the household consumed it. However now prosumers can be end-use consumers of electricity who produce their own electricity either to meet their own electricity needs or to export electricity to "the grid" (the electricity system), or some combination of both. There are discussions about utilising electric vehicle batteries as energy storage²⁵³. These ideas further stretch the 'decentralisation' of energy production

Reduction of risk:- Decentralised energy can reduce the scale of risk involved when large numbers of people/industries are all connected into one centralised grid. A single problem affecting the main grid could directly impact all people. If the same people were divided between say 10 mini-grids, the same single problem only 10% of the people.

Skilled local employment :- community-grids can constitute useful sources of skilled local employment. This contrasts with the large labour force in centralised energy systems. Labour disagreements within a single large state owned utility can not only impact energy supply within a country but can also affect supplies and push up energy prices elsewhere in the world because of the global energy market.

Complex governance: - Some would argue that decentralised systems have a simplicity of governance and therefore have some advantage. However, without suitable regulation, they are vulnerable to questions of ownership, responsibility, affordability, security and resilience.

So, the advent of decentralised energy systems changes both the generating and technical landscape, but also the political economic landscape. Ownership, rent seeking, regulation, are all changing, so initiatives supporting transitions to modern energy cooking services need to keep this in mind when considering how PEA might influence planning and roll out of modern energy cooking services.

²⁵³ <https://www.ovoenergy.com/guides/electric-cars/vehicle-to-grid-technology.html>

This brings us to the question of how the decentralization of energy relates to decentralized governance. If the efficiency advantages of decentralised energy are to be realised then they are intimately connected to the strengthening of decentralised forms of governance.

Decentralization at least in principle brings government closer to the people and allows citizens to take a closer look at the decisions that affect them.

There is a shared core to the claimed benefits for Political/Administrative Decentralization

- Efficiency and Cost
- Quality
- Transparency
- Democratization of decision-making
- Enhanced Participation

“For women, decentralization provides opportunities to scrutinize how well local services that they are interested in are being provided and how the decisions are being made around the provision of those services. Decentralization also provides women with more opportunities to become involved politically. How decentralization works for women in practice, however, depends on their ability to participate in the political process and to exert pressure on political leaders. There are still many barriers – cultural, societal, and institutional -- to sustained female participation in local government”²⁵⁴

Until recently little had been made of the potential for political decentralization to support more effective energy policy making. Emerging research on this suggests that strengthened local government can be an effective means of delivering joined up and coordinated local development policy where energy resources can be deployed more effectively in support of other important local priorities²⁵⁵.

Potential measures include:

- Local authority provision of energy services in collaboration with local partners
- Ensuring that NGO/private sector energy initiatives are connected adequately into local and regional development strategies and local programmes in water, education, health etc..
- Provision of information and training about energy issues (for example about specific technologies, how to use energy for livelihood enhancement, contacts for companies operating in particular fields, funding possibilities etc.).
- A ‘demonstrator role’ in promoting new technologies or approaches in the delivery of services to local citizens (e.g. energy efficiency measures free up funds for other uses)
- E.g. the use of clean energy technologies in powering municipal buildings.
- Coordination of energy services with other service provision infrastructures (health, education, economic development, agricultural extension services).
- Coordination of the wide variety of actors involved in the energy sector and more effective targeting of national energy policy and provision of support services and networking opportunities.
- Political decentralization should encourage local people to play a more active role in articulating local solutions to the challenges which they face including energy (closer to where decision-making takes place) – assumes decentralization implies encouragement of consultation/participation

²⁵⁴ (Slack, Enid, Zachary Spicer and Makram Montacer (2014:14), 'Decentralization and gender equity', Occasional Paper Series 14, Ottawa: Forum of Federations.)

²⁵⁵ http://thereadproject.co.uk/?page_id=108

Of course, in reality, undemocratic forms of centralised control may simply be replaced by undemocratic forms of local control. In Kenya, decentralisation of the budget to County level puts an onus on county governments to plan the energy supply, matching it to demand. Nevertheless, Long Seng et al argue that Decentralization by itself is no silver bullet; there are no guarantees implicit in decentralization of political governance and the literature and evidence give many reasons for concern.

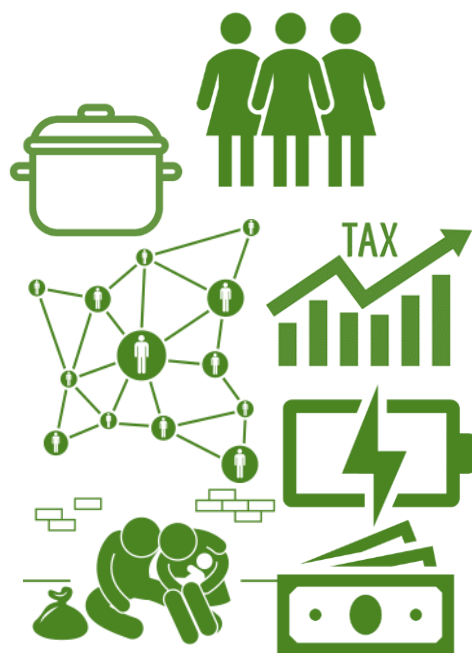
Where Decentralization has failed to live up to its promises, the literature suggests a range of broader governance and environmental factors that lay behind this.

- Inadequate devolution of power, particularly over finance and staff
- Vague and/or inappropriate systems and procedures
- Inadequately qualified, underpaid and unmotivated staff
- Political Interference, corruption and abuse of power
- Lack of state/political motivation/leadership
- Hostility/interference by centralised stakeholders
- Lack of 'downward' accountability

6.9 Empower women within industry and governance

Underlying the above call to use recovery plans to increase democratisation of national energy systems, is the call for equity. Greater equity in economics, greater equity in governance of energy systems, greater gender equity. We have discussed how the use of modern energy for cooking will benefit women (their children) redressing the hours spent in the unpaid labour of cooking (fuel collection and cleaning). In this section we consider how the industry stimulated by the recovery plans could embrace gender equity, and possibly get more coherent results and outcomes.

The argument for leveraging Covid recovery plans to include the promotion and uptake of modern energy cooking services incorporates the idea that modern energy cooking can release women's time from a significant unpaid activity, and that that released unpaid time could be used for paid activities contributing to economic recovery.



6.9.1 Using modern energy to improve profitability of women's enterprises

It is important to note that women are engaged in economic activities. In the informal sector in Kenya, 38% of owners of firms are female²⁵⁶, and 40% have at least one female owner, with 38% having the female as the main decision maker. 52% of all informal businesses use electricity, and 76% of these are connected to the grid. This is not always reliable, and 2% have to have a backup generator while 38% report that the unreliable electricity causes a severe obstacle to their current operations. Gender equity is not a given, but while men do have a greater average take home income at 5405KSh, the income for females averages at 4805KSh.

²⁵⁶ <http://documents.worldbank.org/curated/en/262361468914023771/pdf/106986-WP-P151793-PUBLIC-Box.pdf>

The point of these statistics is that females are already engaged with the informal sector and have a strong role within the economy. Many of these women will have to go home and light a biomass stove and cook a meal for their families. Release of several hours of the time take to preparing meals could potentially translate into more time in the business and more income earned – or into more leisure time meaning that work time was not as exhausting to the women.^{257 258 259}

The view that women are engaged in the economy, is supported by more generalized data from the World Bank. Table 2 illustrates Sub Saharan Africa and East Asia & the Pacific and shows Ghana and Cambodia as a specific comparators. In low income countries in Asia, the picture is slightly better than Africa with a greater equality across the genders.

Table 3 Proportions of men and women in informal industries (authors own developed from World Bank data)

Indicator	Ghana	Sub-Saharan Africa	Cambodia	East Asia & Pacific	All Countries
Percent of firms with female participation in ownership	31.6	29.6	46.2	52.7	35.8
Percent of firms with majority female ownership	14.7	12.3	43.7	28.8	14.4
Percent of firms with a female top manager	14.9	15.4	57.3	32.8	18
Proportion of permanent full-time workers that are female (%)	24.7	28.2	46.5	38.9	33.3
Proportion of permanent full-time production workers that are female (%) [*]	18	19	60.7	39.5	26.8
Proportion of permanent full-time non-production workers that are female (%) [*]	32.8	29.4	18.8	36	37

Gill, et al., 2012²⁶⁰ evidenced that improvements in technology can enhance women's economic opportunities. In the case of modern energy cooking this not only releases unpaid domestic time but gives new opportunities for more efficient businesses. There are opportunities in the food industry to process crops and food for longer term storage, to pre-cook food, to serve ready-made meals, and to do this with modern energy technology that doesn't not require hours of cleaning utensils and standing over a hot fire²⁶¹. LPG use by women in food kiosks, small restaurants and bars is common in Kenya²⁶²

²⁵⁷ <https://blogs.worldbank.org/african/understanding-the-informal-economy-in-african-cities-recent-evidence-from-greater-kampala>

²⁵⁸ <https://www.gemconsortium.org/economy-profiles/uganda>

²⁵⁹ <https://www.enterprisesurveys.org/en/data/exploreconomies/2013/ghana?topic=corruption#gender>

²⁶⁰ <https://www.icrw.org/wp-content/uploads/2016/10/Invisible-market-energy-agricultural-technologies-women's-economic-advancement.pdf>

²⁶¹ <https://www.sciencedirect.com/science/article/pii/S2214629617300981>

²⁶² <https://www.cleancookingalliance.org/binary-data/RESOURCE/file/000/000/363-1.pdf>

Starting or improving a small business based on modern energy access can lead to enhance revenues, and the extra earning capacity can (in most cases – not all) lead to increased women’s status and decision making within the household and community²⁶³. Many of the informal food sector industries are energy intensive. The opportunity of modern energy is that relatively low cost energy efficient appliances can cook and process at a fraction of the biomass based urban cost.

However, the words of caution throughout the above that modern energy cooking needs solid supply chains and reliability apply equally to its use for businesses. In Ghana sporadic shortages of LPG affect food vendors (mainly women)²⁶⁴. Energia 2014²⁶⁵ reports that after entrepreneurs in rural Himachal Pradesh, India had trekked for hours to roadsides to refill canisters, the distributors were not there. And local taste associated with local cooking processes can be important. In the same document there are reports that in Guatemala sometimes women continue to cook street food with wood because they think that their customers will taste the difference.

And secondly as a reality check it is important to note that women’s businesses tend to be less profitable compared with men in the same business²⁶⁶. Clancy and Dutta (2005)²⁶⁷ attribute this to the informal and unorganized nature of enterprises; heavy reliance on process heat; high use of women’s metabolic energy; energy as a cost factor in sustainability of rural enterprises; and the role of complementary inputs. Recovery plans supporting women’s enterprises using modern energy cooking services will eliminate the inefficient use of process heat and with training the other factors could be addressed.

“The pandemic is impacting women’s livelihoods – those employed as small-scale traders, in tourism, hospitality, manufacturing, and retails and now sitting home with no guarantee if and when they will re-enter the job market. There is a room to argue for a recovery plan that could reach severely hit sectors in a more targeted manner. For example, take the food-away-from-home business, poor urban households depend on those services to purchase meals in small quantities. In 2019, FAFM represented 25% of households’ food expenditure in (urban) in Nigeria²⁶⁸. Food vendors are mostly informal and operated by women with no formal safety nets to access or rely on. An equitable recovery approach should differentiate impact and respond accordingly.” M Tesfamichael (private communication)

6.9.2 Engaging women in the modern energy supply chain

In addition to businesses that are food orientated and utilise the modern energy cooking services, women can also be engaged in the manufacturing and selling of the technology. It therefore becomes important to engaged women during all the Covid recovery plans. A multistakeholder consultation at CSD 14 and 15 suggested that “energy is women’s business” in all regions throughout the globe²⁶⁹.

²⁶³ https://pdfs.semanticscholar.org/67ab/226f87c0b1792154b0857dac536e25a5bb18.pdf?_ga=2.60694123.735407284.1592573194-881099705.1592573194

²⁶⁴ <http://www.ijstr.org/final-print/sep2013/Assessment-Of-Liquefied-Petroleum-Gas-lpg-Utilisation-In-Ghana-A-Study-At-Tarkwa.pdf>

²⁶⁵ <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

²⁶⁶ <https://openknowledge.worldbank.org/handle/10986/4391>

²⁶⁷ https://www.researchgate.net/publication/255623896_Women_and_Productive_Uses_of_Energy_Some_light_on_a_shadowy_area

²⁶⁸ <https://www.jstor.org/stable/24241302>

²⁶⁹ <https://www.ctc-n.org/resources/where-energy-womens-business-national-and-regional-reports-africa-asia-latin-america-and>

It is important that women have access to credit facilities for setting up and maintaining their business. The advent of self-help and women's savings groups often mean that women have mechanisms to access credit as long as they are not prevented by their family circumstances (a drunk and uncooperative husband!). Women led women to women selling of Solar PV products has been shown to be viable, and there is no reason not build into recovery plans women led women to women initiatives.²⁷⁰

Solar Sisters²⁷¹ in East Africa uses a "micro-consignment" model and partners with formal and informal women's organisations to market off-grid lighting, and combines sales with promoting mobile phone charging as a women's business, and using mobile banking and text messaging to communicate with the entrepreneurs and to streamline funds.



Figure 29 Gender equality in the energy sector²⁷²

7 Underlying concepts for CHEEG COVID recovery strategies

In the following section we conclude our journey through the intersect of Cooking, health, energy, environment and Gender (CHEEG), and COVID 19 recovery plans with a look at what those plans might best contain.

The above has outlined the case for focusing on this 'cooking' intersect. Action in this intersect would have many knock on effects and address the three main concerns resulting from Covid 19 (co-morbidity from Non communicable diseases, pressure on the health systems, economic recovery), and improve the journey to fulfilling SDG 3, SDG 5 and SDG 7, alongside action on climate change.

7.1 Supply and transition balancing acts

Covid recovery plans could create an opportunity to move a significant proportion of the population from biomass cooking to modern energy cooking services. To do this requires a number of balancing acts which are very context specific.

7.1.1 Balance decentralized responses with centralised

Investment in the electrical grid (either as a whole or inclusive of off-grid considerations) improves energy self-sufficiency, and potentially leads to an export with inter country connections. However, building substantial large-scale renewable energy generating capacity to feed into the grid does require time and significant investment. Building off-grid renewable energy can be done in a much shorter time span but still involves upfront investment.

Setting up new distribution models for LPG could be taken as a decentralized model, where the private sector fills in the last mile gap for refilling. Cylinder retention and safety protocols are what are important here.

²⁷⁰ <https://slidelegend.com/1-empowering-women-in-developing-countries-through-energy-for-59ec5a4a1723dddcba545329.html>

²⁷¹ <https://solarsister.org/>

²⁷² World Bank. 2020. *Gender Equality in the Energy Sector Calendar (2020 - 21) (English)*. ESMAP paper. Washington, D.C. : World Bank Group. <http://documents.worldbank.org/curated/en/408831583334669605/Gender-Equality-in-the-Energy-Sector-Calendar-2020-21>

7.1.2 Balance national finances

To substitute biomass based cooking with modern energy, either LPG or electricity, could be an opportunity to create more energy security, sustainability, reliability, safety and affordability or could in some circumstance increase pressure on the balance of payments.

Most countries import a substantial portion of the petroleum fuels and so the ongoing use of LPG would put an ongoing pressure on the need for foreign exchange. If LPG is subsidised this puts a further pressure on government funds.

Focusing on renewable generating equipment for electricity, potentially increases the capital investment but mitigates the need for ongoing exchange to buy in fossil fuels. It may be better to utilise capital available on renewable generation of modern energy rather than seek to burden a country balance of payments with ongoing, and potentially ever increasing, fossil fuels operating costs.

However, if the finance available is not a grant, both of these potential approaches require international finance and loans that can commit the country to ongoing repayments in foreign exchange.

We have noted that the economic downturn will be characterized by a loss of tourism as an export revenue, and perhaps by a loss of international remittances from migrant workers. Both these will put pressure on the treasury and national finances when attempting to either purchase oil based fuels or invest in and repay renewable energy technologies.

As we have seen, balancing the gender equation, particularly the role of cooking and its impact on health, power and equity, will need investment. Global, national and local levels of finance are required to meet both men and women's energy needs, and international climate funds, national energy budgets and other such instruments are required to address the gender equity balance within the energy needs portfolio.

7.1.3 Balance women's engagement in the supply chain

Use this as an opportunity to increase the number of women in the supply chain, whether that be women MPs making policy decisions, collecting agents for utility payments, women to women demonstrations of the new possibilities, or women engineers installing and maintaining.

We have framed this opportunity as an intersect of gender equity, modern energy and Covid. If populations are going to transition to modern energy cooking services, let these recovery plans explicitly include a gender balance in the planning teams, and explicitly preference women led enterprises.

7.1.4 Balance Demand

Balancing the household budgets is also important. Where urban and peri urban populations are spending real money on traditional or polluting biomass fuels, modern energy in the form of LPG or electricity can be substituted with minimal financial realignment. Context specific markets will decide whether LPG, electricity or the old fuels are the 'cheapest' in purely financial terms. Where electricity is being sold at a few cents per kWh, it can easily compete, especially where energy efficient appliances are used. The households may learn to do a more complex financial calculation where they realise (from watching their neighbours) that the extra controllability of modern energy can lead to lower energy use by the household. And if the household takes into consideration the air pollution, the health effects, the time saved and the cleanliness of the processes (saving clothes washing!), then the benefits of modern energy become more obvious.

However, where households do not pay cash for the traditional fuel and collect it, balancing the household budget may be more complex. While as outsiders we can see that household air pollution leads to health problems which cost money to solve, and the time taken to collect wood is time that could be spent on other productive uses, this is not an easy thing to see from the 'inside'. Just as governments need to consider the

pressure on the balance of payments, so too households undertake the same calculation. Converting households from collecting wood to paying for fuel could bring them into energy poverty.

On the other hand, the growth in urban environments does mean that more and more will be paying for their fuel. In the same vein, peri urban sprawl does mean that more and more have connections to electricity, and they are often fuelling their cooking with a mixture of purchased and collected biomass. When urban communities have ‘converted’ to modern energy cooking, it is more than likely that they will share their positive experience with their rural and peri urban cousins and aunties, and even they may start purchasing appliances for their relatives. “Auntie, I brought you this as a gift from the city”.

7.2 Focus on the potential impacts

Having been shocked by the advent of Covid and its impact on the world, Covid recovery planning teams need to focus on the potential opportunity, not dwell on how to get back to the past. Before Covid we were already on a pathway such that the number of people cooking with biomass would be the same in 2030 as today, with all the associated burdens (health, environment, economics, etc). Covid gives an opportunity to **do something other than business as usual**.

7.2.1 The benefit of improved health

The guidelines on household air pollution issued by WHO are clearly fulfilled by use of modern energy for cooking. Modern energy cooking is a strategy that matches the health targets set. However, as discussed throughout the document, modern energy is currently only fit for purpose in some specific market contexts. There is a genuine danger that households could be led into energy poverty if their only options are paid for cooking services when their previous experience was free wood that they just had to collect. The bartering of time for fuel is something that will likely be around for many years to come.

However, it is a matter of public health for the consumers to develop an awareness of both the real cost of fuel and the real cost of the impact on their lives. Strategies are required to promote health through adoption of clean cooking fuels and the role of women. Public Health working with the relevant departments of energy, could analyse the situations and markets that might affect household finances and health in tandem. Where appropriate they can then work with women’s organisations to support local awareness and health promotion campaigns.

7.2.2 The benefits on the environment

Using modern energy is clearly good for the local deforestation. Whether LPG or electricity, preventing the cutting of trees could enable the local environment to recover, creating better microclimates for better agriculture.

The contribution of biomass cooking to global climate forcing, is mainly through short lived black carbon. The literature variously describes this as



Figure 30 Lucy reminds us that this is about real people and real food.

responsible for up to a quarter of global warming although most acknowledge that it is a short lived climate forcing contribution. The 'short lived' aspect of black carbon suggests that its elimination by shifting to modern energy cooking would have an immediate and significant impact.

7.2.3 The benefits on the economy

There will be tremendous economic stress on poor families, and a strategy to move them to modern energy cooking could release household expenditure. Those living in urban centres could make significant savings over their current fuel expenditure, and the likelihood that charcoal prices are going to go up is very high, thus enabling them to save even more.

There will be a shortage of jobs. Migrant workers may come home from overseas and international remittance may reduce significantly, and tourism industry will lose many jobs. One downside of the proposed strategy might be the loss of jobs in the charcoal industry, however other than charcoal barons who are over exploiting forests, small scale charcoal producers especially women who tend to be responsible for the wood collection, could repurpose towards wood products, and/or make gains on food production from a better micro climate and soil condition. In contrast to the losses in the charcoal industry are the gains in the renewable energy sector. Home systems are best encouraged through females sales agents, renewable energy technology is a greater employer per kWh than most other industries.

The food industry particularly informal 'street' food is an important employer of women. There are reports of women starting new businesses that have provided cooked or pre prepared food during lockdown and strengthening those innovations would boost the economy. Preparing food for sale would be significantly easier with modern energy cooking.

Incorporating digital gains such as 'Pay as you go', and 'Uber eats' could enable employment and economic pivoting to a new normal.

Modern energy cooking holds the possibility of releasing women from hours of unpaid drudgery. The electric pressure cookers holds the potential for releasing women not only from collection wood or charcoal (from the forest or the market), but also of reducing the preparation time and releasing them to do other things even during the cooking time (which by the pressurization already is about a quarter of what it was). And easy washing up! This released time could be used for income generating activities – agriculture, informal food industry or paid work.

7.2.4 The benefits on gender equity

By engaging with women in this planning, by enabling their voice in preferences, and by ensuring they have equal access to the proposed solutions, a certain gender inequity may be addressed. Awareness raising of modern energy cooking will be necessary, and women to women dialogue is the best way to do that (either by face to face or digital social media). The presence of women in the informal food sector is already strong, and greater attention to that should strengthen their hands.

As discussed, the strategic use of electrical appliances could release women for more paid employment – or they could choose to take more leisure time. The key point is that they are released from unpaid drudgery and have more choice over their lives (although that often depends on their negotiations with their spouses!).

There is the tantalizing possibility that men may become more interested in cooking, and that even further time is released from women. There has been a move in developed economies to a more shared approach to cooking, and for whatever reason the ease of modern energy cooking has contributed to that shift. Women in Tanzania freely speculated that men might do more in the kitchen.

7.3 Leverage existing funds with recovery funding

We have noted that a major impact of the virus will be on the global economy. That will affect LMICs. Tourism, international remittances and global supply chains will be disrupted, and economies need to find alternative mechanisms for generating income. International remittances particularly in Asia will likely to be affected. What then do we need to substitute for these absences and to assist the economy to find its new balance point? As the EU says how can we 'Build Back Better'

7.3.1 Leverage of climate investment

There is a call for green recovery plans. Although we have talked about LPG, and that it has its place as a transition fuel, how much better would it be to create economies based on renewable energy technology.

With biomass cooking contributing climate change pivoting away from it can be counted in carbon credits. By transitioning from this carbon polluter (including its black carbon), the finance the world has already allocated for National Determined Contributions and international carbon finance can be leveraged to 'recover from Covid, improve the health of women and children, release women's time for the economy and implement a low carbon green strategy.

7.3.2 Leverage of urban planning

We know that urban migration in SSA and Asia has been, and pre-virus was, predicted to be significant. Africa, traditionally thought of as rural agricultural societies, was predicted to see the inward migration to urban centres reach 950 million by 2050. The post Covid situation could accelerate this. The lack of international migration will mean that households will seek income activities in urban centres. The myth that migrating to urban centres can offer job opportunities is only likely to increase.

Expansion of urban centres will need to be planned as much as possible. High rise solutions in city centres can mitigate transport needs for the wealthy but will create the possibilities of sprawling suburbs that supply low skilled workers. As residential areas are built, building homes with modern energy cooking services could be incorporated. Government and private sector could benefit from providing services, that mitigate the use of biomass (particularly charcoal) and ensure clean environments (clean both in indoor and outdoor air pollution). Investment in building schemes can be leveraged to include modern energy cooking services.

At the same time, if urban centres are to mitigate the carbon footprint of transport, they either need to be built in high rise centres (which do not lend themselves to polluting biomass cooking and therefore should have modern energy cooking service built in), or will encourage a shift to electric vehicles. With Bangladesh already having more than 1.5m electric tricycles offering public passenger services, there is a need to improved electricity generation and delivery. Again, this holds potential for leveraging the improvements in delivery infrastructure into modern energy (electrical) cooking services.

*"As it is in most European cities, people talk a lot about partnerships and community. Organisations that are in some sort of alliances appear to be better equipped to navigate the covid world. I guess it is no surprise considering that social capital is a crucial ingredient to resilience. With many out of work and uncertain about the future, colleagues say people are relying on social networks even more. Community-level problem solving will also continue to be critical, especially where the central government is unable or unlikely to deliver. **This could be an opportunity for local governments to shine.**" M Tesfamichael (private communication)*

7.3.3 Leverage tax collection

We have already discussed how households using formal energy services create income for the service provider, who can, if policies are put in place, pay appropriate corporation tax. In contrast to the informal charcoal sector

which does not deliver revenue to the treasury, formal providers give the government more opportunity for replenishing the spend on Covid recovery.

7.3.4 Leverage investment in youth

Youth are the most likely to transition to modern energy cooking services. Their cultural shift, particularly in urban centres opens the opportunity for more gender equity. Youth will require employment – it was a problem pre virus and will be more of a problem post virus in a downturned global economy. By focusing on youth, preferably a balanced invitation to both men and women, recovery plans could draw on job creation finance. Grants and soft loans could be harnessed to ensure that the informal cooking sector is enhanced, and women and youth are favoured in their innovation of services connected to modern energy cooking.

7.3.5 Leverage digital economic investment

We note the role of youth as likely early adopters of modern energy cooking services. They will utilize digital services to communicate new opportunities. We already see the role of social media in Kenya to communicate the possibilities of cooking with electricity and LPG.

Pay as you go mostly relies on digital services, by monitoring remotely appliance use and by giving mechanisms for payment. Any CHEEG Covid recovery plan in this intersect should include assessment of how to involve and engage digital infrastructure to strengthen PAYG offerings and future proof the solutions.

“Digitalising and adjusting business models are now being seen as critical to building resilience. Governments are also talking about easing cashless transactions. Consumers behaviour is changing rapidly and the private sector is responding. In Kampala, LPG suppliers have now started home delivery service. (some news articles on the ‘covid driven digital revolution’ [here](#) or [here](#) and [here](#)). Explore its use to promote an equitable approach to recovery.” M Tesfamichael (private communication)

7.3.6 Leverage the aspiration of a better life

Green economies, urbanisation, youth, social media are all about the future. The new normal from Covid has created a global reflection on who we are as a society.



Figure 31 Lucy, serving the food.

8 Conclusions

After illustrating how biomass based cooking constrains poor communities and particularly women on so many different levels the paper has outlined seven key strategies that address the intersect of cooking, health, energy, environment and gender within Covid 19 recovery plans.

- Integrate gender equity, cooking and economic stability into the planning of electrical networks.
- Include LPG in the toolkit of responses where appropriate?
- Identify transition finance
- Use lifeline tariffs to ensure inclusion of the poor.
- Balance increased tax collection with lifeline tariffs.
- Strengthen decentralised energy and governance systems
- Empower women within industry and governance

If these strategies can be put in place we believe we can build back the economy in a better way. The EU and the UK have adopted the slogan ‘**Build Back Better**’ primarily meaning a greater use of green energy. However, by expanding ‘Build back better’ to include the intersection within CHEEG, these strategies open the way for there to be **better** progress towards gender equity and the aspirations of SDG5. With these strategies in place the long neglected consumption of biomass for cooking could be transitioned to modern energy cooking, resulting in **greater progress** towards SDG7. With these strategies in place the economic downturn caused by the virus can be mitigated by creating **better** private sector responses to a huge market and **better** taxation and finance mechanisms for creating sustainable growth in renewable energy technologies, **build stronger** and more resilient economies.

The term Build Back Better has been used before. We believe it was first used after the Tsunami in 2004. It is easy to have aspirations to do something other than business as usual, but often the priorities after a shock are the short term; let us get business back up and running as soon as possible. Politicians are under pressure to ensure the economy gets back to working in the short term. So, while we hope this paper suggests a way forward, we hope readers will see that the strategies suggested here are implementable in the short term, and that they lead to a longer term resilience without compromising the short term.

Through the virus emergency of this first wave, throughout lockdown, people have continued to cook with biomass. Early data suggests that some who made the switch to LPG have reverted to biomass as LPG supply chains have broken down, and lockdowns have prevented people from going to shops. In contrast, there is also early data that suggests LPG and biomass users have purchased electrical appliances and are making greater use of electricity – a fuel they can use on a regular basis without going out their house.

In the short term, the strategy above could create jobs, and encourage a flow of finance. In this sense it will help get the economy back up and running. In the longer term it could build the economy in a better way.

The paper is a working paper and we invite comment on the ideas contained within it.

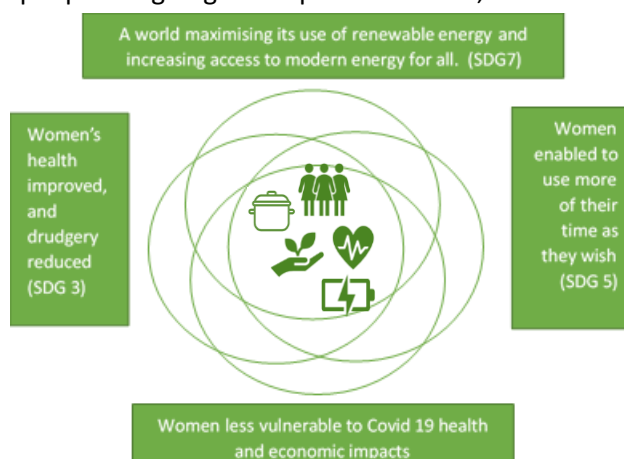


Figure 32 The intersectional nature of positive outcomes

9 Annex - Social change and impact after recovery plans

In addition to the effects on health, time, violence and the environment (climate change) in this section we briefly consider the demand for modern energy cooking, and our anticipated societal change (particularly the contribution to change in gender roles)

9.1 Modern energy cooking as an aspiration

There are many women who want LPG and electricity for cooking. Modern energy is “aspirational”. In recent trials of eCook and electric multicookers, women in Zambia, Tanzania, Kenya and Myanmar were effusing about how clean the technology was. They were not talking about the cleanliness of the air while cooking, but about how they started with clean clothes, and finished with clean clothes. To them this seemed the single most important aspect (Ref).

Modern energy for cooking is aspirational. It enables women to control the cooking process more precisely, it enables them to start and stop when they want, in the case of multicookers, the cooking process can to some degree be unsupervised enabling them to do other work, and it delivers good tasting food – the number one important factor.

There are constraints – LPG tends to be associated with fear of accidents – even an electric hotplate can seem a threat to children. Higher fuel costs depend on market specifics – LPG and electricity are unlikely to compete with wood that can be collected nearby for free. One may argue that collecting wood requires time and that time is money, and we have explored this in the main text. LPG can sometimes be cheaper than electricity and vice versa – it depends on the market specifics. And there may be supply issues, with intermittent delivery of cylinders, and blackouts and load shedding of electricity. Nevertheless, there are still **a growing number of women who are switching to modern energy and aspire to switch to modern energy**.

9.2 Can modern fuels change gender roles in cooking?

LPG and electricity are generally considered status symbols within developing countries. They are said to induce or correlate with more forward looking investments. There are literature that suggests that those adopting LPG reported increased status. Similarly, there are correlates between the adoption and use of LPG and electricity. The use of modern energy for cooking is both a function of acceptance (prompted by higher education), access (i.e. is it available), wealth (affordability) and aspiration (age).

Take the example of Cameroon. In their study Pope et al 2016²⁷³ report that “*Wood (40.7%) and LPG (51.1%) were the most frequently reported fuels, although the dominant fuels in rural and peri-urban communities were wood (81%) and LPG (58%) respectively. Fuel stacking was observed for the majority of LPG using households (91% of peri-urban and 99% of rural households). In rural homes, a higher level of education, access to sanitation and piped water and household wealth (income and asset ownership) were all significantly associated with LPG use ($p < 0.05$). In peri-urban homes, younger age, access to sanitation and piped water and increasing education were significantly associated with both any and exclusive use of LPG ($p < 0.05$). However, whilst household wealth was related to any LPG use, there was no relationship with exclusive use.*”

The existing correlates between wealth and age potentially muddy the water over whether modern energy cooking could change gender roles. Certainly women think they will. In focus groups in Zambia, Tanzania and Kenya, women stated clearly that by having a multicooker, they believed that their spouses might do more in

²⁷³ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6267519/>

the kitchen^{274 275 276}. They noted that even when men cook they fail to clean the pots and pans, and that heavily sooted pots dissuade men from cooking – modern energy cooking with its cleanliness could encourage men into the kitchen. This is supported in part by Annecke (2005)²⁷⁷ who found that access to modern energy services can facilitate shifts in gender roles and responsibilities in the domestic sphere – if backed by serious institutional and legal support by the State for gender equality. In Lag Valley in India, men and children started helping with cooking duties after the introduction of LPG²⁷⁸.

Winther 2008²⁷⁹ reported that men sometimes cooked with electricity but not with LPG in South Africa and Zanzibar. Winther attributes this to doing things which do not threaten their ideas on masculinity. Using ‘technology’ can speak to this.

This has been the case in UK. While cooking is still a very heavily gendered activity, there have been some movements between 1970 and today. And interestingly the greater movement has been among ethnic communities that one might not expect to change. Caribbean men for instance, one might think are more reluctant to cook than their European counterparts – and yet they are more willing.^{280 281 282 283}

In Himachal Pradesh (Parikh, 2010²⁸⁴) reported, “a clear pattern can be seen that as the fuel quality becomes superior, the role of women declines and that of men increases.” They noted that kerosene and LPG purchases were the responsibility of young men and women were not engaged in that part of the acquisition trail. In contrast in recent work in Ethiopia²⁸⁵ shows an alternative view, with women getting greater joint control of relevant assets in the household. The myth that men take all the technological purchase decisions is challenged by the Ethiopia data. Matinga, et al., 2013²⁸⁶ suggested that women may fear a loss of cultural identity, for example by being judged lazy if they switch from traditional wood stoves to modern LPG. The switch was said to transgress women’s gender roles. The urban rural divide may address some of this, as urban women change the gender norms more easily than those steep in a tight knit rural culture. In Himachal Pradesh, the introduction of LPG was made through community organisation focusing on organising women in savings and credit groups to access LPG connections. As a result of this approach, women gained confidence and their participation in gram sabhas (village assemblies aimed at ensuring participation in village-level decision making), their ability to articulate needs and issues in village meetings, and their visibility as a group increased.²⁸⁷

²⁷⁴ <https://mecs.org.uk/wp-content/uploads/2019/10/eCook-Zambia-FGD-Summary-Report-APPROVED-2-4-19-MECS-COMPRESSED.pdf>

²⁷⁵ <https://mecs.org.uk/wp-content/uploads/2019/10/eCook-Tanzania-FGD-Summary-Report-1-10-19-MECS-COMPRESSED.pdf>

²⁷⁶ <https://mecs.org.uk/wp-content/uploads/2019/09/NAIROBI-FGD-WITH-APPENDIX-JL-9-9-2019.pdf>

²⁷⁷ https://assets.publishing.service.gov.uk/media/57a08ca4e5274a27b2001317/R8346_finrep_annecke.pdf

²⁷⁸ <http://www.jagritikullu.org/LPG%20-%20Mamta.pdf>

²⁷⁹ <https://www.berghahnbooks.com/title/WintherImpact>

²⁸⁰ <https://www.thetimes.co.uk/article/original-flava-interview-we-are-part-of-a-new-generation-of-caribbean-men-who-are-happy-to-cook-nnmrr03d7>

²⁸¹ <https://nutritionj.biomedcentral.com/articles/10.1186/s12937-018-0347-9>

²⁸² <https://www.tandfonline.com/doi/abs/10.1080/15528014.2015.1088191>

²⁸³ <https://www.sciencedirect.com/science/article/pii/S0195666315300672>

²⁸⁴ Cited in <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

²⁸⁵ <https://mecs.org.uk/wp-content/uploads/2020/04/Ethiopia-Cooking-transitions-31032020.pdf>

²⁸⁶ <https://pubmed.ncbi.nlm.nih.gov/24161104/>

²⁸⁷ <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>

At an individual basis, women reported increased self-esteem, increased networking and interactions with government officials and greater mobility also increased²⁸⁸.

The advent of modern energy cooking could herald a greater intra household decision making process. As LPG and electric cooking go to scale, it is possible that men will get more interested in cooking (although they probably still will not wash up after themselves!). The concept of masculinity as found in traditional biomass cooking will not be challenged in quite the same way. It is interesting to note that many TV chefs are male, and that also may influence the acceptability of men cooking.

²⁸⁸ http://www.undp.org/content/dam/rbap/docs/Research%20&%20Publications/environment_energy/energy-plus/EE-2012-Case9-Jagriti.pdf

10 Annex – Research gaps

Undertake analysis on pre and post COVID transition mechanisms.

10.1 Transition barriers and drivers

It would be good to base recovery plans on evidenced experience, however there are to date very few impact evaluations of modern energy cooking services transition programmes. MECS and ESMAP have recently brought together a recent systematic review of transition factors in modern energy cooking, and this is available at [HYPERLINK](#) (World Bank 2020). Of note is the Andadari, et al., 2014 impact analysis of the Indonesia program although it shows the effect on economics, but not on gender equity.

10.2 Improved gendered time

A gender analysis of time use is that there are synergies, and short-term trade-offs, between and within market-oriented and household-oriented activities. According to Energia 2014, there have been studies following electrification of households on the effects on women's literacy and girls' education. There seem to be few studies on the development impacts of improvements in cooking, however most of these are on biomass fuels and so time savings are limited.

10.3 Improved gendered agency

We need more studies on the effects on intra household decision making, gender equity and balancing unpaid and paid work, and even domestic violence.

10.4 Infrastructure development and 'bundling'

Again Energia 2014 call for research on the synergistic effects of bundling of more than one type of infrastructure or development intervention. They note that studies have been conducted on electricity and water and electricity and education. However, they point to there being only anecdotal evidence about the synergistic effects of providing modern cooking and heating fuels together with other development initiatives. Perhaps the intersectional nature of the proposed CHEEG Covid recovery plans gives opportunity for research on 'bundling'.

10.5 Fuel stacking and health

The advent of modern energy cooking services will be very much mixed in with household fuel stacking strategies. As such the continuous but less frequent use of biomass is likely, mitigating the direct health effects of the Tier 5 cooking regime. It would be good therefore to have nuanced studies on the fuel switching processes and to ensure that health outcomes are realistically assessed. Lower emissions and hence lower exposures of female cooks to pollution when cooking with LPG have been well-documented (Energia 2014). However due to fuel stacking (continued use of multiple fuels), health outcomes can be ambiguous.

Beyond household air pollution, other public health impacts of switching to modern energy cooking has not really been examined. Is the reduction in collecting fuelwood enough to change the quality of life for the woman? This could also include statistics on accidents, fires and burns comparing LPG and electricity with kerosene and biomass cooking to provide cooks with clarity over the risks associated with each.

10.6 Modern energy stacking

A correlation has been found between electricity connection and adoption of LPG. More understanding is needed of how these two work together in practice and how to influence these. Is a "package" approach to fuel switching needed.

10.7 Impacts on the local environment

In the same way that rapid recovery of localised environments were seen during the absence of humans due to Covid 19 lockdowns, so too it would be good to document and note the recovery of forests, woodlands and agroforestry on the reduction of wood harvesting.

10.8 Impacts on urban environment

In the same way that localised deforestation may change quite rapidly, so too the urban environment could change. Not only should air quality be researched, but aspects such as access, mobility, safety and even security of tenure.

11 Annex Consider other fuels for ‘modern energy cooking services’

Beyond the two main contenders of electricity and LPG for a scaled response to transition to modern energy, there are other fuels that could provide a modern energy cooking experience. We focus on LPG and electricity because the supply chain is more established. LPG supply chains can be created in urban areas relatively easily and with PAYG, there are ever emerging opportunities for using it as a transition fuel. Electricity generation and use is growing. With energy efficient appliances new opportunities have opened up, making it not only affordable, but cheaper than most alternatives in urban locations, and making it a possibility in rural areas.

Nevertheless, we acknowledge that there are other clean fuels that could be classed as the basis of a modern energy cooking services.

11.1.1 Ethanol

Ethanol has been suggested as a clean alternative. The GIZ study on ethanol²⁸⁹ suggests the following advantages to ethanol as a fuel. Its renewable nature, its very clean combustion, instant heat, intrinsically cheap, the development of [alternative feedstocks](#), more applicable to local conditions, has the potential to improve yields, farmer income and food security

Because ethanol can be made from a variety of low-cost, simple feedstocks, it is an intrinsically cheap fuel. Ethanol fuel can be produced at a scale which suits the community in demand. For example, in Ethiopia ethanol is sourced from the government-owned Sugar Corporation to meet the cooking demand of several thousand households and ethanol for household energy use is recognised as an official priority of the [National Biofuels Policy](#)^[8]. In humanitarian interventions where energy for cooking is in large and urgent demand and resources are extremely scarce, ethanol stoves and fuel have proven successful²⁹⁰.

KoKo networks, a major new venture in Kenya, are combining the potential of the networks of fossil fuel stations with the dispensing technology of the digital world to develop a delivery system for ethanol which

“It uses smart canisters that dock with KOKOpoints to dispense fuel, which consumers have usually pre-purchased via M-PESA. Consumers then take their smart canister home to dock into their KOKO Cooker, a modern 2-burner ethanol stove that delivers affordable cooking energy.” “To place an order, consumers can either use our smartphone app or order from a KOKOpoint screen. KOKOpoints are easy to find – consumers can simply visit the KOKO Fuel website to find their nearest KOKOpoint. The brand new KOKO Cooker is delivered

²⁸⁹ https://energypedia.info/wiki/Cooking_with_Ethanol_and_Methanol

²⁹⁰ <https://www.sciencedirect.com/science/article/pii/S0973082618302722>

to the same Agent shop as soon as payment is complete; when it is collected, consumers can fill the personal, reusable fuel canister instantly at any KOKOpoint.”²⁹¹

Certainly, there are a number of innovative ethanol based responses. Cape town municipality in South Africa for instance provides the poorest households with a monthly ethanol allowance.

Alcohol fuels are increasingly recognized by the international community as a clean liquid fuel solution of the future. Ethanol and ethanol-based gel-fuel are quite common in niche applications, where clean combustion, safety and convenience are required: e.g. marine markets, camping, catering services and restaurants.

“Disadvantages using ethanol as a cooking fuel:

- Low heating value when further diluted with water to make gel-fuel - Basic monitoring suggests that many people appreciate the cleanliness but are disappointed by the speed at which it can cook food. New ethanol cooker designs seem able to speed up the cooking process, and produce a higher temperature flame, so technological fixes are not beyond possibilities.
- High flammability, burns at low temperatures
- In health terms, ethanol causes dryness to the skin and should not stay on the skin for long time. If ingested, it causes intoxication and large quantities can cause damage to the nervous system (as with drinking alcohol). Ethanol should always be denatured and dyed before distribution to prevent unintentional eating.
- It can be difficult to establish a fuel supply chain in conjunction with developing a market for a new stove
- The large scale ‘mono-agricultural’ production of ethanol can be environmentally and socially damaging in developing countries”

See also²⁹²

There is however a potential issue with the supply chain and access to quantities of ethanol even with the kinds of solutions being proffered by koko networks and other innovative new entrants. The world has started to blend ethanol and derivatives into the transport sector fuel chain, and this has led to controversy about whether to grow sugar for food or for energy. Certainly most governments are currently limiting the amount of ethanol that can be used for fuels (even for cooking).

11.1.2 bioLPG and biogas

bioLPG is an option of turning crops into a substitute for the fossil fuel based LPG, with all the associated benefits of the LPG cooking experience. Calorgas the UK market leader introduced BioLPG into the UK in 2018 and plans to shift entirely to BioLpg by 2040²⁹³. However, it too is currently derived from oil palm and vegetable oils, and oil palm plantations can be controversial in terms of clearance of forests.

²⁹¹ <https://www.itnewsafrika.com/2019/09/interview-projects-delivering-technology-for-life-in-africa/>

²⁹² <https://www.sciencedirect.com/science/article/pii/S0973082617305458>

²⁹³ <https://bioenergyinternational.com/biogas/calor-introduces-biolpg-uk-sets-target-fully-renewable-2040>

Biogas is another fuel that could deliver a clean cooking modern energy experience. My family used biogas for our cooking for three years, and I know that when managed, it can respond just like LPG. However while biogas has many advantages on paper, it has failed to reach scale in most countries^{294 295}.

New approaches are being attempted with pay as you go, utilisation of municipal waste and sewerage, and exploration of bottling the gas, but none of these have a clear path to scale yet and therefore while they can form a part of the intersection recovery plans, they are unlikely candidates for a route to scale.

11.1.3 Tier 4 and above only please

As programme coordinators for the UK Aid funded programme Modern Energy Cooking Services, we focus on reaching Tier 5 stoves. Definitions of what modern energy cooking services are, are still evolving. The programme is described in the paper 'Two Birds, One Stone' Batchelor et al 2019.

However, realities suggest that biomass cooking will continue for some considerable time particularly in rural areas. Over the preceding pages we have stressed the massive significance of the shift to urban poverty and its implications for fuel choice and availability and we have acknowledged the many ills and burdens of biomass cooking for women, but the inertia of society, tradition, resource management, government policy all conspire such that rural areas with a low density of households will likely utilise biomass for the foreseeable future.

Should COVID 19 recovery plans be used to accelerate access to clean cooking, we appeal for nothing less than tier 4 solutions to be contemplated. It is important to note that the new Multi-Tier Framework acknowledges the context of the cooking, not just the fuel (see below 5.4.2). We therefore acknowledge that programmes that encourage tier 4 cooking experiences are a way forward.

However, whilst tier 4 responses would certainly address elements of the needs of those with access to modern energy cooking services, they would not be transformative, they would not leverage prior and ongoing investment in electrical infrastructure, they may alleviate some of the gendered health concerns but they would only partially release time for women and only partially mitigate environmental deforestation and climate emissions. We therefore call for tier 5 responses to be a made a strategic priority within Covid recovery plans as part of global commitments to 'build back better.'

11.1.4A Multi-Tier View?

As the multi-tier framework emphasises ventilation plays a significant role in household air pollution (IAP) levels. Jaiswal found no difference in lung function in healthy non-smoking women who used either biomass or LPG as their sole cooking fuel. The researcher attributed this finding to good ventilation²⁹⁶ and outdoor cooking among the biomass users. Abalak, et al., 2001 found that PM concentrations were reduced by an improved biomass cookstove by 85% while LPG users only by 45%. Again the attribution is to fuel stacking, and that LPG users also had open fires²⁹⁷.

Significant improvements in relation to ventilation (design features (chimneys) and behavioural factors (opening windows) and kitchen placement (moving to outside cooking) are all possible and relatively cost effective

²⁹⁴ <https://www.sciencedirect.com/science/article/pii/S0973082618302497?via%3Dihub>

²⁹⁵ <https://www.sciencedirect.com/science/article/pii/S1364032116308280>

²⁹⁶ https://www.researchgate.net/publication/256076035_Ventilated_cookstoves_associated_with_improvements_in_respiratory_health-related_quality_of_life_in_rural_Bolivia

²⁹⁷ <https://www.tandfonline.com/doi/full/10.1080/10810730.2014.994246>

mitigations of household air pollution. However, all these require even stronger behavioural elements or end up pushing the problem more widely back into the neighbourhood^{298 299}.

An interesting point often made here is that biomass behaviour change involves persuading people to change their behaviour without necessarily having a reason to do so beyond some complex motivations around health. Adopting modern energy cooking also involves behaviour change but is change that can save considerable amounts of time and money which provide very different motivations for that activity.

WHO (2006) states that a significant investment in Tier 4 or 5 stoves such that household air pollution is actually reduced would repay itself many times over in improved health (and lower pressure on the health system) and economic benefits. This is why the intersect with the CHEEG nexus and Covid becomes so important. But what is the best way to achieve the WHO targets? The above discussion suggests the unlikelihood of getting there via improved biomass cookstoves given the behavioural challenges involved in adoption of effective ventilation challenges

At some points in this paper we have used the term 'Tier 4' for the cooking experience. Pellets stoves fall into this category, as long as other MTF factors such as ventilation are in place. It is perhaps worth noting that the potential climate and health benefits of the pellet stove approach those of gas stoves³⁰⁰. Compared to cooking over a three-stone fire, the pellet stove reduced emission rates by approximately 90% or more for most measured pollutants (black carbon, particulate matter, and carbon monoxide). Therefore the climate impacts of the pellet stoves are negligible when the pellets are produced from renewable sources, such as gathered wood or agricultural waste, and when using renewable energy to power pellet production. Although the pellet stove exceeded the particulate matter emissions target for the World Health Organization indoor air quality guidelines, it neared the interim target, offering drastic improvement over traditional stoves, and the pellet stove met the guideline for carbon monoxide emissions.

However, stove maintenance and customer support programs are critical for ensuring that stoves perform as designed once they are off the shelf and in customers' homes. Emission levels are still higher than electricity and biogas; supply chains are an issue; stoves tend to be expensive, business model still not verified.³⁰¹ We don't recommend pellet stoves as core to Covid recovery plans because establishing a pellet production facility in central Africa is costly and complex. and sign-up fees and minimum purchase packages are not favourable for scale-up. **Better to invest in the multiple wins of modern energy unless there are specific reasons to not do so.**

²⁹⁸ <https://www.sciencedirect.com/science/article/pii/S2214629618301907>

²⁹⁹ <https://www.spectrumsdkn.org/en/home/other-sectors/energy/420-ventilation-behaviour-change/file>

³⁰⁰ <https://www.cleancookingalliance.org/about/news/06-05-2019-new-research-finds-that-an-advanced-biomass-stove-and-fuel-reduces-climate-and-health-damaging-emissions-almost-as-much-as-a-gas-stove.html>

³⁰¹ <https://www.sciencedirect.com/science/article/pii/S0973082618302801>