WORKING PAPER
September 2020

BEYOND A NEW NORMAL

The energy access landscape after Covid-19

SUMMARY

Covid-19 (CV19), and measures being taken to limit its spread are hitting people, livelihoods and economies around the world hard. How will this affect the energy access landscape in developing countries and what are the implications for future energy access delivery?

The interactions between energy access and CV19 are multi-faceted. Indoor air pollution from traditional, "dirty" fuels used for cooking increases vulnerability to CV19, while access to modern energy is vital at all stages in responding to CV19.

An immediate focus has been on providing energy as an essential service to enable people to stay at home and maintain social distancing. Meanwhile energy companies are struggling and the financial viability of many is threatened; staff are losing jobs and commission-based employees are unable to earn a living wage. Even after the immediate effects of CV19 have ebbed, its economic impacts will carry over into shrunken markets, customers with less money, fewer companies and less funds to invest as part of the wider economic downturn.

Alongside direct, local effects, measures taken elsewhere have rippled through the global economy to hit developing countries, with the deepest and widest recession in over 80 years expected. These economic upheavals are hitting the poor hardest, with at least 60 million people expected to fall into extreme poverty. Together they will transform the landscape for future delivery of energy access and SDG7.

One result of the pandemic has been a welcome increase in focus on electrification of health facilities (and other social infrastructure), raising opportunities to support electrification of wider communities. (Less attention is so far being paid to the need for energy for heating and cooking in health facilities.)

CV19 has also highlighted the need for clean cooking to reduce respiratory disease and hence vulnerability to infection and the burden it places on health services. This recognition combined with falling LPG prices and lower demand for biofuels for transport may offer opportunities for large scale transition to clean cooking fuels.

Lower fossil-fuel prices have been one of the highest profile impacts on the energy sector. While this makes it more difficult for renewable modern energy to compete it may also drive down prices for renewable energy products, providing opportunities to move to modern energy at lower cost than would previously have been possible and for subsidies to be transferred to renewable off-grid energy options.

As CV19 (we hope) recedes, stimulating economic recovery will become the priority with the aim of creating employment, incomes and demand, while providing infrastructure and building human capacity to support longer-term growth. It's critical that off-grid energy access for poor people – which will provide employment; can be deployed rapidly; supports productive uses and economic growth; enables health and education services; and reduce carbon emissions - is included in stimulus packages.

BACKGROUND

The global CV19 pandemic has created a paradigm shift in the context within which people seek to harness the transformational power of clean, affordable energy. It has focussed a spotlight on combatting the virus and reducing people's vulnerability to it (and future pandemics), and the role of energy access in achieving these goals. At the same time, steps taken in response to CV19 are affecting both energy access and the economic background for future energy provision. National and international efforts to re-boot economies are likely to result in further, massive, changes in patterns of public and private expenditure, which will in turn impact on energy access provision.

This note looks at the role of energy access in addressing CV19 and how CV19, and the measures taken to limit its spread, may affect people, livelihoods and economies in developing countries. It goes on to consider what the energy access landscape may look like in the aftermath of CV19, and how we can respond to the challenges and opportunities it creates to accelerate energy access provision.

ENERGY AND HEALTH

The nexus between energy and health is multi-faceted. Access to energy is vital for health service delivery – electricity is needed to operate health facilities, from lighting in wards to powering medical equipment, testing and diagnostics, sterilization of instruments and refrigeration of vaccines. Alongside specialist uses, energy is needed to pump water; wash clothes and sheets (vital to limit the spread of infection) and cook food for patients and staff.

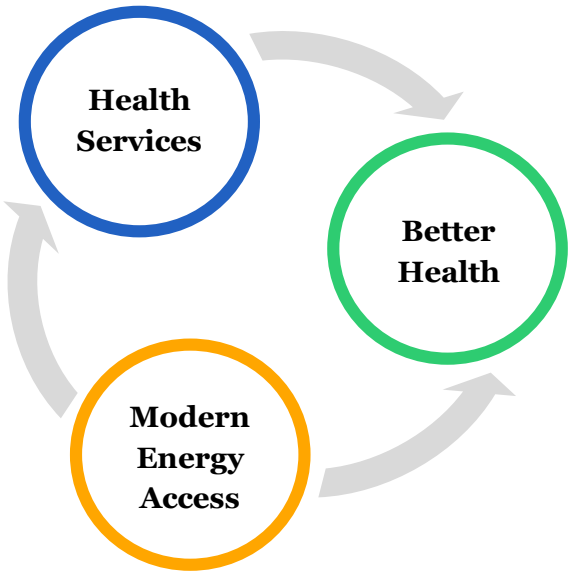


Fig 1 – The Energy-Health Nexus

At the same time lack of modern energy access itself creates ill-health – emissions from traditional stoves, lamps and fuels are a major cause of respiratory and cardiovascular diseases and cancer, with the World Health Organization estimating that they result in some 3.8 million additional premature deaths per year worldwide[50]. Kerosene stoves and lamps cause deaths and serious injuries from scalds, burns and poisoning. The physical burden of collecting traditional fuels and carrying out household and productive tasks without powered devices also affects health. All these health impacts fall disproportionately on women and children who spend most time in kitchens and often carry the bulk of the responsibility for fuel collection, cooking and other household, as well as many productive, tasks.

CV19 & ENERGY ACCESS

CV19 spreads through interconnection and interaction between people. In the absence of vaccines or effective drug treatments, the focus in most countries has been on reducing infection - initially by the blunt instrument of **lockdown** to bring the level of infection down to a point where a combination of hygiene measures; **social distancing**; and testing, tracing and isolating contacts can contain the rate of infection until ultimately (it is hoped) vaccines and/or new treatments can be developed. Lockdowns and social distancing require strong communication and messaging. Essential services (food supplies, water etc.) are needed to enable people to remain at home and water is needed for hand hygiene. Energy (e.g. fuel for cooking) is both one of the services needed to support life during lockdown and a key input to other services such as water, sanitation and hygiene (WASH) and communications[32].

Testing and tracing can allow social distancing measures to be loosened but require testing capacity, laboratory and diagnostic facilities[34], all of which need reliable electricity[32], and good communications infrastructure to support feedback of test results and contact tracing so electricity is also needed for network coverage and to keep phones charged without visits to charging kiosks (risking infection).

There is some suggestion that fine particles, such as those from **"dirty" cooking fuels,** may provide a means of transmission for the CV19 virus[35] and so increase spread of infection. They certainly lead to a range of conditions including pneumonia, heart disease, pulmonary disease and lung cancer, many of which have been identified as increasing vulnerability to the effects of with CV19[47], and a study in USA found that higher environmental particulate matter levels were associated with increased CV19 death rates[57]. Thus, use of traditional energy for cooking seems likely to increase death rates from CV19, reinforcing the need to accelerate the move to clean cooking solutions to reduce future vulnerability. Sadly, however, the health benefits of doing so are likely to take some time to materialize.

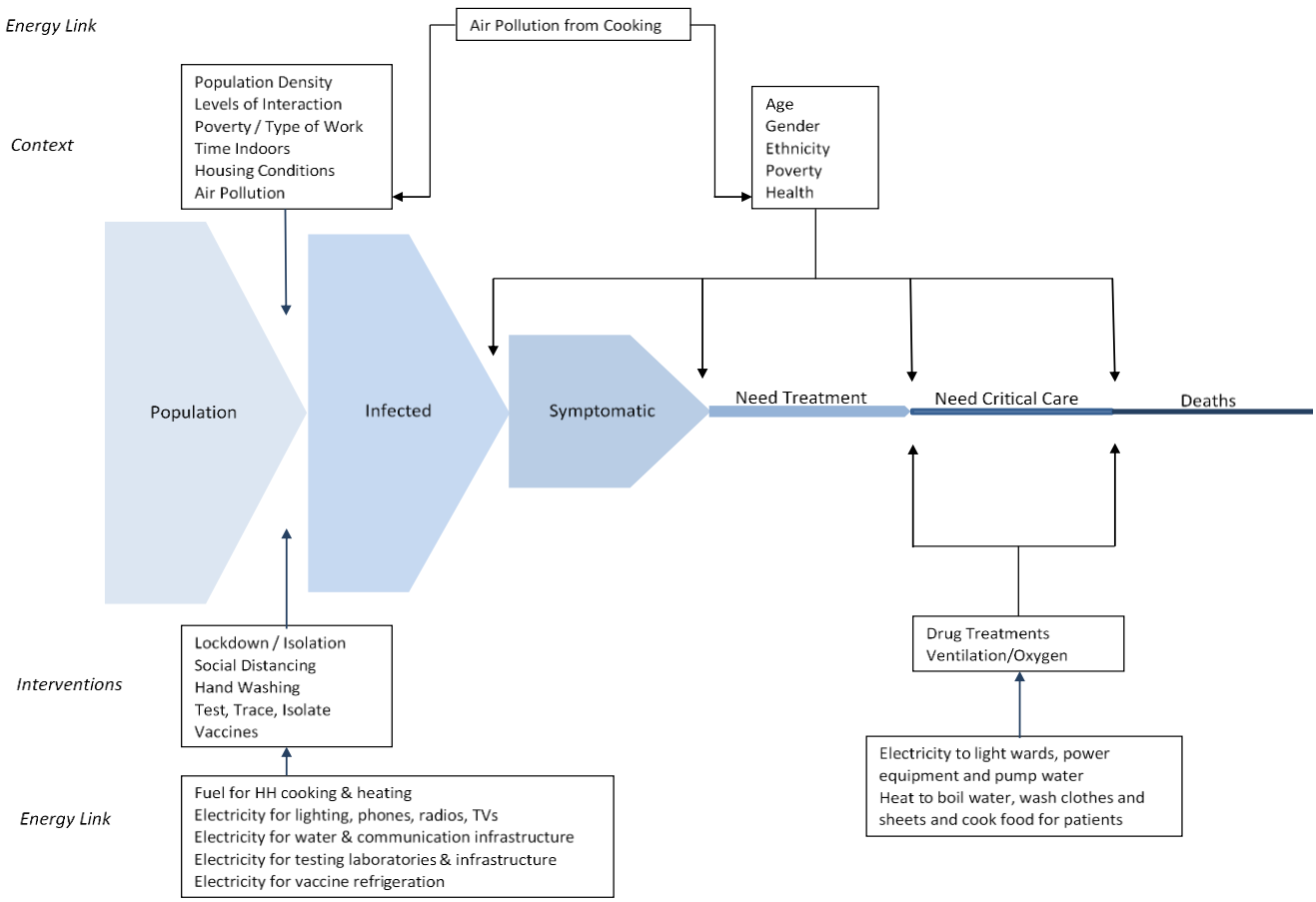


Fig 2 – Contextual Factors, Interventions and Energy Requirements along CV19's Path

[i] As a parallel, it has been estimated[39] that it takes 5 years for the risk of cancer in those who give up smoking to fall by 40%.

Only a relatively small proportion of those infected suffer significant illness[12,30] and an even smaller percentage (probably <0.5%) actually die[37]. How severely people are affected seems to depend on a range of factors including age[37], gender[17], underlying health[47] and socio-economic factors[48].

There has been much **speculation that people in developing countries may be less susceptible** to CV19, though this hope has been partially dissipated by rising levels of infection in Latin America, India and South Africa. It is certainly true that developing countries are generally less connected, with higher proportions of their populations in rural areas (alongside crowded mega-cities), and that people in developing countries often spend more time outside where the virus is less easily transmitted. However, while these factors may slow the virus' spread they will not stop it, and where people live crowded together in informal urban settlements, have to go out to work in order to eat, and lack clean water, it is very difficult to implement social distancing.

Populations in developing countries are generally younger than in Europe and USA and the effects of CV19 are less severe in younger people - this might reduce deaths by half or three quarters[14,37,47]. Conditions such as obesity and diabetes, which increase vulnerability to the effects of CV19, are also less prevalent in Asia and sub-Saharan Africa[49,54], but the reduction in those requiring critical care expected as a result of, for instance, lower levels of obesity would only be ~20%[8]. And even these reduced percentages applied to whole populations would result in horrifying consequences, with up to 40 million deaths globally being predicted[47]. The reality is that no-one, even medical experts, yet understands how this virus will progress in different contexts and we cannot assume that countries which have been relatively little affected so far will continue to be "safe" from it.

In addition, many developing countries lack health facilities where CV19 can be treated - on average, governments in developing countries spend only about 3% of the global per capita average on health[55], and more than 50% of the world's rural, and 20% of its urban, population lack legal health care[46]. This is reflected by the tens of thousands of health centres across low- and middle-income countries which lack adequate access to energy, with only 28% of health facilities in parts of Sub-Saharan Africa estimated to have reliable electricity[2]. Without this energy, it is impossible to treat those with CV19 – treatment options such as ventilation will be unavailable, as will diagnosis and testing, and even basic services such as lighting, hand-hygiene, water pumping, washing sheets and clothes.

The ultimate hope is for a **vaccine**, which will allow rates of infection to be minimized without onerous social distancing measures, together with simpler and more effective treatments to mitigate the need to avoid infection[16]. A number of potential vaccines are being pursued – and are likely to require refrigeration which in turn requires reliable electricity.

Modern energy access is thus vital at all stages in the response to CV19, as summarized in Figure 3:

Lockdown	Energy for Households: • Fuel for cooking and heating • Electricity for lighting, phones, radios, TV etc Electricity for Water & Communication Infrastructure
Social-distancing & hand washing	Electricity for Water & Communication Infrastructure
Testing & tracing	Electricity for laboratories, diagnostic facilities and communications Electricity for households to charge phones
Vaccination	Energy for Health Facilities for refrigeration to maintain vaccine cold chain
Reducing Impact of Infection	Modern Cooking lowers air pollution (but health impact longer term)
Treatment	Energy for Health Facilities: • Electricity to light wards, power equipment and pump water • Heat to boil water, wash clothes and sheets and cook

Fig 3 - Roles of Energy Access in Responding to CV19

ECONOMIC AND SOCIAL IMPACTS OF CV19 & ITS CONTAINMENT

CV19 and the measures taken to limit its spread are having a massive impact on economies around the world. Food and agriculture chains have been disrupted[1] and food prices have risen, raising concerns about food security, with acute hunger potentially doubling in 2020 to affect more than 260 million people[56]. The education of millions of children has been interrupted, with school closures in over 190 countries affecting more than 90% of the global student population[45], inevitably reducing future economic prospects.

Demand for non-essential goods has plummeted while travel, production and supply chains have been disrupted. This double supply-demand shock is having a devastating effect, with the poor; those working in SMEs; daily wage earners; the self-employed particularly in the informal sector; and women being hardest hit[28,46,53].

Alongside national measures, actions taken across the world have rippled through the global economy to hit developing countries[29,36]. Oil and commodity exporters (such as Bolivia, Peru and Zimbabwe) are amongst those worst affected as prices have plunged[51]. Oil importers (including Bangladesh, Kenya and Nepal) have benefitted from lower

prices, but Bangladesh, Nepal and other countries with economies focussed on manufacturing clothing and similar goods, remain among the worst affected[1]. Countries such as Nepal and Rwanda, which are heavily reliant on tourism, have also been hit hard[36], while massive job losses have been seen amongst migrant workers[46], with immense hardships for workers and loss of remittances (the largest source of foreign exchange earnings for developing countries in 2019[53]) affecting, for instance, Senegal and acting as a mechanism for loss of urban employment to impact on families and rural communities[1,25]. Overall there was a 14% drop in global working hours in the second quarter of 2020, equivalent to the loss of 400 million full-time jobs[21] and the global rate of unemployment is expected to climb to its highest level since 1965 (when records began)[53]. The world is entering the deepest global recession since WWII, and the widest since 1870, with global GDP forecast to contract by 5.2% and per capita incomes in the vast majority of developing countries expected to shrink, pushing at least 60 million people (mainly in sub-Saharan Africa and S Asia) into extreme poverty[11,27,28,53].

It seems inevitable that this disruption to lives and livelihoods, loss of income and employment, firms going out of business, interruption to education and loss of nutrition will cause lasting damage. Though some recovery may be expected once the pandemic is brought under control and social restrictions start to ease, it is becoming apparent that early hopes of a "V" shaped recession and quick recovery were over-optimistic and that CV19 will affect the economic position for years to come and drive (or at least accelerate) further structural shifts in the global economic landscape, the consequences of which for developing countries are extremely hard to predict[25,44].

Alongside immediate relief measures for the most vulnerable and to enable businesses to survive and maintain employment in the short-term, many developing countries have put in place macro-economic policies to maintain financial resilience and promote demand during the crisis, including reducing interest rates and encouraging temporary loan repayment holidays[6,53]. However, government support in low income countries has, even as a percentage of GDP, been limited to a fraction of that in developed countries[24]. Developing country resources are being absorbed by the need to strengthen weak health systems[46] and depleted by lockdowns and social distancing, as well as falls in remittances, commodity prices, and income from exports and tourism.

Record capital outflows[10] and falling foreign direct investment[43,44] are contributing to rising fiscal deficits, public debt and risk of sovereign default, higher government borrowing costs and weakening currencies[10,41,44]. Some steps have been taken to provide debt relief[22,52], but this covers only a fraction of total public debt built up[42], while overall development aid is expected to fall at least in line with GDP in donor countries. Not only are people in these countries suffering greater hardship during the pandemic, but their governments' capacity to support recovery is being undermined.

As CV19 (hopefully) recedes and recovery becomes possible, attention will turn to creating jobs to provide incomes and so stimulate consumption and demand, as well as building infrastructure (roads, communications, energy etc.) and human capacity (education, health services, etc.) to support longer-term growth. Many, including IEA[20], IRENA[23], and leading economists[18] have suggested that stimulus investment should do double-duty by also greening the economy and reducing carbon emissions. Whether national governments with depleted resources will be able, or the international community will have the vision, to make these investments remains to be seen[15].

THE POST-CV19 ENERGY ACCESS LANDSCAPE

Just as CV19 is re-shaping the wider social and economic context, it is also transforming the energy access landscape. Progress towards universal energy access is being severely disrupted by CV19[19]. In the short-term, households and other customers have less money for modern energy and cannot reach points of sale for off-grid solar, cook-stoves and fuel, even if they can afford them. Off-grid energy companies are similarly struggling to access supplies or to reach customers; commission-based employees are unable to earn a living wage; and with customers unable to afford products, the financial viability of many companies (across the full range from small off-grid and mini-grid companies to large utilities) is threatened. 69% of Global Distributors Collective members have reported reduced sales and 17% have ceased operations altogether[9]. 85% of off-grid energy companies will struggle to survive for more than 5 months[13], putting some 370,000 jobs at risk[33].

With energy recognised as essential to maintain lockdowns and social distancing, efforts are being made to enable households to get fuel, utilities to continue operating and companies to survive to provide future access. Support is being made available to energy companies[40] but it's not clear how much of this funding is reaching off-grid companies, particularly smaller companies – a recent survey[13] indicated that only ~20% had been able to access funding (of which just 8% was CV19 support grants), while ~30% had benefited from tax deferrals and other government support and most had received no assistance.

Even after the immediate effects of CV19 have ebbed, these impacts will carry over into shrunken markets, with customers having less money to spend in a globally depressed economy, fewer companies and those which survive having less funds to invest. Prospects for international investment in energy infrastructure in developing countries, particularly by China in Africa, must also be in doubt[7]. Reduction in foreign investment would hit plans to extend and strengthen grid infrastructure and grid-connected

generation and intensify the need for off-grid energy. However, as discussed above, without support many off-grid companies will not be around in the future and as a result perhaps 12 million people who might have been expected to gain access to electricity, and 85 million to clean cooking, each year over the next few years[ii] will not have that option. Furthermore, an even greater number who already have clean energy may lose it as they are unable to access replacement products. New companies may emerge to meet demand as economies recover post-Covid, but this will take time. We are in danger not just of losing progress towards universal energy access, but of seeing levels of access reduce.

Despite these dark clouds over energy access, there are some glimpses of light. One result of the pandemic has been a very welcome increase in focus on electrification of health facilities (and to a lesser extent WASH and communications infrastructure) with increasing recognition of the importance of energy to treat patients, support children's education, pump clean water, and for people to access information[19,40] and of the extent of the lack of energy access (in sub-Saharan Africa, for instance, only 28% of healthcare facilities and one third of schools have reliable electricity)[32]. We must ensure that that these needs are not addressed in isolation (producing a solution that meets immediate healthcare or education needs but, by carving this demand out of the energy needs mix of the wider community, preventing economies of scale and aggregation being achieved and so potentially making future provision of wider energy access less economic). Instead health facility electrification should be leveraged to support electrification of the wider communities in which they sit. This will require integrated planning and development of inclusive models through which investment in energy for health, WASH and communications facilities can enable wider community access.

Less attention is so far being paid to the equally essential, though less glamorous, need for energy for heating and cooking in health facilities – for washing clothing and sheets, for patients' and staff meals and, in colder regions, for space heating. These needs too must be addressed if we are to be in a position to treat people in a pandemic situation (and generally).

The spotlight CV19 has thrown on respiratory health has also raised the profile of clean cooking as a means of reducing vulnerability to future pandemics and removing a burden on health services[32]. At the same time, LPG prices have fallen alongside other fossil fuel prices[5] and so become more competitive with traditional biomass for cooking, while demand for biofuels for transport (largely driven by regulatory requirements to mix biofuels with petrol and diesel) is also expected to contract[51]. This may open up opportunities for transition to cooking with bioethanol and LPG (which while fossil-based meets health requirements and so provides a stepping-stone to longer-term renewable solutions).

[ii] Estimated from figures in IEA, IRENA, UNSD, World Bank, WHO. 2020. Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC. © World Bank. License: Creative Commons Attribution—Non Commercial 3.0 IGO (CC BY-NC 3.0 IGO)[19]

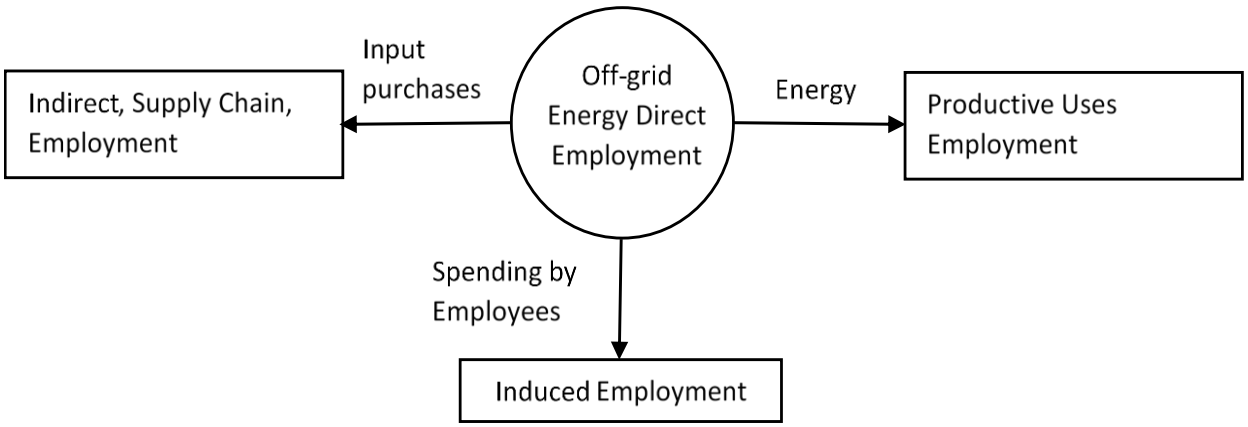
With oil prices ~2/3rds of pre-CV19 levels and not expected to recover to where they were before the pandemic for several years[51], it will be more difficult for renewable modern energy to compete with fossil-based alternatives, particularly when users are facing falls in income and more precarious livelihoods. However, it also provides an opportunity for fossil fuel subsidies to be reduced and/or transferred to renewable off-grid energy options.

Slower global growth in new renewable electricity capacity is also expected to lead to excess solar PV and wind generation manufacturing capacity[20] and hence, combined with lower oil prices, potentially drive down renewable energy prices further - offering an opportunity to make the fossil to RE transition at lower cost than would previously have been achievable.

As CV19 (we hope) recedes, economic recovery will become the priority and the question will be how to stimulate this recovery by using public investment to create employment, incomes and demand, while also developing infrastructure and human capacity to support longer-term growth.

Off-grid energy access provides an excellent means of achieving these objectives. An estimated 25 jobs are created for every 1000 customers with a minigrid connection or solar home system (SHS)[38] - this implies that bringing electricity to the 789 million[19] people who currently lack it could create some 4.4 million jobs. In addition to employment directly in the off-grid energy sector, jobs would also be created further up the supply chain (in manufacturing and assembly of equipment) and in service providers[31], and through "induced" jobs created as a result of additional demand for other goods and services by the incomes of those directly employed – taken together these might be expected to generate ~7-8 times as many jobs as those created directly[26].

Productive uses of newly available energy also support additional employment with approximately twice as many jobs estimated to be created by productive use of electricity as directly in the off-grid energy sector[31]. At the macro-economic level, it's estimated a 1% increase in electricity availability in Uganda in 2011-14 led to 0.06% increase in GDP[26].



Off-grid energy solutions can be deployed more rapidly than large-scale infrastructure projects,, without extensive planning and licensing processes, and brings a mix of formal and informal employment embedded in local communities. Off-grid renewable energy access also brings many other benefits alongside economic advantages including better health, improved communications, and reductions in carbon emissions and de-forestation. For example, it has been estimated that providing clean cooking pays back $9 for every $1 spent in economic, health and environment benefits[38]. Rapid growth in the off-grid energy sector, and the employment it supports, will also need investment in training in a range of skills from technical to sales and marketing and business administration, in line with the objective of building human capacity for economic growth.

The off-grid energy sector needs to make the case to include modern energy for poor people in government stimulus packages, on the basis that it will provide employment (especially for young people and women); can be deployed rapidly; will support productive uses and economic growth; improves health and resilience; and reduces carbon emissions[3,4,18,23,38]. Developing countries, whose resources have been depleted by lower revenues; the urgent need to strengthen weak health systems; capital outflows; weakening currencies and higher borrowing costs, will need support from the international community for this investment.

CONCLUSIONS

The global social and economic landscape will be fundamentally changed by CV19. What comes after it will be heavily affected by government (and international) policies, how much public investment is available and how it is directed. At present, the focus is on maintaining essential services and supporting people and sectors which have been adversely affected (including energy access). Beyond that attention will turn to strengthening health services and resilience to future outbreaks, and in the longer-term to economic recovery and investment in sectors which can provide employment and generate demand. The development sector needs to make the argument for prioritising support to developing countries in rebuilding their economies, and to poor and disadvantaged people (including women and remote communities). In particular, those of us working for energy access need to ensure that actions taken in response to CV19 enable wider energy access, and that off-grid energy is included in economic recovery packages. To achieve that we must make the argument to economic and financial policy-makers that off-grid energy will support employment, productive uses and economic growth; improve health and resilience; and reduce carbon emissions.

BIBLIOGRAPHY

1. Acosta, A., Evans, D. 2020. The Economic Impact of COVID-19 around the World: A Round-Up of the Most Recent Analysis. [Online] Center for Global Development. Available at: https://www.cgdev.org/blog/economic-impact-covid-19-around-world-round-most-recent-analysis [Accessed 7th August 2020]
2. Adair-Rohani, H., Zukor, K., Bonjour, S., Wilburn, S., Kuesel, A., Hebert, R., et al. 2013. Limited electricity access in health facilities of sub- Saharan Africa: a systematic review of data on electricity access, sources, and reliability. Global Health Science Practice. doi: 10.9745/GHSP-D-13-00037
3. Alers, M. 2020. How clean energy can power a COVID-19 recovery. [Online] UNDP. Available at: https://www.undp.org/content/undp/en/home/blog/2020/how-clean-energy-can-power-a-covid-19-recovery0.html
4. Alliance for Rural Electrification. 2020. Call to Action: Roadmap for the decentralised renewables sector to survive and flourish in the wake of the COVID-19 Crisis. [Online] ARE. Available at: https://www.ruralelec.org/sites/default/files/2020-06-26%20-%20ARE%20COVID-19%20Response%20-%20Call%20to%20Action%20-%20EN.pdf [Accessed 7th August 2020]
5. Argus Media. 2020, Northwest European LPG prices plummet [Online] Argus Media Group. Available at: https://www.argusmedia.com/en/news/2092729-northwest-european-lpg-prices-plummet
6. Baker Mackenzie. 2020. COVID-19 in Africa: Response measures taken by African governments [Online] Invest Africa. Available at: https://insightplus.bakermckenzie.com/bm/attachment_dw.action?attkey=FRbANEucS95NMLRN47z%2BeeOgEFCt8EGQJsWJiCH2WAVEgQBGtyE7WPC4qzUx4MOp&nav=FRbANEucS95NMLRN47z%2BeeOgEFCt8EGQbuwypnpZjc4%3D&attdocparam=pB7HEsg%2FZ312Bk8OIuOIH1c%2BY4beLEAeekQM6mir7BQ%3D&fromContentView=1 Accessed 24th May 2020
7. Baker McKenzie. 2020. The Impact of COVID-19 on Key African Sectors. [Online] Baker Mckenzie. Available at: https://www.bakermckenzie.com/en/insight/publications/2020/03/the-impact-of-covid19-on-key-african-sectors [Accessed 7th August 2020]
8. Caussy, C., Pattou, F., Wallet, F., et al. 2020 Prevalence of obesity among adult inpatients with COVID-19 in France. The Lancet. doi:https://doi.org/10.1016/S2213-8587(20)30160-1
9. Colenbrander, E. 2020. Coping with shock: Last-mile distributors and COVID-19, EEG Energy Insight June 2020, Available at: https://energyeconomicgrowth.org/sites/eeg.opml.co.uk/files/2020-06/EEG%20Energy%20Insight_LMD%20and%20covid19.pdf

10. Congressional Research Service. 2020. Global Economic Effects of COVID-19. [Online] CRS. Available at: https://fas.org/sgp/crs/row/R46270.pdf [Accessed 7th August 2020]
11. David, D. 2020. Coronavirus 'a devastating blow for world economy'. BBC News. Available at: https://www.bbc.co.uk/news/business-52939846 [Accessed 7th August 2020]
12. Day, M. 2020. Covid-19: four fifths of cases are asymptomatic, China figures indicate. BMJ. doi: https://doi.org/10.1136/bmj.m1375
13. Endev. 2020. Covid-19: Energy Access Industry Barometer – Results and observations, Aug 2020. [Online] Available at: https://endev.info/content/COVID-19_Energy_Access_Industry_Barometer_-_Presentation_of_results_in_a_webinar_hosted_by_EnDev
14. Evans, D., Werker, E. 2020. How Africa's Age Structure Will Affect the Impact of Covid-19. [Online] Italian Institute for International Political Studies. Available at: https://www.ispionline.it/en/pubblicazione/how-africas-age-structure-will-affect-impact-covid-19-25703. [Accessed 4th August 2020].
15. Evans, S., Gabbatiss, J. 2020. Coronavirus: Tracking how the world's 'green recovery' plans aim to cut emissions. [Online] Carbon Brief. Available at: https://www.carbonbrief.org/coronavirus-tracking-how-the-worlds-green-recovery-plans-aim-to-cut-emissions [Accessed 7th August 2020]
16. Gallagher, J. 2020. Coronavirus cure: What progress are we making on treatments? [Online] BBC News. Available at: https://www.bbc.co.uk/news/health-52354520 [Accessed 4th August 2020].
17. Gebhard, C., Regitz-Zagrosek, V., Neuhauser, H. K., et al. 2020. Impact of sex and gender on COVID-19 outcomes in Europe. Biology of sex differences, 11(1). doi: https://doi.org/10.1186/s13293-020-00304-9
18. Hepburn, C., O'Callaghan, B., Stern, N., at al. 20202. Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change? Oxford Review of Economic Policy. Available at https://academic.oup.com/oxrep/advance-article/doi/10.1093/oxrep/graa015/5832003?searchresult=1 [Accessed 7th August 2020]
19. IEA, IRENA, UNSD, World Bank, WHO. 2020. Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC. Available at: https://www.irena.org/publications/2020/May/Tracking-SDG7-The-Energy-Progress-Report-2020
20. IEA. 2020. Renewable Energy Market Update Outlook for 2020 and 2021. [Online] IEA. Available at: https://www.iea.org/events/presentation-renewable-energy-market-update-2020 [Accessed 7th August 2020]
21. International Labour Organisation. 2020. ILO Monitor: COVID-19 and the world of work. 5th edition. [Online] ILO. Available at: https://www.ilo.org/global/topics/coronavirus/impacts-and-responses/WCMS_749399/lang--en/index.htm [Accessed 7th August 2020]

22. International Monetary Fund. 2020. COVID-19 Financial Assistance and Debt Service Relief. International Monetary Fund. [Online] IMF. Available at: https://www.imf.org/en/Topics/imf-and-covid19/COVID-Lending-Tracker [Accessed 7th August 2020]
23. IRENA. 2020. Global Renewables Outlook: Energy transformation 2050 (Edition: 2020), International Renewable Energy Agency, Abu Dhabi.
24. Keane, J. 2020. Covid-19 and Developing Country Trade: A focus on the Least Developed Countries. Overseas Development Institute. Presentation to British Expertise International 11th June 2020 [Unpublished]
25. Khan, D., Khan, L. 2020. The Economic Impact of COVID-19 on Developing Countries. [Online] Inter Press Service News Agency. Available at: http://www.ipsnews.net/2020/04/the-economic-impact-of-covid-19-on-developing-countries/ [Accessed 7th August 2020]
26. MacGillivray, A., Kim, R., van Moorsel, T., at al. 2017. Measuring Total Employment Effects: a lean data methodology for a portfolio of investments in developing countries. [Online] CDC Group Plc. https://assets.cdcgroup.com/wp-content/uploads/2018/06/25150849/Methodology-for-measuring-total-employment-effects.pdf [Accessed 13th August 2020]
27. Mahler, D., Lakner, C., Aguilar, A., et al. 2020. Updated estimates of the impact of COVID-19 on Global Poverty. [Online] World Bank Blogs. Available at: https://blogs.worldbank.org/opendata/updated-estimates-impact-covid-19-global-poverty [Accessed 7th August 2020]
28. Montes, J., Silwal, A., Newhouse, D., et al. 2020. How Much Will Poverty Rise in Sub-Saharan Africa in 2020? [Online] The World Bank Group. Available at https://olc.worldbank.org/content/poverty-and-equity-notes [Accessed 26th May 2020]
29. Nicola, M., Alsafi, Z., Sohrabi, C., et al. 2020. The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *International Journal of Surgery*, 78, pp.185-193.
30. Oran, D. and Topol, E. 2020. Prevalence of Asymptomatic SARS-CoV-2 Infection. Annals of Internal Medicine. doi: https://doi.org.10.7326/M20-3012
31. Power for All. 2019. Powering Jobs Census 2019: The Energy Access Workforce [Online]. Available at https://www.powerforall.org/application/files/8915/6310/7906/Powering-Jobs-Census-2019.pdf [Accessed 13th August 2020]
32. Puliti, R., Ogunbiyi, D. 2020. Energy access takes center stage in fighting COVID-19 (Coronavirus) and powering recovery in Africa. [Online] The World Bank. Available at: https://www.worldbank.org/en/news/opinion/2020/04/22/energy-access-critical-to-overcoming-covid-19-in-africa [Accessed 4th August 2020]
33. Responsible Finance Forum. 2020. CDC, IFC, Responsibility, other investors launch covid-19 energy access relief fund. [Online] Responsible Finance Forum. Available at: https://responsiblefinanceforum.org/covid-19-energy-access-relief-fund/ [Accessed 7th August 2020]

34. SELCO Foundation. 2020. Sustainable Energy Access for COVID-19 Testing. [Online] SE4ALL. Available at: https://www.seforall.org/system/files/2020-05/COVID-19-testing-solar.pdf [Accessed 4th August 2020]
35. Setti, L., Passarini, F., De Gennaro, G., et al. 2020. SARS-Cov-2 RNA Found on Particulate Matter of Bergamo in Northern Italy: First Preliminary Evidence. MedRxiv. doi: https://doi.org/10.1101/2020.04.15.20065995
36. Shretta, R. 2020. The Economic Impact of COVID-19. [Online] University of Oxford. Available at: https://www.research.ox.ac.uk/Article/2020-04-07-the-economic-impact-of-covid-19 [Accessed 7th August 2020]
37. Spiegelhalter, D. 2020. How much 'normal' risk does Covid represent? [Online] Winston Centre for Risk and Evidence Communication, University of Cambridge. Available at: https://medium.com/wintoncentre/how-much-normal-risk-does-covid-represent-4539118e1196 [Accessed 4th August 2020]
38. Sustainable Energy for All. 2020. The Recover Better with Sustainable Energy Guide for African Countries. [Online]. SE4ALL. Available at: https://www.seforall.org/publications/recover-better-africa [Accessed 7th August 2020]
39. Tindle, H., Duncan, M., Greevy, R., et al. 2018. Lifetime smoking history and risk of lung cancer: results from the Framingham Heart Study. JNCI J Natl Cancer Inst. doi: 10.1093/jnci/djy041
40. Trace, S., Perera, A. 2020. EEG Energy Insight: International energy-related organisations' response to COVID-19. [Online] Energy and Economic Growth - Applied Research Programme. Available at: https://energyeconomicgrowth.org/publication/eeg-energy-insight-international-energy-related-organisations-response-covid-19 [Accessed 7th August 2020]
41. UNCTAD. 2020. The Covid-19 Shock to Developing Countries: Towards a "whatever it takes" programme for the two-thirds of the world's population being left behind. [Online] United Nations Conference on Trade and Development. Available at: https://unctad.org/en/PublicationsLibrary/gds_tdr2019_covid2_en.pdf [Accessed 25th May 2020]
42. UNCTAD. 2020. From the Great Lockdown to the Great Meltdown: Developing Country Debt in the Time of Covid-19. [Online] UNCTAD. Available at: https://unctad.org/en/PublicationsLibrary/gdsinf2020d3_en.pdf [Accessed 7th August 2020]
43. UNCTAD. 2020. *Investment Trends Monitor March 2020* [Online] USA: United Nations Publications. Available at: https://unctad.org/en/PublicationsLibrary/diaeinf2020d2_en.pdf?user=1653 [Accessed 25th May 2020]
44. UNCTAD. 2020. *World Investment Report 2020 – International Production Beyond the Pandemic.* [Online] USA: United Nations Publications. Available at: https://unctad.org/en/PublicationsLibrary/wir2020_en.pdf [Accessed 7th August 2020]

45. UNESCO. 2020. Education: From disruption to recovery. [Online] UNESCO. Available at: https://en.unesco.org/covid19/educationresponse [Accessed 7th August 2020]
46. UNSDG. 2020. Shared Responsibility, Global Solidarity: Responding to the socio-economic impacts of COVID-19. United Nations Sustainable Development Group [Online] Available at https://unsdg.un.org/resources/shared-responsibility-global-solidarity-responding-socio-economic-impacts-covid-19. [Accessed 11th May 2020]
47. Walker, P., Whittaker, C., Watson, O., et al. 2020. The Global Impact of COVID-19 and Strategies for Mitigation and Suppression. Imperial College London. doi: https://doi.org/10.25561/77735
48. White, C., Nafilyan, V. 2020. Coronavirus (COVID-19) related deaths by ethnic group, England and Wales: 2 March 2020 to 10 April 2020. [Online] Office for National Statistics. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/coronavirusrelateddeathsbyethnicgroupenglandandwales/2march2020to10april2020 [Accessed 4th August 2020]
49. WHO. Global Health Observatory Data: Overweight and obesity - Prevalence of obesity among adults. World Health Organization [Online] Available at: https://www.who.int/gho/ncd/risk_factors/overweight_obesity/obesity_adults/en/. [Accessed 10th August 2020].
50. WHO. Household Air Pollution. [Online] Available at: https://www.who.int/health-topics/air-pollution#tab=tab_1 [Accessed 17th August 2020]
51. World Bank Group. 2020. Commodity Markets Outlook, April. World Bank, Washington, DC.
52. World Bank. 2020. Debt Service Suspension and COVID-19. [Online] World Bank. Available at: https://www.worldbank.org/en/news/factsheet/2020/05/11/debt-relief-and-covid-19-coronavirus [Accessed 7th August 2020]
53. World Bank. 2020. Global Economic Prospects, June 2020. Washington, DC: World Bank. doi: https://doi.org/10.1596/978-1-4648-1553-9
54. World Bank. Databank: Diabetes prevalence (% of population ages 20 to 79). Available at: https://data.worldbank.org/indicator/SH.STA.DIAB.ZS. [Accessed 10th August 2020].
55. World Bank. Databank: Domestic general government health expenditure per capita (current international $). Available at https://data.worldbank.org/indicator/SH.XPD.GHED.PP.CD [Accessed 28th August 2020]
56. World Food Programme. 2020. COVID-19 will double number of people facing food crises unless swift action is taken. [Online] World Food Programme. Available at: https://www.wfp.org/news/covid-19-will-double-number-people-facing-food-crises-unless-swift-action-taken [Accessed 7th August 2020]
57. Wu, X., Nethery, R., Sabath, B., et al. 2020. Exposure to air pollution and COVID-19 mortality in the United States: A nationwide cross-sectional study. MEDRxiv. doi: https://doi.org/10.1101/2020.04.05.20054502