Applying Multilevel Perspective Analysis to Energy Justice in India

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring 2020

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

Having access to the energy needed to maintain a home is essential as the world economy changes and grows (McCauley et al., 2019). Energy provides opportunities, not just through direct maintenance jobs, but through the ability to commute to work, keep homes lit and warm, cook food and retrieve water, and connect to educational resources (Levey & Schuller, 2018). McGee and Greiner argue that energy is fundamental to economic prosperity and establishing a standard of living (2019); this sentiment is shared by McCauley et al., who states energy provides a means of economic development (2019). It can even be considered tangentially a basic human right (*Universal Declaration of Human Rights*, 2015).

However, many individuals and communities do not have access to energy in any form. These individuals fall into two larger, often intercepting groups: those in economic poverty, and those in rural isolation. For the poor, modern energy systems create a cost burden, as energy's proportional cost is higher (McGee & Greiner, 2019). For the other group, rurality creates an isolation from standard grid design (Organization for Economic Co-operation and Development, 2012). Often, the latter usually leads to the former: poverty can be directly correlated to isolation (Kamalapur & Udaykumar, 2011), meaning rurality would more likely constitute a poor community. This is a critical issue for energy infrastructure development.

There is another issue at play in the energy discussion. Across the globe, environmentalists demand a reduction in energy's greenhouse gas emissions (Suberu et al., 2013). Any developments in the energy sector need to move away from fossil fuels to renewables (McCauley et al.). Green energy technologies could make obtainable improvements for the planet (Kåberger, 2018). There are even those that claim robust green energy can

simultaneously enfranchise energy-impoverished groups and reduce emissions (Organization for Economic Co-operation and Development, 2012).

Now, while providing green energy to impoverished communities addresses both issues, implementation is critical. McGee and Greiner found that poorly implemented policies can be detrimental to desired outcomes; their findings showed that improper, top-down approaches could put more burden on impoverished groups, providing green energy at their expense (2019). Other works share this concern, citing poorly implemented systems that garnered resistance from targeted communities (Organization for Economic Co-operation and Development, 2012). To avoid this, policies must accomplish two things: address both production and consumption in a green, efficient, and economically viable way, and properly allow impoverished groups to access this energy without undue burden from their construction.

That sentiment is energy justice, and is the focus of this work. Energy justice is generally defined as energy that is equally available to different groups (Jenkins et al., 2016). It is a qualitative metric that weighs the inclusivity of energy technology and the opportunities energy systems provide (LaBelle, 2017). One region that lends itself well to energy justice analysis is India. As of 2005, one third of the world's population without electricity resided in India (Bhattacharyya, 2013), with three-quarters of India's population living in rural areas as of 2012 (Khandker et al., 2014). India has also had massive energy infrastructure projects to electrify poor, rural communities (Palit, 2013). For the purposes of this work, "energy" will refer to electric energy in relation to these works. While various government and private-industry infrastructure investments sought to address the energy concerns (Yenneti & Day, 2015), energy justice may not have been achieved. This work applies energy justice principles to national,

regional, and local works in India to examine and critique the energy justice those works achieved.

Literature Review

Environment for Solar Works in India

Many factors pushed electrification in India. In the 1960s, once India had gained independence, the government began implementing massive energy projects to develop the country. Their goal was total grid-based electrification of the country by 2012. Sadly, as of 2005, India was not on track to meet these goals based solely on grid works (Khandker et al., 2014). Two out of every five rural inhabitants were still without power (Palit, 2013), which is about 157 million homes without electricity. The population and per capita electrical use were also expected to increase, surpassing the completed infrastructure's capabilities (Kamalapur & Udaykumar, 2011). This is where solar works became an attractive option. Solar projects began with the initial initiatives, but it wasn't until about 2009 when solar really became the focus (Yadav et al., 2019). The grid was already unfit for the increasing demand and scale, and any grid would lose relative power as the distance increased (Kamalapur & Udaykumar, 2011). Since most communities were rurally isolated, the only way for the energy to be provided would be through localized energy for each community (Palit, 2013). And it wouldn't be impossible to make solar viable, as India has about 300 clear sunny days a year (Kamalapur & Udaykumar, 2011), and certain regions can receive about 6 kWh/m^2 of radiative energy (Yenneti & Day, 2016). It would become a matter of land use, infrastructure, and funding to take advantage of that energy potential.

Main Framework Elements

Energy justice in India will be evaluated using Multilayer Perspective (MLP) analysis elements. Social improvements are examined at three different levels: niche, regime, and landscape. Niche elements are actions by individuals or local groups looking to gain involvement in the development of technology. Regime level works include local governments or corporations looking to enact change involving the relevant technologies. Landscape elements involve larger groups, such as the whole country, whose perceptions and cultural norms will shape or be shaped by incoming technology.

Energy justice itself can be broken into sub categories: distributional, recognition, procedural, and cosmopolitan (McCauley et al., 2019). This work will focus on distributional, procedural, and cosmopolitan. Recognition is not excluded, however, as India's goal to electrify energy-impoverished communities meets the criteria of recognition justice. Enacting policies and commissioning works to address an issue gives weight to the situation, the very concept of recognition justice (LaBelle, 2017).

As defined by McCauley et al., distributional justice focuses on the physical location of the energy (2019). Is the energy in a place convenient and accessible to the groups it seeks to aid? Do new energy systems displace targeted groups, or take up lands in a way that disenfranchises one group on behalf of another (McCauley et al., 2019)? Such questions are important considerations, as this can be a common failure among such programs (McGee & Greiner, 2019). One last consideration for distributional justice is the distribution of burdens. Certain energy systems can create dangerous or harmful waste, so minimizing the distribution of these side effects is also critical (Jenkins et al., 2016). The distributional lens is critical to the

Indian studies, as the rurality means energy must be convenient to these communities without using up valuable land to local industries or posing further harm to the region.

Cosmopolitan justice is defined by morality aspects of the works: does this improve humanity as a whole (McCauley et al., 2019)? This justice comes from changed behaviors, attitudes, and perceptions catalyzed by the new energy technology (LaBelle, 2017). Much of the cosmopolitan aspects of this energy justice come from the use of green energy. However, the productivity and standard of living improvements would be beneficial to India as a whole. The success these works see, not just in terms of quantitative numbers but acceptance into communities, could catalyze further improvements in other realms of Indian life.

Procedural justice focuses on the involvement of individuals in the process. This describes their ability to lobby or voice opinions to applicable bodies. This can come in the form of direct interaction with the community at large (McCauley et al., 2019), or in the form a group's ability to use established justice systems to raise concerns and appeal decisions (LaBelle, 2017). Some of these regions do have education issues as a result of poverty concerns (Khandker et al., 2014), so making community engagement accessible is critical. India's large population would then require robust, transparent systems to handle the scale of involvement possible.

The energy justice and MLP frameworks come together under a description given by Labelle (2017). He states that there are technically two "energy justices:" universal and local. In universal justice, distributional and cosmopolitan elements are the primary pillars. These two subcategories focus on infrastructure actions above the communities themselves (LaBelle, 2017). In MLP, this would correlate with regime and landscape actions, where powerful actors shape implementation and use of technology on a higher level. Local justice, which is dominated by

procedural justice, directly connects to the niche level of MLP. By giving individuals and communities a platform to express their opinion, they can begin to push the adoption of a technology in the most beneficial way.

Framework Considerations from Secondary Works

Since these works are focused on India, it could be worth comparing what is considered "successful" against Western standards. The Western standards will be provided by a work produced by the Organization for Economic Co-operation and Development (OECD). Their work agglomerated the energy improvements and implementation strategies of several cities in rural North America and Europe. Most of the work details strategies for policy implementation, including methods to escape funding traps as well as integrate niche technologies into larger systems. Many of the implementation strategies, however, hinge on either an established market or other regional industries to couple the infrastructure (Organization for Economic Co-operation and Development, 2012). The OECD's considerations fall predominantly into distributional justice, as their goal was to present niche works that fit into national and global movements to green energy. There is not much procedural justice covered in this work, though the authors do broach the topic of community engagement in decision making (Organization for Economic Co-operation and Development, 2012). This work does provide methods for structuring and locating rural works. However, the standards of those nations may be higher than those of India. Again, many of the claims assume there is some pre-existent industry, government policy, or investment opportunity to drive energy demands (Organization for Economic Co-operation and Development, 2012). Still, the governmental framework would provide some point of comparison to judge in the context of the environment.

Closer to the Indian economic environment is rural Sub-Saharan Africa. Both regions contain some of the least electrified nations in the world (Bhattacharyya, 2013). A work by Suberu et al. found that the nations they studied had widely different, yet on average low, electrification rates for rural regions and sometimes the whole (2013). Efforts to electrify the regions faced high barriers: inconsistent government action across levels, inconsistent funding, few private groups looking to invest, and limited public awareness and interest. The resources were available to make green energy viable in most cases, but the implementation was lacking. However, governmental inconsistency prevented large works from taking hold. There were some sources of funding, but not enough to spur local groups to invest their own capital into projects to achieve local success. And, without people's support and acclamation, the scene was not conducive to progress (Suberu et al., 2013). The Sub-Saharan Africa case provides a good basis for energy justice for India's progress. If some of the missing elements that halted Sub-Saharan energy implementation are present in Indian cases, then some level of energy justice was achieved. Upper level works and policies provide at least some level of universal justice, and any citizen involvement and integration into the process would accomplish local justice requirements.

Data and Analysis

Distributional Justice Considerations

In terms of electricity distribution, there are direct measures of India's progress. As of 2000, there were about 1.7 billion people without electricity (Bhattacharyya, 2013), requiring massive infrastructure to improve. Thankfully, by 2004, 84% of villages in India had access to power through grid extensions (Bhattacharyya, 2013); by 2012, all villages had electricity in

some form (Khandker et al., 2014). The number of individuals without power dropped to about 293 million by 2010. Then, works by private companies and NGOs made further progress. By 2012, about 730,000 solar home systems and 830,000 solar lamps brought electricity and lighting to individual homes, with about 12,000 more community systems also installed (Palit, 2013). From 2010 to 2014 alone, solar grid capacity jumped from 150 MW to 3 GW (Yenneti & Day, 2015). While the amount of energy provided did not fully address all energy poverty, these efforts made significant strides; creating such infrastructure physically distributed benefits to a higher portion of the population, which marked a major win for distributional justice.

Unfortunately, electrification was not a full success, as some aspects of distributional justice were not addressed. First is the distribution of benefits. As Khandker et al. notes in their findings, rich families often saw better improvements to their way of life compared to poor groups (2014). Such technological inequality creates tensions within communities and possible unrest (Yenneti & Day, 2016). Plus, if poor groups were not included initially, their situation would be worsened by such a divide (Yenneti & Day, 2015). While there was targeted legislation directed towards poor individuals, such as the Energy Policy of 2005 (Bhattacharyya, 2013), equitable electrification could have partially failed and would result in such a divide. The second is the minimization of burdens. As Yenneti and Day address almost immediately in their 2015 work, rapid, idealistic solar implementation can often overlook environmental concerns. They later found that land usage was not optimized in the infrastructure's construction. While the government worked to primarily use "waste" land, they did portion and purchase some grazing and farm land for the solar farms (Yenneti & Day, 2016). Working land provides direct benefits to farmers, so taking land away presents a burden not equally distributed to all receiving the

electricity. It falls wholly on the shoulders of the farmers who now have less land to work at the cost of said electricity.

Cosmopolitan Justice Considerations

Cosmopolitan justice was achieved in India based on the number of programs the government enacted to address electrification. Initially, policies like the Electrification Programmes, the 2003 Electricity Act, and the Energy Policy of 2005 sought to address electrification broadly through grid extensions. They sought to spur agricultural and economic development (Bhattacharyya, 2013). There is a significant issue with these works: the reliance on grid extensions from existing factories and not green energy sources. They provided initial improvements to distribution and poverty, but emissions were unaddressed. Such is the conundrum put forward by Yadav et al. (2019). As they state, the modern development of nations has connected poverty elimination and a nation's emissions (Yadav et al., 2019); poverty improvements must be green improvements. Luckily, India's government would address this issue with the National Action Plan of Climate Change (NAPCC) in 2008. This policy focused energy infrastructure works towards renewables, hoping to reach 40% non-fossil fuel sources by 2022, and included rural electrification works as key components (Yadav et al., 2019). To truly achieve cosmopolitan justice, solutions following the NAPCC, like the solar works of the 2010s detailed later, must address both simultaneously.

India's electrification did see some benefits to the poor. Household per capita income increased by about 38% due to the electrification works (Khandker et al., 2014). This follows other claims connecting fundamental energy access to economic development (McGee & Greiner, 2019). However, that benefit was not entirely seen by impoverished communities. In

fact, the lower income groups only saw a 26% increase in income, while richer neighborhoods saw a 46% increase. We must also consider that, as of 2008, two-thirds of electrification works went to rich households (Khandker et al., 2014). This is an overarching issue of overly broad policies. Khandker et al., when addressing these numbers, mentioned that the only focused policies truly address poverty issues (2014). Bhattacharya's work shows that there was no focus in the policy implementation. Up until the Energy Policy of 2005, the metrics of success were only based on how far the grid was extended. There was no metric for population number or percentage, let alone a secondary metric for electrification of the poor. Luckily, the 2005 Policy would put the target specifically towards poor groups (Bhattacharyya, 2013). Later solar policies would also include targeted plans. Policies like the 2009 Decentralized Distributed Generation act, the 2010 National Solar Mission, and the 2017 Saubhagya Scheme (Yadav et al., 2019) achieved better levels of cosmopolitan justice. Each sought to electrify impoverished or isolated regions through upper level grants, private works, or individual initiatives. Such missions addressed both climate concerns and energy poverty simultaneously.

Procedural Justice Considerations

The implementation of procedural justice saw the least success compared to the other forms. The main procedural success was the inclusion of home solar systems. Policies put in place after 2010 allowed citizens to interact with nascent solar technology either locally to their community or directly to their home. These connections, for the most part, were actually well received (Yadav et al., 2019). In fact, solar home systems were the most common implementation of solar works across the country (Palit, 2013). Plus, the cost of a solar panel dropped by roughly 80% from 1998 to 2008 (Kamalapur & Udaykumar, 2011). All of these

factors increased accessibility and meant incomes could be spent on other necessities. It also improved employment and, as mentioned earlier, incomes – not directly through the infrastructure's construction but through opportunities now viable with reliable energy (Khandker et al., 2014). Solar technology greatly allowed citizens to be a part of the decision. And, with increased living standards, they would have more income to engage with the community.

However, the positives end there due to several hindrances to procedural justice. The first is transparency. Yenneti and Day found systems for direct communication with government officials and company sponsors, such as town meetings like the *Gram Sabha*, lacking transparency (2015). Communication was mostly one-way with few opportunities for two-way discussion (Yenneti & Day, 2015). This is inherently opposed to procedural justice, as the ability to communicate to officials is a key element. A similar failure involved the definition of land quality. As mentioned earlier, when the government allocated lands for solar works, they defined certain regions as "waste land" (Yenneti & Day, 2016). Such "unused" land seemed perfect for infrastructure. However, some of those lands were used by nomadic groups, who had no say in the matter (Yenneti & Day, 2015). Such actions caused the citizens to lose trust in the government officials, something that cannot happen with such top-down heavy works (Yenneti & Day, 2016). Procedural justice cannot truly be achieved if one group is disenfranchised and ignored. Including all inputs from those who use the land would create fairer implementation of solar works. The last failure is a balance between distribution and empowerment. Yadav et al. found that systems that maximized distribution through free subsidies often made individuals receiving solar panels less likely to advocate for more infrastructure (2019). If the solar panels

are implemented to optimize coverage, apathy may reduce procedural justice. But, to thoroughly include community engagement would slow physical implementation and impede distributional justice. This paradox is one that India has to solve for just, equitable works.

Comparisons to Other Justice Works

Some of India's electrification efforts follow OECD suggestions. The first element is connection to industry. By instituting the Irrigation Pump Set Energisation program, a portion of the Electrification Programmes, India connected electrification infrastructure to agricultural works (Bhattacharyya, 2013; Yenneti & Day, 2015). Similarly, solar works in Gujarat greatly benefited from local industrialization (Yenneti & Day, 2016). These examples match principles outlined in the OECD's recommendations: coupling electrification with industry demands made investment easier to achieve. However, the OECD recommendations also state that the investment must lead to further development in the community (Organization for Economic Co-operation and Development, 2012), unlike certain regions of India. As Yenneti and Day go onto describe, the investment remained almost solely with the agriculture industry and local citizens did not receive complementary electrical infrastructure (2016). Had electrification continued into the communities, distributional justice may have been better achieved.

The other major component is the economic opportunities provided to the region – not necessarily through direct employment, but through improved standard of living (Organization for Economic Co-operation and Development, 2012). Based on Yenneti and Day's findings, direct employment for construction was limited (20160. Often, jobs were temporary or paid worse than pre-existing jobs (Yenneti & Day, 2016). There were local NGOs that lended themselves to citizen participation (Yenneti & Day, 2015), but, again, these were short-term

forms of work. This is a landscape issue, where long-term employment strategies are not developed. A long-term solution would provide procedural justice by engaging more individuals in the electrification process. Another benefit is secondary, non-electrical infrastructure. The OECD analysis found the secondary benefits that came from investments in a region helped offset fewer direct benefits. In India, some companies and state governments promised works such as roads complementing the energy expansion, then provided none (Yenneti & Day, 2016). If those benefits never manifest, the energy systems may not provide enough primary benefits alone. That said, there were some economic benefits. As mentioned earlier, Khandker et al. found that overall there were valuable benefits to these electrical systems (2014). Monthly incomes did increase, money was diverted away from purchasing fuel to purchasing food, and more individuals found employment opportunities elsewhere (Khandker et al., 2014). However, it is yet to be seen if those benefits, present but limited, were more crucial to cosmopolitan and procedural justice than the other infrastructure not provided.

There is a key tactic that India implemented that the OECD recommended against: direct subsidies. For the longest time, the Indian government funded its policies through a system of subsidies, loans, and grants (Bhattacharyya, 2013). The subsidies often fell to the individual level, hindering the motivation and funding to grow solar works (Yadav et al., 2019); loans and grants led to state-imposed tariffs, further hindering the implementation through added costs (Bhattacharyya, 2013). The OECD stated repeatedly not to use subsidies like these to fund systems. Rather, more robust, multi-source funding is required (Organization for Economic Co-operation and Development, 2012). Funding policies did improve after 2003. The 2003 Electricity Act and the Energy Policy of 2005 opened up opportunities for companies and citizen

groups to invest their own capital with government assistance (Bhattacharyya, 2013). And the works of the 2010s outlined by Yadav et al. show that the government assisted individual citizens willing to change to solar energy (2019). These newer investment strategies should have been used from the start to address all three aspects of energy justice. Such systems would have allowed for more inviting investment opportunities at state and local levels, leading to further electrification, better empowerment, and greater inclusion among villages involved.

We can also compare the electrification of India to the standards of Suberu et al. (2013). Unlike the findings of Suberu et al., there was a landscape desire to improve India. Overall, India had a clear goal set with their projects: energize the country as thoroughly as possible (Khandker et al., 2014). Later, policies would implement solar energy as a greener source (Yadav et al., 2019). The government set up program after program to set works in motion that were then shadowed by more regional efforts and local initiatives (Bhattacharyya, 2013; Yadav et al., 2019; Yenneti & Day, 2016; Yenneti & Day, 2015). Despite the imperfections, a base level of distributional and cosmopolitan justice was achieved due to these united efforts. On another point of Suberu et al., there was funding available for India's efforts. While not the best methods, as mentioned before, there was never a lack of funding. In fact, to describe the willingness of the Indian government, they invested 4.5 billion rupees to provide electricity to 5.8 million homes (Bhattacharyya, 2013). While some programs did see investment declines (Khandker et al., 2014), investments were sustained. This level of distributional justice exceeds Suberu et al.'s bar for funding (2013). Lastly, India saw public interest in improvements backed by citizen support. Those who went to *Gram Sabha* meetings were looking to get a say in the distribution (Yenneti & Day, 2015). Those who formed NGOs sought power for their entire community

(Bhattacharyya, 2013; Yenneti & Day, 2015). The fact that a policy for direct interaction with the government was viable, through the Saubhagya Scheme (Yadav et al., 2019), is proof of a local drive to improve. These procedural and distribution elements were missing in Sub-Saharan Africa but were present in India's process, leading to its various successes.

Conclusion

The story of energy justice in India's electrification efforts is one of mixed success. Of the three energy justice tenets examined, distributional, cosmopolitan, and procedural, India succeeded in some respects and failed in others. For distributional justice, India achieved massive electrical implementation, leading to better electrification by orders of magnitude. However, fair land usage and equitable implementation suffered. Cosmopolitan justice saw mixed, but generally positive, results as well. Laters works involved solar energy to protect the environment, but initial efforts relied on standard grid extension. And again, impoverished communities did see improvements to their standards of living, though not to the extent possible with better targeted legislation. Then, procedural justice was less abundant. Certain systems did allow for individual participation and action. However, transparency issues and government subsidies limited the extent of community engagement. When applying other nation's standards, India made great strides despite some missed opportunities. The Indian government, in general, was able to craft much needed initial legislation that promoted both private and individual involvement with later iterations. However, the heavy use of subsidies hurt the efforts in the long run. The improved investment and spending techniques could have expedited the implementation from the start. This international comparison provides a good basis for work in other nations. Could Africa see the progress it wanted following India's model despite the turmoil? Could

Western nations benefit from the government-citizen policies that installed local works for the cost? Such actions could manifest in other countries' efforts to implement clean energy, and will be crucial for beneficial improvements in the future.

References

Bhattacharyya, S. C. (2013). Financing energy access and off-grid electrification: A review of status, options and challenges. *Renewable and Sustainable Energy Reviews*, *20*, 462–472. https://doi.org/10.1016/j.rser.2012.12.008

Jenkins, K., McCauley, D., Heffron, R., Stephan, H., & Rehner, R. (2016). Energy justice: A conceptual review. *Energy Research & Social Science*, *11*, 174–182. https://doi.org/10.1016/j.erss.2015.10.004

Kåberger, T. (2018). Progress of renewable electricity replacing fossil fuels. *Global Energy Interconnection*, *1*(1), 48–52. https://doi.org/10.14171/j.2096-5117.gei.2018.01.006

Kamalapur, G. D., & Udaykumar, R. Y. (2011). Rural electrification in India and feasibility of Photovoltaic Solar Home Systems. *International Journal of Electrical Power & Energy Systems*, *33*(3), 594–599. https://doi.org/10.1016/j.ijepes.2010.12.014

Khandker, S. R., Samad, H. A., Ali, R., & Barnes, D. F. (2014). Who Benefits Most from Rural Electrification? Evidence in India. *The Energy Journal*, *35*(2). https://doi.org/10.5547/01956574.35.2.4

LaBelle, M. C. (2017). In pursuit of energy justice. *Energy Policy*, *107*, 615–620. https://doi.org/10.1016/j.enpol.2017.03.054

Levey, T., & Schuller, S. (2018, September 17). *To End Poverty, Increase Access to Energy*. Scientific American Blog Network. https://blogs.scientificamerican.com/observations/to-end-poverty-increase-access-to-energy/

McCauley, D., Ramasar, V., Heffron, R. J., Sovacool, B. K., Mebratu, D., & Mundaca, L.

(2019). Energy justice in the transition to low carbon energy systems: Exploring key themes in interdisciplinary research. *Applied Energy*, *233–234*, 916–921. https://doi.org/10.1016/j.apenergy.2018.10.005

McGee, J. A., & Greiner, P. T. (2019). Renewable energy injustice: The socio-environmental implications of renewable energy consumption. *Energy Research & Social Science*, *56*, 101214. https://doi.org/10.1016/j.erss.2019.05.024

Organization for Economic Co-operation and Development. (2012, November 10). *Linking Renewable Energy to Rural Development—OECD*. https://www.oecd.org/regional/linkingrenewableenergytoruraldevelopment.htm

Palit, D. (2013). Solar energy programs for rural electrification: Experiences and lessons from South Asia. *Energy for Sustainable Development*, *17*(3), 270–279. https://doi.org/10.1016/j.esd.2013.01.002

Suberu, M. Y., Mustafa, M. W., Bashir, N., Muhamad, N. A., & Mokhtar, A. S. (2013). Power sector renewable energy integration for expanding access to electricity in sub-Saharan Africa. *Renewable and Sustainable Energy Reviews*, *25*, 630–642. https://doi.org/10.1016/j.rser.2013.04.033

Universal Declaration of Human Rights. (2015, October 6). https://www.un.org/en/universal-declaration-human-rights/

Yadav, P., Davies, P. J., & Sarkodie, S. A. (2019). The prospects of decentralised solar energy home systems in rural communities: User experience, determinants, and impact of free solar power on the energy poverty cycle. *Energy Strategy Reviews*, *26*, 100424. https://doi.org/10.1016/j.esr.2019.100424

Yenneti, K., & Day, R. (2015). Procedural (in)justice in the implementation of solar energy: The case of Charanaka solar park, Gujarat, India. *Energy Policy*, *86*, 664–673. https://doi.org/10.1016/j.enpol.2015.08.019

Yenneti, K., & Day, R. (2016). Distributional justice in solar energy implementation in India: The case of Charanka solar park. *Journal of Rural Studies*, *46*, 35–46. https://doi.org/10.1016/j.jrurstud.2016.05.009