

## **Energy Access as a Driver of Gender Equality: What is the Evidence?**

Prepared for: Clean Cooking Alliance

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## Acknowledgements

Thank you to my advisor, Subhrendu Pattanayak; to Ipsita Das, who served as second reader; to P.P. Krishnapriya, who helped guide this project at an early stage; to the Duke Energy Access Project and SETI; to the staff at Clean Cooking Alliance and the United Nations Foundation; to Xun and Shivangi for lending their talents near the finish line; and to everyone else who has supported me throughout this project.

## Executive Summary

### *Introduction*

**Policy Problem.** Worldwide, 2.7 billion people rely on traditional fuels such as wood, charcoal, agricultural residue, and animal dung for their cooking and heating needs (Mulugetta et al., 2019). Meanwhile, 1.4 billion do not have access to electricity (Gould et al., 2018). Lack of energy access negatively impacts outcomes as varied as health, time savings, economic empowerment, and education. Solid fuel use leads to household air pollution (HAP) exposure, causing chronic obstructive pulmonary disease (COPD), pulmonary tuberculosis, pneumonia, lung cancer, and acute respiratory infection (ARI).

Primitive cookstoves can cause burns and fires in the home. The act of collecting solid fuels can also cause back pain and be extremely time-consuming, thereby restricting time for other activities. The absence of electricity, meanwhile, can increase the time spent on chores, restrict educational opportunities, and pose a safety concern (due to low lighting in dangerous areas). For each of these outcomes, evidence suggests that women are more severely impacted than men.

**Policy Question.** “Does energy access contribute to increased gender equality?” This project seeks to understand the extent to which energy access, namely clean cooking access and electrification, benefits women through improvements in outcomes that can include health, time savings, education, and economic empowerment. This project defines interventions contributing to increased gender equality as those that benefit women *relative to* men. This includes interventions that benefit women but do not benefit men and those that benefit women more than men. Studies that find a positive impact of a given intervention on women—but do not study the impact on men—cannot be used as evidence of gender empowerment.

### *Methodology*

The Sustainable Energy Transitions Initiative (SETI) conducted an ambitious systematic review in which the researchers examined nearly 80,000 peer-reviewed articles related to energy and development (Jeuland et al. 2019; Pattanayak et al., 2018). The team identified 3,183 quantitative studies on affordable and clean energy, which they then categorized according to the 17 Sustainable Development Goals (Jeuland et al. 2019; Pattanayak et al., 2018). Of these studies, 67 demonstrate the effect of energy access on gender equality. This project examines the studies in this sample that find a statistically significant relationship between energy access and gender equality. As the SETI study concluded in 2017, this project also collects and presents studies relating to energy access and gender equality written in the past three years.

### *Results*

Evidence strongly supports that health benefits resulting from energy access contribute to gender equality. By far, health is the most well-supported pathway for gender equality in peer-reviewed studies that examine the impact of energy access on women. Organizations undertaking development work can credibly claim that energy access and clean cooking solutions benefit the health of women.

Evidence moderately supports that time savings, education, and economic empowerment from energy access contribute to gender equality. The evidence for each of these pathways is limited to a handful of studies, even though these studies often find a sizable impact of energy access on any one of these three outcomes.

### *Recommendations*

1. Evidence strongly supports that health benefits from energy access contribute to gender equality.
2. Evidence moderately supports that time savings, education, and economic empowerment from energy access contribute to gender equality.
3. More studies need to be undertaken that examine women's benefits of energy access *relative to men*.

## I. Research Question

*Does energy access contribute to increased gender equality?*

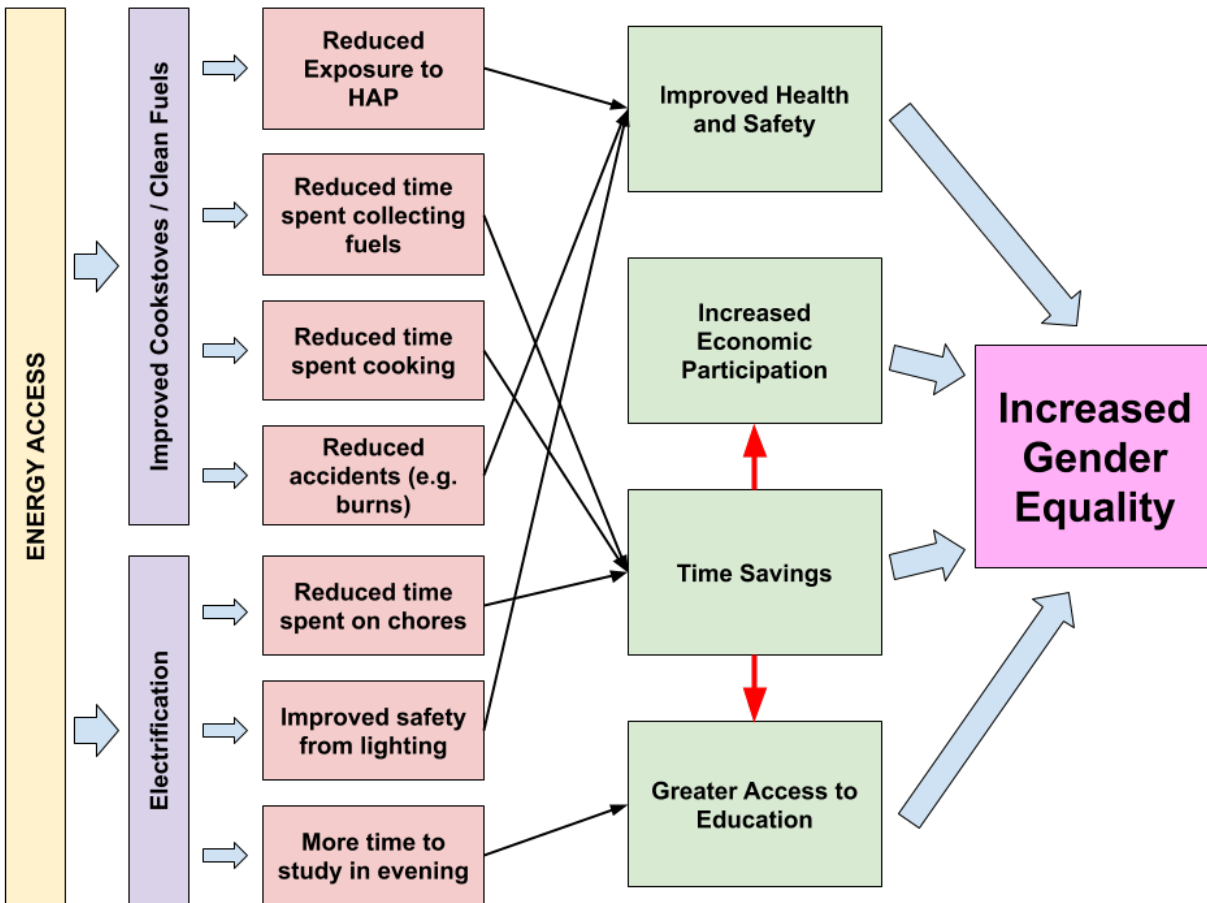
Goal 5 of the United Nations (UN) Sustainable Development Goals (SDGs) states, “Achieve gender equality and empower all women and girls” (Bastos, 2019). The UN describes gender equality as occurring when men and women enjoy the same levels of wellbeing, the same rights, and the same access to opportunity (Rosche, 2016). Across a number of sectors—health, education, economic opportunity, vulnerability to violence, and political representation—women and girls in developing countries face worse outcomes than men and boys (Sen, 2015).

In other words, there is catching up to be done in regard to the rights and wellbeing of women. As such, interventions will be viewed as advancing gender equality only if they address women’s *comparative disadvantage* to men. The most recent gender-based analysis of household energy interventions focus on “whether interventions achieve their intended impacts and whether these are differentiated by gender (e.g., women’s health improves more than men’s health as a result of subsidies for new cooking technology)” (Köhlin et al., 2011). Their framework emphasizes that studies that find a positive impact of a given intervention on women, but that does not comment on impacts on men, might not provide sufficient evidence of gender empowerment. This project revisits the question ten years later.

### *Hypothesis*

For energy access to be considered a driver of gender equality, it must (1) benefit women but not men or (2) benefit women more than men. This paper explores a number of pathways through which energy access could serve as such a driver. Figure 1 presents a hypothesized theory of change (TOC) based on the author’s understanding of the impacts of energy access prior to beginning this paper. This TOC explores two types of energy access: improved cookstoves/clean fuels and electrification. For both forms of energy access, a number of potential impacts are listed (in red). These impacts are then grouped into four thematic areas (in green). The four thematic areas should be considered pathways through which energy access could contribute to gender equality.

**Figure 1.** Hypothesized theory of change for energy access and gender equality.



**Improved Cookstoves/Clean Fuels.** Because solid fuel use for cooking is associated with a number of dangers, the introduction of clean fuels in a household provides a number of household and individual benefits. These include reductions in:

- exposure to household air pollution, or HAP (also sometimes referred to as indoor air pollution, or IAP);
- time spent collecting fuels;
- time spent cooking; and
- accidents such as burns or fires.

**Electrification.** The introduction of electricity in a household also provides a number of specific benefits:

- reduced time spent on chores;
- improved safety due to lighting; and
- more time to study or engage in educational activities.

From these specific benefits we can derive four larger outcomes that can, in turn, contribute to increased gender equality. These are:

- I. improved health and safety,
- II. increased economic participation,
- III. time savings, and

#### IV. greater access to education.

Reduced exposure to HAP, reduced accidents while cooking, and improved safety from lighting each contribute to improved health and safety. Reduced time spent collecting fuels, reduced time spent cooking, and reduced time on chores contribute to time savings. Finally, more time to study in the evening contributes to greater access to education. Time savings plays a complementary role to increased economic participation and greater access to education. While few specific benefits contribute directly to increased economic participation and greater access to education, time savings contributes positively to both. The four outcomes outlined above, as a result of interventions targeting energy access, are believed to benefit women and girls more than men and boys, thereby contributing to increased gender equality.

This paper will go on to revise the TOC presented in Figure 1 by examining peer-reviewed quantitative studies. Based on the strengths of those associations—i.e., a statistically significant, positive relationship between energy access and gender equality—we will update this figure to reflect the relative confidence we have in these assumed linkages.

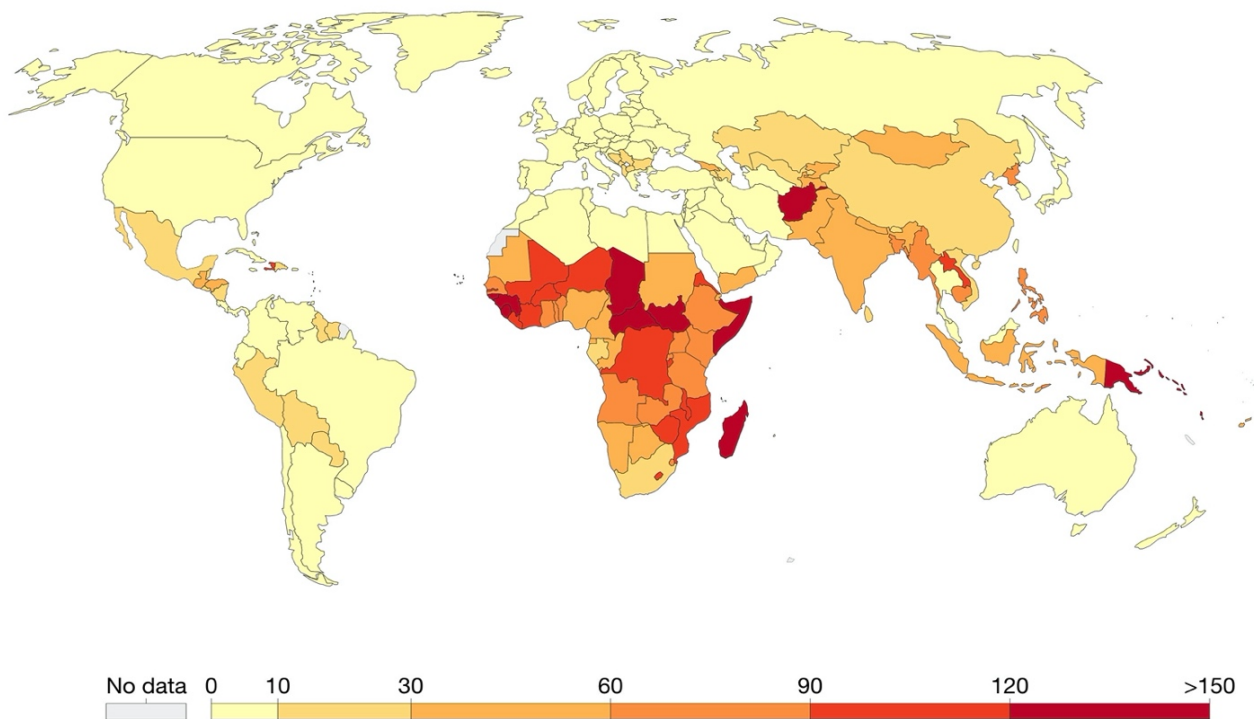
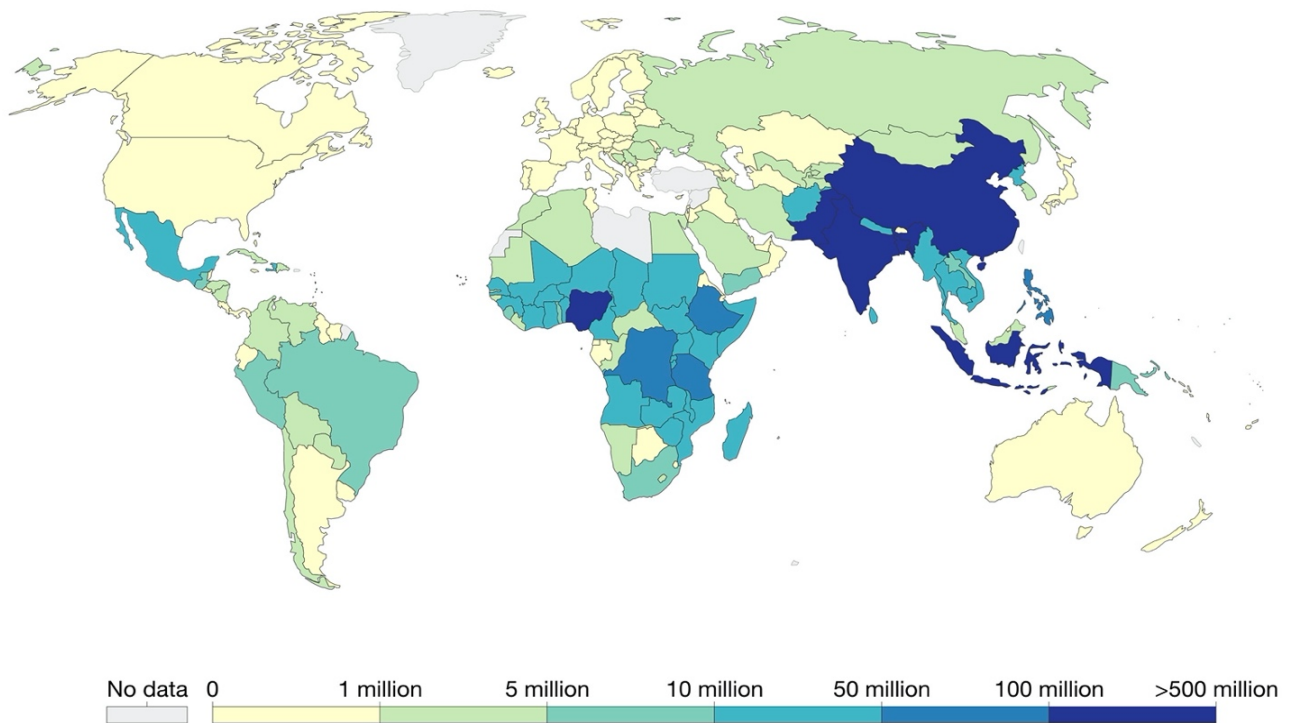
## II. Background and Importance

Lack of energy access can be defined as the absence of adequate energy services to meet basic household needs like cooking and lighting (Sokona et al., 2012). It also refers to the lack of basic energy for essential services such as healthcare, education, or economic participation (Sokona et al., 2012). The number of people who have little or no access to energy is extremely high. Worldwide, 2.7 billion people rely on traditional fuels such as wood, charcoal, agricultural residue, and animal dung for their cooking and heating needs (Mulugetta et al., 2019). Meanwhile, 1.4 billion do not have access to electricity (Gould et al., 2018). Death rates from indoor air pollution give us an accurate comparison of differences in its mortality impacts between countries and over time. In contrast to the share of deaths that we studied before, death rates are not influenced by how other causes or risk factors for death are changing.

It is often believed that women are disproportionately impacted by a lack of energy access. Negative impacts on women include time spent traveling long distances for solid fuel collection and time spent preparing food using traditional methods (Danielsen, 2012; Matinga et al., 2019). Health impacts include increased mortality and morbidity as a result of household air pollution, or HAP (Gould et al., 2018; Standal et al., 2016; Winther et al., 2020). Women without energy access also face higher rates of accidents and injuries. Burns may result from the use of open fires while back injuries may be sustained from arduous fuel collection (Danielsen, 2012; Ulsrud et al., 2018; Winther et al., 2018). Lack of energy access is also believed to decrease school attendance and participation since more time is needed for household chores (Carr et al., 2010; Ulsrud et al., 2018).

**Panel A.** Number of people without access to clean fuels for cooking, 2016.

**Panel B.** Death rates from indoor air pollution (measured per 100,000 individuals), 2017.



**Source:** IHME, *Global Burden of Disease*

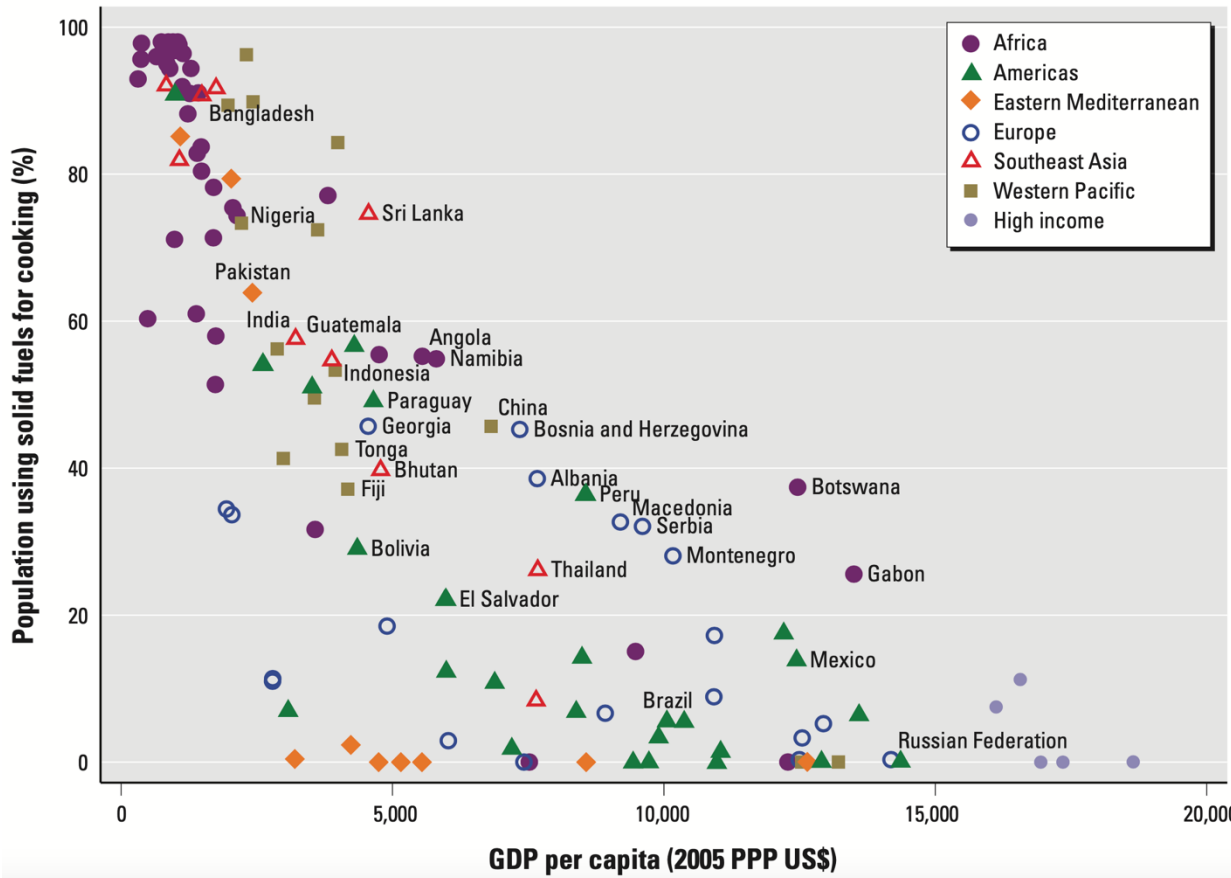


With these impacts in mind, energy access is generally believed to benefit women through a number of pathways (Yeh, 2019). First, electrification or modern cooking solutions are believed to reduce the time women spend on household chores and responsibilities (Carr et al., 2010). These time savings, in turn, free up time for women to pursue income-generating activities and thereby increase their economic participation (Bastos 2019).

Women are also believed to benefit from the introduction of lighting. Lighting in the home and in one’s community has both safety and education benefits. Lighting in the home allows girls to continue their schoolwork in the evening after completing their chores (Carr et al., 2010). Meanwhile, lighting in public spaces greatly increases safety and reduces assault, harassment, and theft (Sen, 2015). While far from an exhaustive list, these are some of the pathways through which women are believed to benefit from energy access.

We may also note that solid fuel use is strongly linked to development and prosperity, both at the household level and at the country level. Those living in countries with lower GDP per capita are much more likely to rely on solid fuels for cooking and heating, indicating this is a problem that hits less developed countries hardest (Bonjour et al., 2013).

**Figure 4.** *Percentage of population using solid fuels as main cooking fuel versus gross domestic product (GDP) per capita, 2010.*



Source: Bonjour et al., “Solid Fuel use for Household Cooking” (2013)

### *Disparities in Male and Female Health Impacts*

Table 1 shows existing evidence on the disproportionate impacts of indoor air pollution between men and women and, to a lesser extent, between men and children. Note that “Strong” evidence indicates many studies of solid fuel use in developing countries, supported by evidence from studies of active and passive smoking, urban air pollution and biochemical or laboratory studies (Rehfuess et al., 2006). “Moderate” evidence indicates at least three studies of solid fuel use in developing countries, supported by evidence from studies on active smoking and on animals. Moderate I indicates strong evidence for specific age/sex groups, and Moderate II indicates limited evidence (Rehfuess et al., 2006).

In one striking difference, we see that the relative risk of COPD for women aged 30 years or older was 3.2 whereas for men aged 30 years or older the relative risk was 1.8. Meanwhile, for incidence of lung cancer resulting from coal use the relative risk of women aged 30 years or older was 1.9 compared to 1.5 for men in the same age group. The WHO found strong evidence for a connection between indoor air pollution and COPD/lung cancer for women (Rehfuess et al., 2006). For men, the WHO found only moderate evidence for the same connection.

One thing that is clear from Table 1, even if we could agree that this evidence is deep (i.e., the methods are sound and therefore the conclusions are valid), is that this is a shallow evidence base, with only about a dozen studies (some of which are not peer reviewed).

**Table 1. Health impacts of indoor air pollution.**

Health outcome	Evidence	Population	Relative risk	Relative risk (95% confidence interval)	Sufficient or insufficient evidence?
Acute infections of the lower respiratory tract	Strong	Children aged 0-4 years	2.3	1.9-2.7	Sufficient
Chronic obstructive pulmonary disease	Strong	Women aged ≥ 30 years	3.2	2.3-4.8	Sufficient
	Moderate I	Men aged ≥ 30 years	1.8	1.0-3.2	Sufficient
Lung cancer (coal)	Strong	Women aged ≥ 30 years	1.9	1.1-3.5	Sufficient
	Moderate I	Men aged ≥ 30 years	1.5	1.0-2.5	Sufficient
Lung cancer (biomass)	Moderate II	Women aged ≥ 30 years	1.5	1.0-2.1	Insufficient
Asthma	Moderate II	Children aged 5-14 years	1.6	1.0-2.5	Insufficient
	Moderate II	Adults aged ≥ 15 years	1.2	1.0-1.5	Insufficient
Cataracts	Moderate II	Adults aged ≥ 15 years	1.3	1.0-1.7	Insufficient
Tuberculosis	Moderate II	Adults aged ≥ 15 years	1.5	1.0-2.4	Insufficient

**Source:** World Health Organization.(2006). *Fuel for life: household energy and health.*

### *Additional Relevant Literature*

Energy access has emerged as a central part of the global development agenda. It is enshrined in Sustainable Development Goal 7: “Ensure access to affordable, reliable, sustainable and modern energy for all” (Munro et al., 2017). Energy access remains a perennially popular target of development work because it is believed to offer a number of co-benefits. Former Secretary-General of the UN, Ban Ki-moon described energy as the “golden thread” that connects “economic growth, social equity, and environmental sustainability” (Pattanayak et al., 2018). Unsurprisingly, there is a large body of research on energy access and development.

A background document prepared for the 2012 World Development Report on Gender Equality and Development reviewed a broad set of literature related to energy access, development, and gender (Köhlin et al., 2011). Their review explores three types of energy access interventions: (1) increased access to woodfuels, (2) improved cookstoves, and (3) access to electricity and motive power.

The authors cite a number of studies that find these forms of energy access can lead to benefits for women. However, the authors also note these interventions have “been shown to have benefits for women and girls, but not necessarily greater benefits than for men and boys” (Köhlin et al., 2011). This is a key point, given it reflects a broader trend in the literature related to energy access and gender equality. While many studies on energy access may show empirical evidence of benefits for women, they often do not prove these effects are gender-differentiated. Köhlin et al. (2011) note there is a clear need for rigorous studies that examine benefits for women alongside benefits for men.

### *Importance to International Development Work*

It is critical to explore the relationship between energy access and gender equality because it is widely assumed that energy access benefits women more than men (Pueyo et al., 2019). This belief prompts governments, intergovernmental organizations (IGOs), and non-governmental organizations (NGOs) to undertake energy access interventions with the belief that gender equality will be among the favorable outcomes (de Groot et al., 2017). However, the evidence supporting the link between energy access and gender equality is thinner than one might think.

Many studies take it as a given that energy access produces gender-differentiated benefits for women (Gupta, 2019; Sovacool, 2012). However, these studies often do not present empirical evidence to support these claims. Instead, they only reference other studies that have conducted empirical analyses on energy access interventions. These analyses vary greatly in their design, from observational to experimental to quasi-experimental (Hirway et al., 2011; Po et al., 2011). Some are quantitative and multivariate; others are not. Some of the most frequently cited studies do find that women benefit from energy access; however, they do not present data on how women benefit *relative to* men (Manjula et al., 2017; Rosenthal et al., 2018).

Studies that do not present evidence showing that women benefit more than men—or that women benefit while men do not—cannot be cited as proof that energy access is a driver of gender equality. If these studies are being used by the development community to motivate energy access interventions, a closer look at the existing literature is badly needed. In other words, the development community needs to know whether or not energy access interventions can be credibly linked to improved gender equality.

### *Environmental Impacts*

While a large body of literature and analyses exist on the health impacts of solid fuel use and lack of clean energy access, considerably fewer studies exist that explore the impact of solid fuel use and lack of clean energy access on the environment directly. It is not difficult to imagine connections between natural resources, solid fuel use, and lack of clean energy (Jeuland and Pattanayak, 2012). Households relying on solid fuel will commonly use wood as their fuel of choice. This wood is most likely to come from the household’s immediate surroundings. Researchers have observed correlations between solid fuel use and localized deforestation (Brand-Correa et al., 2018; Pueyo et al., 2019).

The burning of solid fuels also contributes to air pollution, not just in the home but in the community and in the region. In addition to these local effects, there are also global consequences. Deforestation reduces carbon sinks, increasing GHG concentrations in the atmosphere (Pueyo et al., 2019). Liquefied petroleum gas (LPG), a common clean cooking intervention, is a fossil fuel product. When households use it, they increase carbon emissions, therefore accelerating climate change.

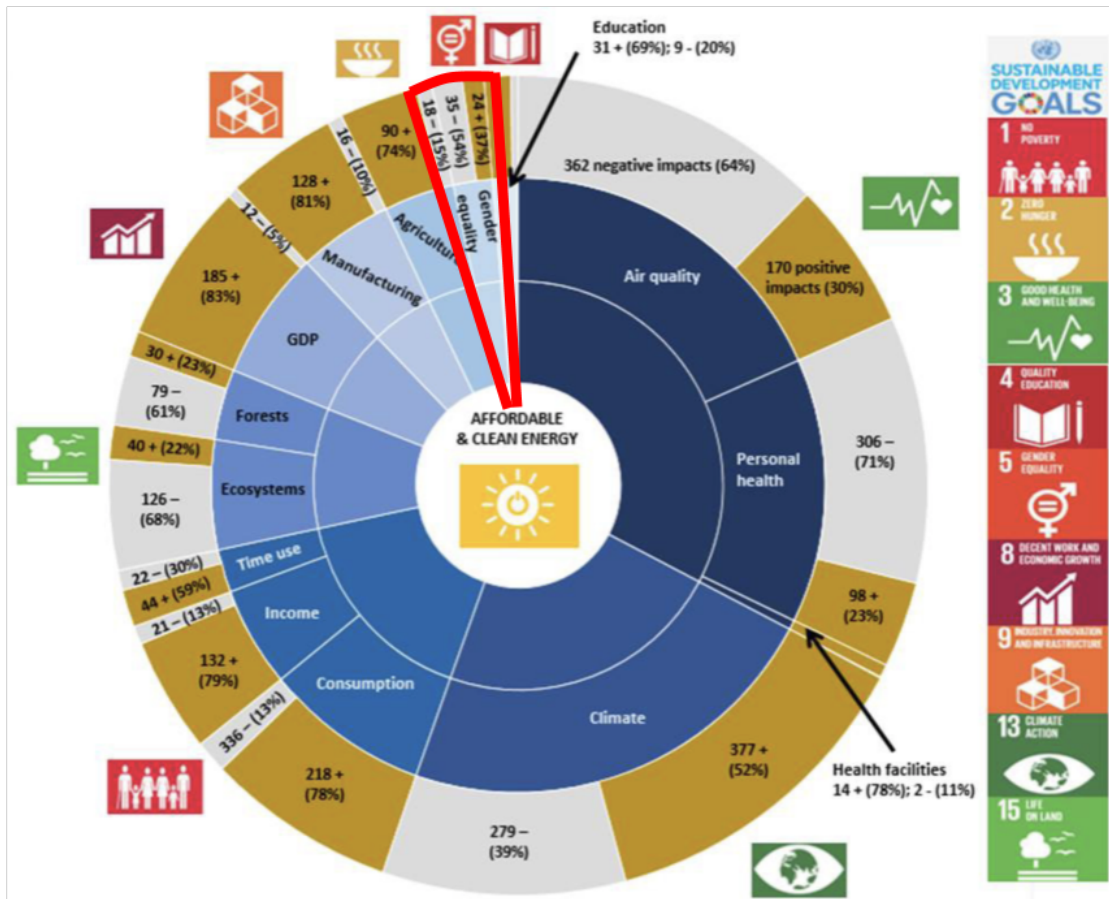
In short, these are important issues that deserve critical attention. This project's short treatment of them should not indicate their lack of importance or inferior importance to another dimension of energy access such as health. Instead, there exist far fewer studies finding a statistically significant relationship between energy access and gender that also consider local and global environmental impacts in detail. It is the author's hope that more studies will be undertaken in the future that explore the intersection of energy access, gender, and environmental impacts.

### **III. Data Sources and Description**

Starting in 2015, researchers from the Sustainable Energy Transitions Initiative (SETI) conducted an ambitious systematic review in which the researchers examined nearly 80,000 peer-reviewed articles related to energy and development (Jeuland et al. 2019; Pattanayak et al., 2018). Their goal was to understand the effects of energy interventions as they relate to the United Nations 2030 Agenda for Sustainable Development. Out of their large initial sample, the team identified 3,183 quantitative studies on affordable and clean energy, which they then categorized according to the 17 Sustainable Development Goals.

Of the set of 3,183 quantitative studies, only 67 demonstrate the effect of energy access on gender equality (Jeuland et al., 2019). The authors describe this as a notable "blind spot" (Pattanayak et al., 2018). By comparison, there were 438 studies related to household health. Figure 5 shows that, of the extremely large set of studies that were reviewed, only a small portion (highlighted in red) were related to SDG 5: Gender Equality.

Figure 5. Gender-related studies as part of larger set of energy-related quantitative studies.



Source: Duke Energy Access Project

Of the 67 studies that examine the impact of energy access on gender equality, 26 studies find a statistically significant relationship. The small size of this sample should not be lost on us. The SETI team reviewed nearly 80,000 peer-reviewed articles related to energy access and development (Jeuland et al., 2019). Of these, more than 3,000 articles were identified as both quantitative and relevant to the SDGs. From this subset, *only* 26 studies find a statistically significant impact of energy access on gender equity.

The remaining 41 studies find a statistically insignificant relationship between energy access and gender equality. Some of these studies find a positive relationship, i.e. energy access improves various outcomes (i.e. health, time savings, or education). Others find a negative relationship—lack of energy access harms women’s health, economic empowerment, etc.

This paper uses the 26 studies of the SETI review that find a statistically significant impact of energy access on gender equality as its foundation while adding studies published in the past three years that also find a statistically significant impact of energy access on gender equality. The SETI review was completed in 2017 and as such does not include any studies published between 2017 and 2020. This project collects and incorporates more recent studies on this topic, which are presented in conjunction with the studies identified by SETI. Two notable additions,

included after consultation with the author's advisor, are Litzow et al. (2019) and Yeh (2019). With this dataset, this paper will demonstrate which links between energy access and gender equality are supported by statistically significant empirical findings.

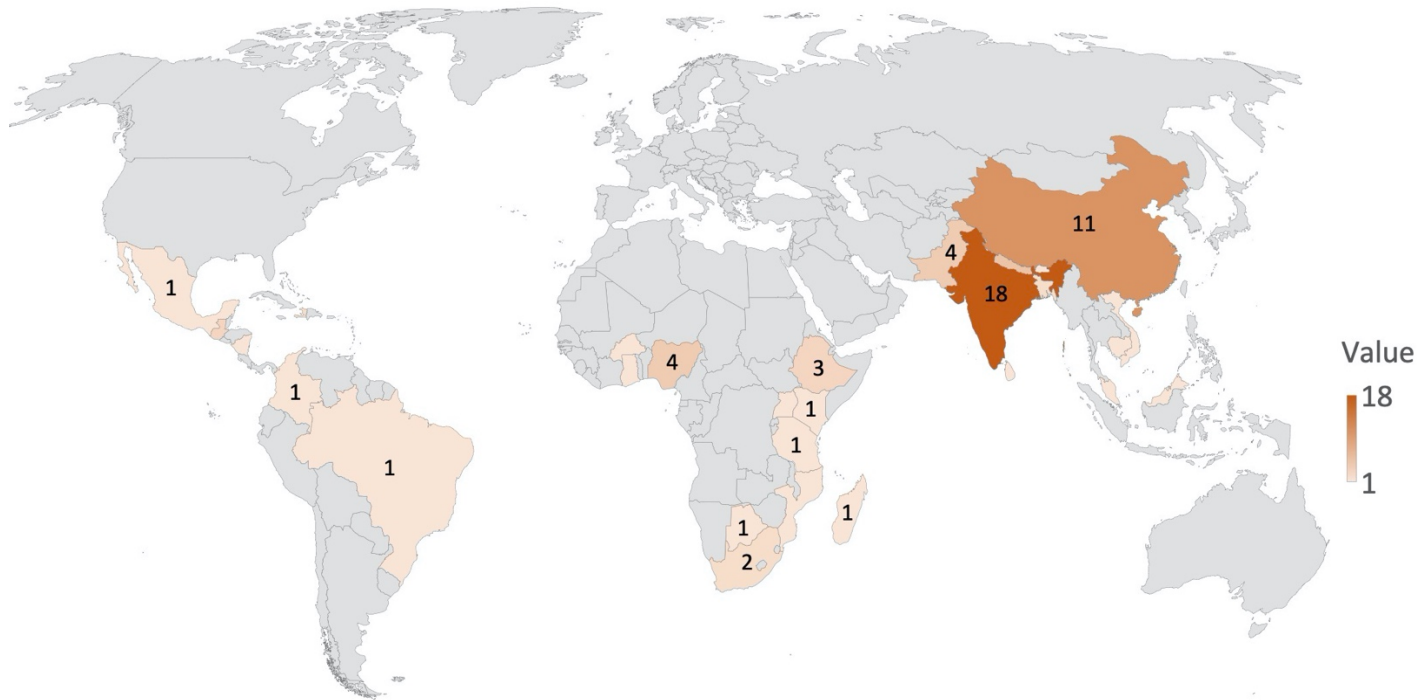
Recall that for a study to be included, it must show that the impacts are differentiated by gender and that the impacts benefit women more than men. These include studies examining interventions that benefit women but not men as well as interventions that benefit women more than men. Since gender equality aims to address women's existing disadvantages, only those interventions that reduce or eliminate the gap in wellbeing between women and men can be viewed as advancing gender equality.

#### **IV. Results**

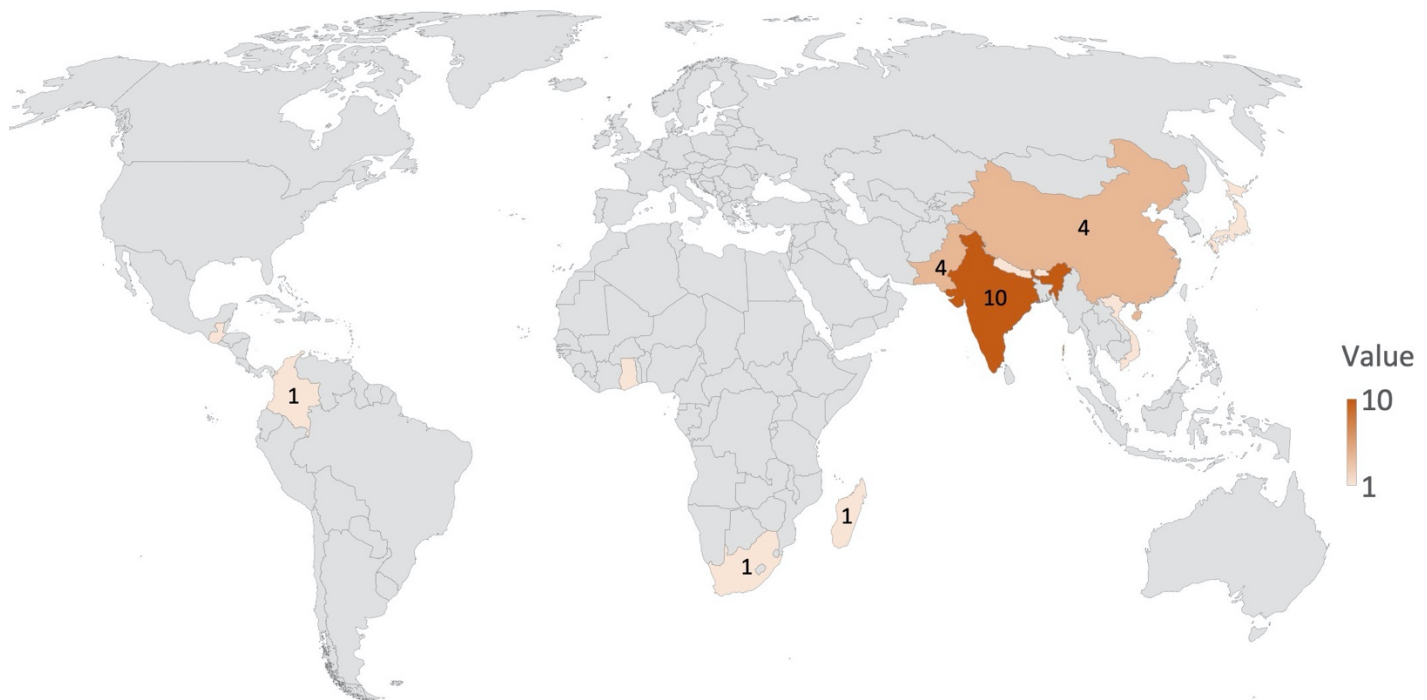
The studies that find a statistically significant impact of energy access on gender equality were conducted in a variety of countries and employed a variety of designs. Some studies were observational, some experimental, and other were quasi-experimental. The majority of the studies were conducted in Asia. The next largest proportion were conducted in Africa, followed by South and Central America. The majority of the studies were quantitative and multivariate. Grid electricity was the most common intervention technology, followed by clean fuels and hydro. A small number of studies (5) do not offer relevant findings on energy access and gender equality due to the nature of the interventions studied (Naz, 2013; Siegrist, 2014; Sonnenberg, 2011). Since these studies were disregarded, this project reviews a total of 23 studies.



**Figure 6.** Number of peer-reviewed studies examining the relationship between energy access and gender equality by country.



**Figure 7.** Number of peer-reviewed studies that find a statistically significant relationship between energy access on gender equality (in health, education, or time savings) by country.



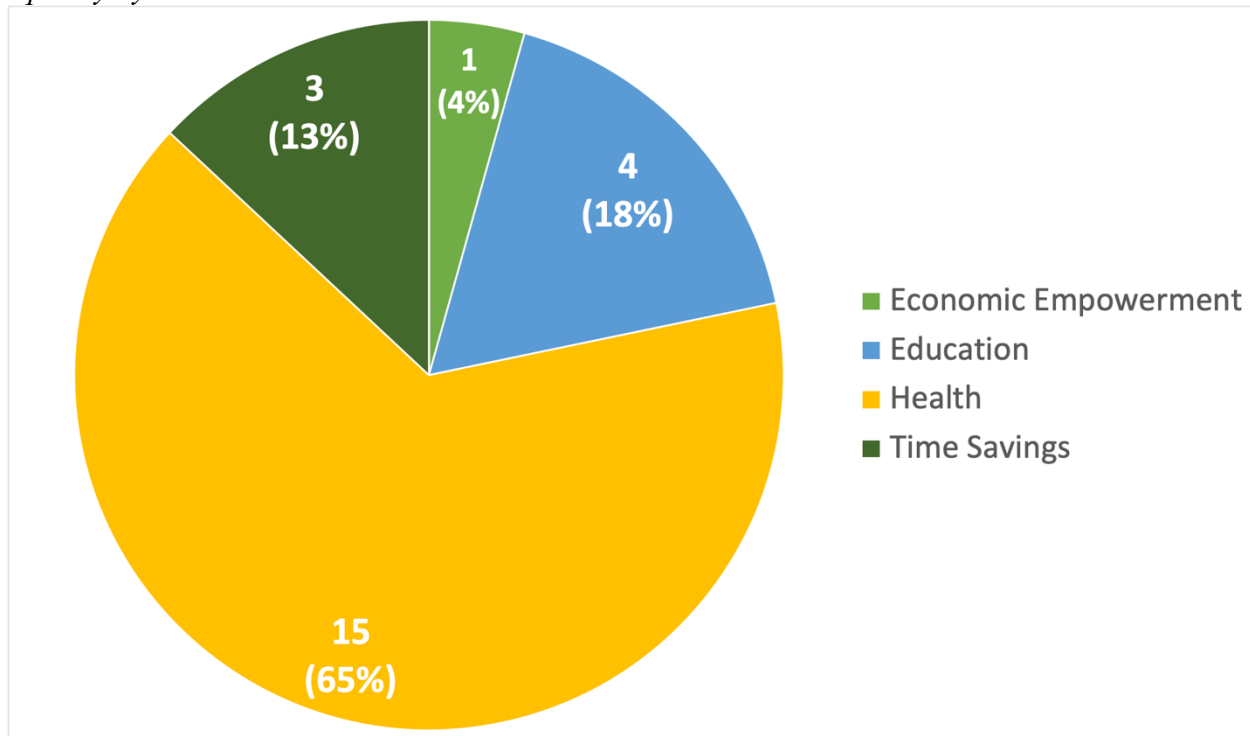


## Clean Cooking

Multiple studies demonstrate that clean cooking positively affects gender equality (Ding et al., 2014; Khushk et al., 2005; Parikh, 2011). Khushk et al. (2005) and Parikh (2011) find that clean cooking access leads to gender-differentiated health benefits. Khushk et al. (2005) find, for households using improved cookstoves, women “had fewer symptoms of dry cough” as well as lower levels of exposure to household air pollution (HAP). The study also found that women using clean cookstoves were “significantly less likely to receive burns (major or minor needing medical attention) in the previous month” than households using traditional fuels. For each of these impacts, women experienced benefits while men were not affected.

Parikh (2011) found that women who transitioned from the use of traditional fuels for cooking to clean fuels saw a reduction in previous-day coughing attacks from 65% to 42%. The same women also saw a reduction in previous-day incidences of backache from 64% to 39%. Both of these benefits were observed among women; no significant changes in coughing attacks or incidences of backache were observed among men. The study also found that transitioning to clean fuels reduced fuel collection time for women. However, the study did not collect corresponding data on fuel collection time for men. As such, it cannot be determined if these time savings were gender-differentiated.

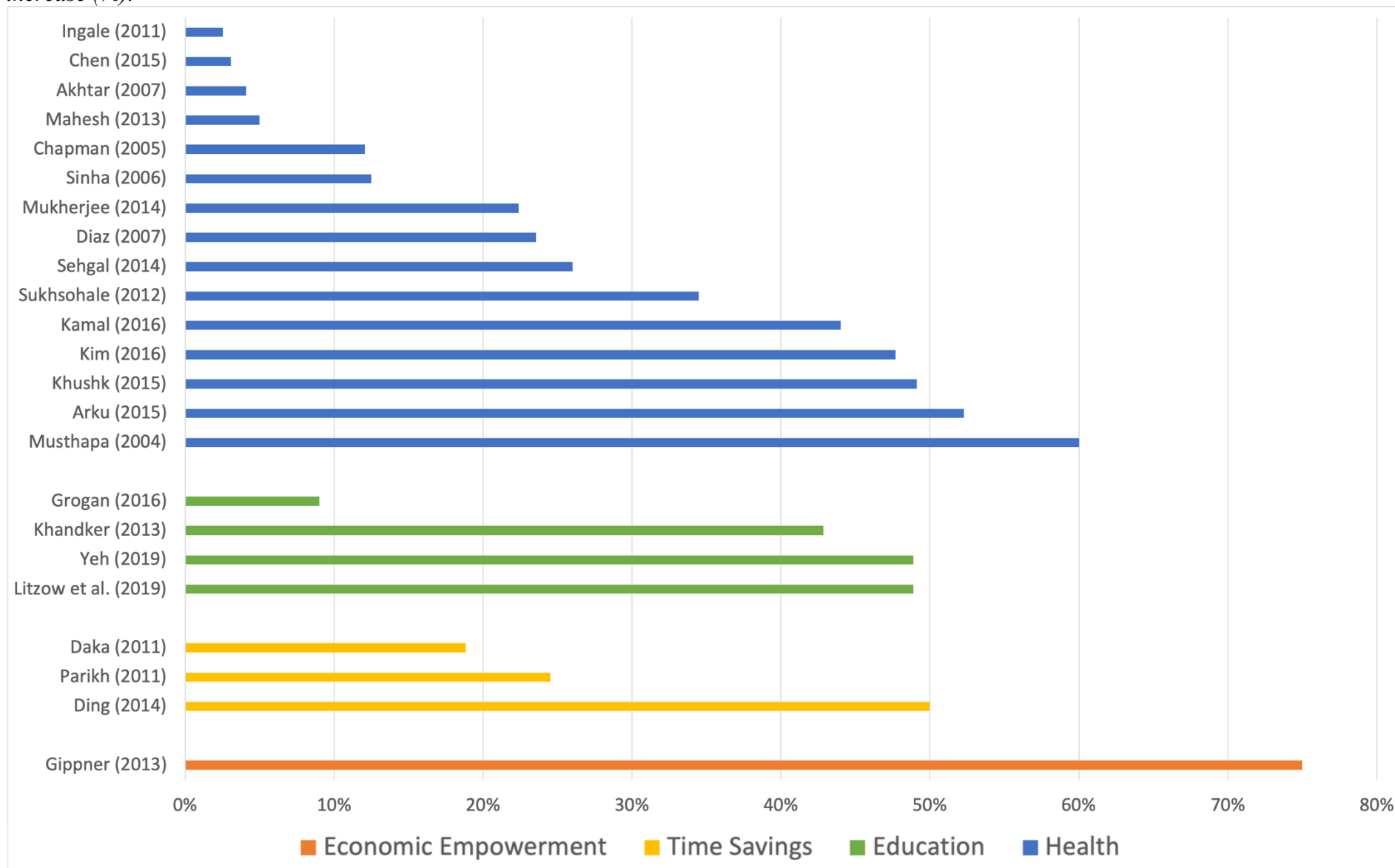
**Figure 8.** Peer-reviewed studies showing a statistically significant positive impact on gender equality by outcome.



Ding et al. (2014) show that women using biogas fuel for cooking see a 50% reduction in time spent preparing food. The study also found men in households using biogas were 33% more likely to participate in cooking and food preparation. The authors attribute this to attitudes about

cooking technologies. Men are more willing to participate in cooking when using a new technology versus a traditional technology. The study found women using biogas enjoyed a reduction of 2.7 hours per week spent collecting fuel. In the households surveyed, men were not responsible for fuel collection and therefore did not see time savings from the transition to biogas.

**Figure 9.** Impact of energy access on outcomes (economic empowerment, time savings, education, and health) measured as mean increase (%).



## *Electrification*

Several studies demonstrate that electrification positively affects gender equality (Daka et al., 2011; Gippner et al., 2013; Grogan, 2016; Khandker et al., 2013). Gippner et al. (2013) found that women experienced dramatic decreases in time spent on household chores following electrification. Daily time spent on food preparation plummeted from 2 hours to 10 minutes. The authors also found over a span of nine years, from 1996 to 2005, women's participation in small-scale enterprises increased by 75% after electrification was introduced to the community in 1996. The study notes it is difficult to control for other sources of variation over this time period that could have impacted economic participation among women. Male participation in small-scale enterprises also increased over this period but not as drastically.

Grogan (2016) finds that electrification led women to have fewer children, which caused women to participate in the formal workforce at higher rates. Women with fewer children were shown to spend less time on household chores. These time savings translated into increased economic participation.

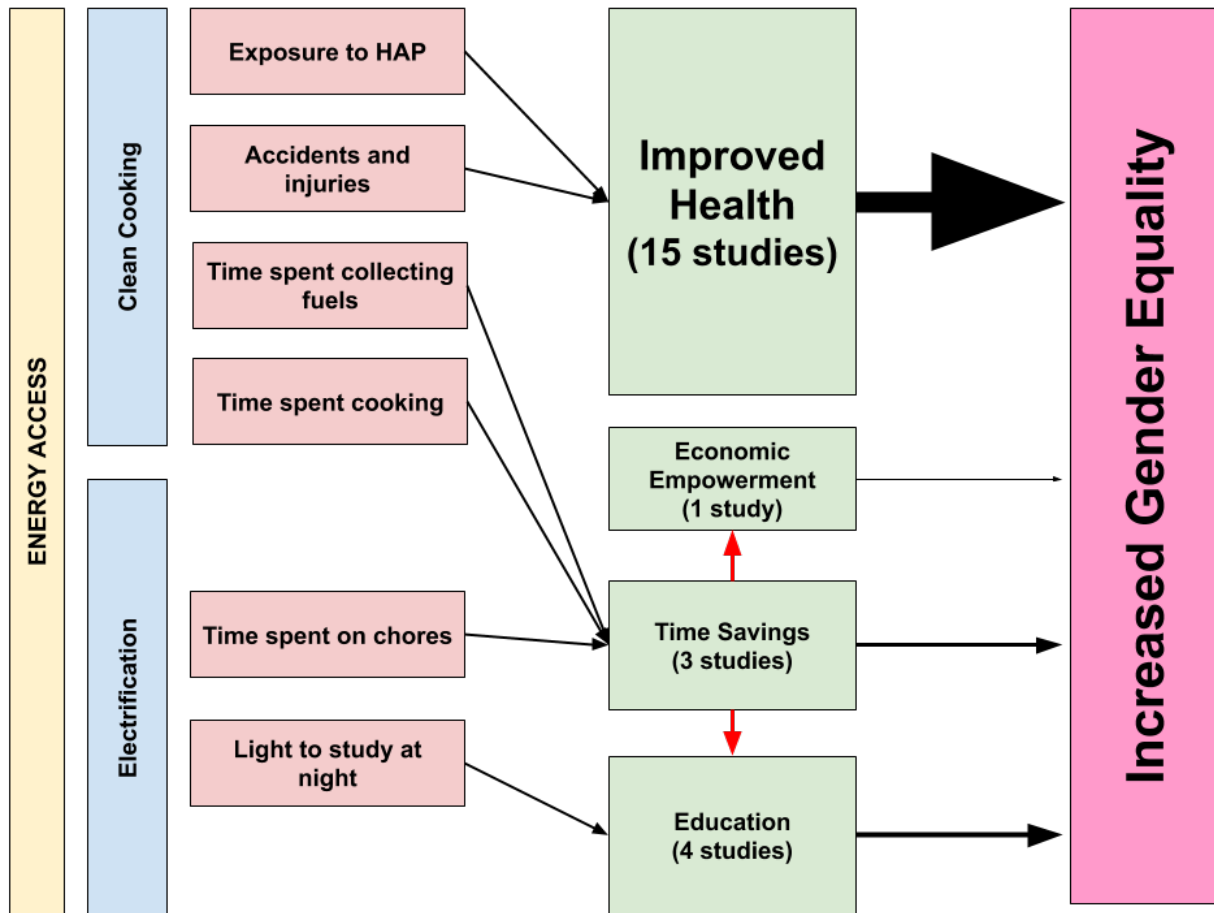
Daka et al. (2011) and Khandker et al. (2013) examine gender-differentiated benefits of energy access solely through the lens of education. Daka et al. (2011) find that electrification enables children to do their homework in the evening. Moreover, the authors find the effects of electrification on education are gender-differentiated. In most households in developing countries, daughters assist mother with domestic chores. Electrification reduced the time that daughters and mothers spent on chores. This allowed daughters to devote more time to schoolwork and gave mothers more time to help them. Boys did not experience increased participation in education as a result of electrification.

Khandker et al. (2013) also find that electrification affects school participation. They observe that household electrification increases school attendance by 6.3 percentage points for boys and 9.0 percentage points for girls. In electrified communities, boys' schooling increases by 0.13 years and girls' schooling increases by 0.90 years. As such, electrification increases access to education for both boys and girls, but the effect is much more pronounced among girls.

## **V. Discussion**

Using the findings of these studies, I revise my hypothesized theory of change to demonstrate which pathways have empirical support. Figure 10 displays only those energy access impacts that were shown to have a statistically significant positive effect on gender equality. The TOC has been updated to include the number of studies that support each outcome that contributes to gender equality.

*Figure 10. Revised theory of change based on reviewed studies.*



Two key findings emerge from my review of these studies:

- (1) There is a very small number of quantitative studies that find a statistically significant, positive relationship between energy access and gender equality.
- (2) These studies confirm many of pathways through which energy access is often believed to advance gender equality.

In regard to the first finding, the most obvious policy recommendation is that more studies of this type should be undertaken. There is a research gap at the intersection of energy access and gender that must be filled. Obviously, this is not the only blind spot in development research. Pattanayak et al. (2018) note there are also blind spots in household income and education, public service quality, and environmental consequences for forests and ecosystems. Just as the development community needs further empirical research into these areas, so too does it need further empirical research into the gender dimensions of energy access.

We have reason to be optimistic about what findings this further research will produce given the studies reviewed in this paper confirm many of the widely-held assumptions about energy access and gender equality. While these studies are small in number, they are quantitative, empirical, and report statistically significant results. We cannot claim, on the basis of a handful of studies, that there is robust evidence for energy access as a driver of gender equality. However, we can

say the findings of these studies support a coherent theory of change on how energy access leads to increased gender equality. Four pathways emerge: improved health, greater economic participation, time savings, and increased access to education. Further quantitative research on the relationship between energy access and gender equality would allow any government, IGO, or NGO undertaking an energy access intervention to claim that their work will advance gender equality.

## **VI. Recommendations**

### **1. Evidence strongly supports that health benefits from energy access contribute to gender equality.**

By far, health is the most well-supported pathway for gender equality in peer-reviewed studies that examine the impact of energy access on women. Organizations undertaking development work can credibly claim that energy access and clean cooking solutions benefit the health of women. Not only that, there is evidence that these interventions provide more benefits to women than they do to men, thereby contributing to gender equality.

### **2. Evidence moderately supports that time savings, education, and economic empowerment from energy access contribute to gender equality.**

Three other pathways for gender equality that are often associated with energy access are time savings, education, economic empowerment. The evidence for each of these pathways is limited to a handful of studies, even though these studies often find a sizable impact of energy access on any one of these three outcomes. This is not to say the link does not exist; instead, too few studies have been undertaken that examine this relationship.

### **3. Stronger partnerships are needed between scholars and practitioners in order to understand the impact of energy access interventions on women.**

Existing evidence does not strongly support the conclusion that energy access offers proven benefits to women outside the area of health. In order to address the gap of research surrounding the impact of energy access on time savings, education, and economic empowerment for women, greater collaboration is needed among scholars and practitioners. Practitioners cite time savings, education, and economic empowerment as reasons why energy access solutions will benefit women. But scholars are not conducting extensive research on these outcomes. Both communities can agree these are important dimensions that deserve more attention, and they should partner to fill the knowledge gap.

**4. More studies need to be undertaken that examine women's benefits of energy access *relative to men.***

Studies examining the gender dimensions of energy access are very few in number. They are almost completely eclipsed by studies exploring topics such as climate or air quality. The rarest kind of study examines the benefits women derive from energy access *as compared to* the benefits enjoyed by men. Without this crucial dimension, a study cannot be used as evidence that women benefit differentially from energy access. As such, the study cannot comment on gender equality. Given the number of development agencies that undertake work related to SDG5, more research needs to be undertaken that will allow us to confirm or deny the connection between different outcomes of energy access and gender equality.

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