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## **Gender Implications of Energy Use and Energy Access**

**Harold Wilhite**

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# **Gender Implications of Energy Use and Energy Access**

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## **Abstract**

The article reviews and consolidates both theory and findings on the gender consequences of energy access in the Global South. The literature shows that women across the Global South have far greater responsibility than men for the work involved in producing essential home energy services such as light and heat, cooking, and cleaning. The most significant impact of electrification is that it enables better time management by women and the reduction of physical work (drudgery). There is evidence from a number of settings that the time saved can be used by women to study, take on salaried work and start new small businesses, and that these benefits can be facilitated by including women in energy governance and planning. A point that is often missed, underestimated or misunderstood from a North American/European perspective is that gendered ideologies and practices in the Global South are deeply anchored in family and kin relations. The joint family is an entity and network through which money, assets and commodities move, creating obligations which are important to understanding the interaction of gender relations and energy access.

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## Introduction

Extending electricity infrastructures to communities in the Global South is essential to economic development and modernization, providing opportunities for improvements in education, health and many other social services. The coming of electricity production and transmission ('tentacles of modernity' in the words of Winther and Wilhite 2015) has consequences for virtually every aspect of local cultural and social practices, from political economies and political power to household routines and social relationships. There is evidence from a number of cultural settings that gender relationships and both men and women's situations are affected in significant ways by the arrival of electricity. Electricity brings social benefits by providing women with relief in the performance of household chores, as well as health benefits and educational opportunities, but these changes can bring with them tensions in both intra-household and community relations. Electricity can provide opportunities for employment and thus increase household incomes, but control over how electricity is used and how costs of electricity are met has consequences for the power relationships between men and women in the household. The literature shows that these gendered consequences of electricity are multifaceted and highly context-dependent. The aim of this scoping paper on gender and energy access is to inform and enrich the research agenda of the Applied Research Programme on Energy and Economic Growth (EEG), the objective of which is to shift energy consumption and pathways towards a more sustainable, efficient, and equitable paradigm. This paper will review and consolidate both theory and findings on gender consequences of electrification in Africa and Asia. It will flesh out challenges in researching the gendered consequences of electrification and identify gaps in our understanding of how electricity affects gender relationships and women's participation in micro-economies, local politics and education, as well as in the control and execution of household tasks. Given the embeddedness of gender in local cultural contexts, one of the EEG project's challenges will be to develop a sound research design that will provide a basis for making confident assertions about causal relationships in the nexus between gender and electrification.

By way of introduction, a few words on the concept of gender are in order, drawing on the excellent discussion by Clancy et al. (2011). Gender refers to a system of socially defined roles, privileges, attributes and relationships between men and women. Gender roles shape identity, determining how women and men are expected to think and act as women and men – and how they are perceived by others. Gender roles are often determined and prescribed by strongly held cultural and religious traditions. In many societies, the tasks and responsibilities that constitute women's roles are centered on the household and family (for example, homemaking, child-rearing, maintenance of family and kin relations, paid work that can be carried out within the home), while men's tasks and responsibilities are assigned to the public sphere (for example, entrepreneur, wage laborer, government employee or civil servant). In many parts of Asia and Africa, women experience strong social disciplining in the form of expectations placed on appearance and mobility. Because gender roles are socially constructed, they are subject to change in response to changing socio-economic circumstances, natural and man-made disasters such as droughts and war, technological development, education and so on. In other words, gender roles have deep roots in social relations and cultural practices, but change with time and circumstances, however slowly (Kelkar and Nathan 2005; Wilhite 2008). Changes induced by electrification can cause tensions in gender relations, but

can also alleviate stress by, for example, providing increased household income from women's salaried work and by freeing up time through the delegation of work to household appliances.

In the domain of international development, gender came late to the development agenda. Women's rights movements in the 1970s raised the need for greater gender-sensitivity in development aims and programs. From the 1980s, a focus on the need for a gender perspective in development increased, but this would not spill over into policies and approaches in the domains of energy and electrification until much later (Kabeer 1994). An important point is that while over the past couple of decades, gender sensitivity has been heralded as important to any development program there are still debates about how this is to be accomplished, which interventions are the most effective and how the benefits are to be measured. Within the field of electrification, the consequences for gender are as yet under-theorized and under-researched. There is a paucity of quantitative evidence on the empowering benefits of electrification such as improved educational opportunities, health improvements, and income generation activities (Kohlin et al. 2011). The single domain within the topic of gender and energy that has been given considerable attention is the benefits to women that accrue from the replacement of wood and fossil fuel-burning stoves with electrified heating and cooking technologies (solar or traditional), thus eliminating smoke and pollutants (World Development report 2012; Clancy et al. 2011 and Kohlin et al. 2011, Haves 2012).

Over the past two decades the call for integrating gender perspectives into energy development has intensified, both in the academic literature and within the international development community. There are two separate but related rationales for this new focus on gender: first, because of electricity's potential to make practical improvements in women's situations, such as reducing the time and drudgery dedicated to household chores, improving health and child care and so on; second, and in the longer term, exploiting electricity's potential to contribute to empowering women, through educational advancement and salaried employment, access to international media and through increasing women's participation in political organizations and energy governance. In the next section, both practical and long-term strategic gender implications of electrification will be discussed.

## **A review of important issues in gender and energy access**

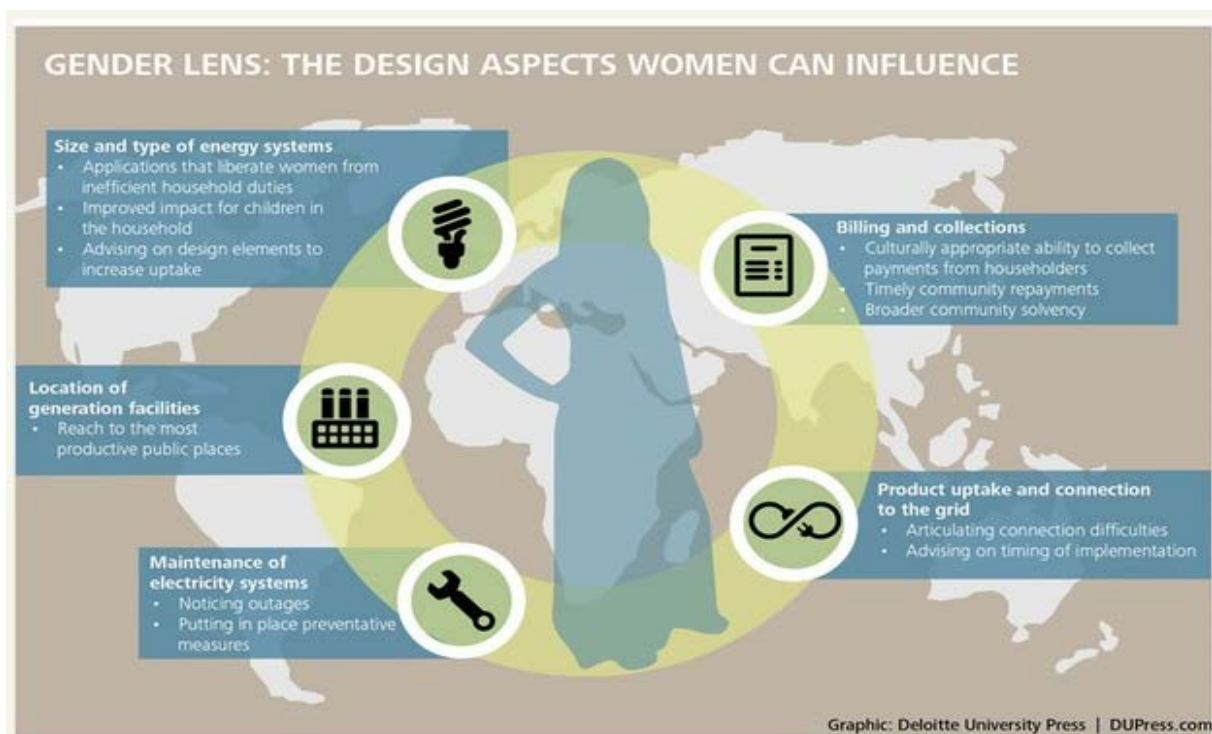
This section is based on a review of the literature on gender and electrification, supplemented by insights from my (the author's) gender-related research experiences in India and Africa. This review has benefitted from discussions with Tanja Winther and Karina Standal from my research group at the University of Oslo's Centre for Development and Environment, both of whom are acknowledged international experts on gender and electrification and who have participated in their own recent reviews (Standal and Winther 2016; Standal in progress; Matinga et al. in publication).

### **The importance of women's participation in energy governance and planning**

According to Clancy (2009), who reviewed the global initiative *Sustainable Energy for All*, the energy policies of most countries are gender-blind and insensitive to women's special needs. They relate this to the fact that international development agencies, the electricity industry and local governments around the world are dominated by men. A comprehensive study in South Africa in 2012 showed

that only 5 percent of those employed in the electricity sector were women (Dinkelman 2011). Research from several cases studied in Asia and Africa conclude that including women in the electrification planning process can better insure that women’s needs are met. Winther’s (2009) study of the electrification of Zanzibar revealed how male dominance in energy governance affects decisions about what gets connected to the grid. Winther points out how lower priority in Zanzibar was given to sites where electrification benefits women, including clinics, village mills and street lighting. A study by Sovacool et al. (2013) in Mali showed that including women in the design of a government project that supported the dissemination of small diesel engines attached to end us technologies led to improved women’s educational opportunities, as well as enhancing food security and community cohesion. Studies from Nepal, Peru, and Solomon Islands show that the involvement of women in the planning of micro-hydro projects led to a number of benefits for women (cited in Kohlin et al. 2011).

The graphic depiction by O’Dell et al. (2014) illustrates ways in which women’s participation in the design of energy systems can benefit women:



While using laws and quotas to bring women into governance positions is important, a study of large hydropower projects in Nepal showed that the appointment of women in project governance positions was not sufficient to insure their active participation in decision-making. Women’s contributions were not given serious consideration by their male counterparts (Upadhyay 2009). Follow-up efforts, such as insuring gender-sensitive leadership, will be needed in order to insure that women are granted full participation in governance decision making. A study led by the author (Wilhite) on rural solar electrification in Tanzania (reported in Elverhøi et al. 2012) found that women’s participation in governance and technical committees from the early design stages of the construction of a solar mini-grid were crucial to the success of the project. The women’s voices were particularly important in decisions about what was to be connected to the mini-grid, including a few

female-led small businesses, street lighting and a community center. In Standal's (2010) study of village solar electrification in Afghanistan, she found that the selection and training of women as solar engineers not only improved the implementation of solar lighting, but also changed men's perspectives on women's capacities.

Another domain of electricity governance where women can play an important role is in the design of information about new energy systems, the opportunities they provide and the design of energy tariff structures and billing procedures. Regular and reliable meter reading is important to the success of electrification and women's participation as meter readers is essential in the many parts of Asia and Africa where men who are not members of the extended family are not welcome - or in some cases not allowed - to enter homes when there are no male members of the household present. A study in rural India found that female meter readers had unproblematic access to in home electricity meters (Standal and Winther 2016).

### **Opportunities for salaried work**

Electricity facilitates economic development in various ways (IDS, 2003; World Bank 2012), which in turn provides new work opportunities for both men and women. Evidence from studies of both urban and rural households shows that acquisition of electric appliances saves women time and that this can be used for constructive purposes, such as income activities, education and political participation. Through the provision of light, electricity extends the length of the working day, especially important for household-based enterprises. There is evidence that in rural areas, where much of women's work is in informal sector activities such as gardening, vending and sewing, electricity can lead to greater productivity and income. However, it is important to note that access to electricity alone is not enough to stimulate startup business enterprises – other necessary inputs include startup capital, raw materials, access to transport and communication infrastructure. A study in South Africa revealed that post-electrification female-related economic activity was hindered by lack of women's participation in markets and distribution networks where men had the advantage of moving facily through social and geographical space while women did not (Dinkelman 2011). Benefits of electrification for women are also hindered by regulations and laws in many African and Asian countries that disfavor women, such as gendered laws on ownership of land and house, inheritance and dowry (see World Bank 2012). In parts of India, Africa and Latin America, women are not allowed to maintain bank accounts in their name or to otherwise retain the wages from their earnings; earnings are placed in a household account, which is controlled by the husband or by the senior members of the family. In parts of India, the decisions as to whether women work outside the home, and which jobs they are permitted to take are still made by the men of the household (Wilhite 2008). Also, in many countries, industries with a high proportion of female workers typically have lower job security, lower pay and fewer opportunities for women to advance into management positions. Another point is that female headed households in parts of Asia and Africa are overrepresented among poor and low-income households (Kohlin et al. 2011). A study of rural electrification in South Africa concluded that women were disadvantaged because they did not have access to credit or to information on the electrical technologies available (Utonih and Dlamini 2001).

Noteworthy studies on the relationship between electrification and salaried work:

- A study by Dinkelman (2011) in South Africa during the mass rollout of electrification found that rural electrification raised female employment in electrified communities by 9.5 percent. The same study was not able to identify increases in male employment. Dinkelman found that electricity provided work opportunities for women outside the home and enabled female-driven microenterprises. The study also found that electric light improved working conditions and extended hours for both in-home and salaried work. The income of self-employed women with access to energy was found to be over twice that of self-employed women without access to energy.
- A study in Northern Tanzania found that time saved by women after a switch from kerosene to electricity led to an increase in home-based income-generating activities (Maleko 2006).
- A World Bank/ESMAP study in rural India showed that women in electrified households use more time on income generating activities than in non-electrified households and that this applies to both rich and poor income groups (Haves 2012).
- In a study of a large sample of households in Brazil, it was found that in poor, rural households, women in households with access to energy are 10 percent more likely to have salaried work outside the home than those with no access (O'Dell et al. 2014). The possession and use of electric appliances were found to be the keys to saving time and providing the opportunity for increased salaried work. The study pointed to the importance of the washing machine, which can save up to 2 hours per day by eliminating the need to wash clothes by hand.
- A study by Grogan and Sadanand (2013) in Nicaragua found that access to reliable electricity increased the opportunity of rural women to work outside the home by approximately 23 percent because of time saved through the use of electric lighting and modern cooking appliances. The greatest impact was on younger women in the age group 20-35. Electricity was found to have no impact on male employment. In an earlier study conducted in Guatemala (2009), the same authors found a 9 percent increase in female employment after rural electrification with virtually no impact on male employment.
- Barkat's (2002) study from Bangladesh showed that in households with electricity, 11.2 percent of women were involved in income generating activities compared to 5.6 percent of women in non-electrified households.

While the results thus far are strongly indicative of a positive relationship between electrification and women's work opportunities, confidence in this relationship would benefit from longitudinal studies in differing national contexts such as that conducted by Dinkelman (2011) in South Africa.

### **Women's work inside the home**

Women in many parts of Asia, Africa and Latin America have full responsibility for carrying out household chores, many of which are time consuming and demand heavy physical labor. Studies from sub-Saharan Africa (Benin, Mauritius, Madagascar, Ghana and South Africa) show that women spend from 3 to 5 times as much time on household related chores as men. Electric light is the first energy service provided after homes are connected to the grid, providing illumination for homes, businesses, government offices and public spaces. The provision of electric light in homes extends light to spaces left unlit by kerosene or candle lighting and permits women to distribute chores such as cleaning and cooking throughout the early morning and evening. In rural and low income areas,



the inexpensive electric appliance purchases such as electric irons and cooking equipment provide time relief. Wilhite (2008) found that the electric iron was one of the first appliances purchased by poor households in south India after connection to the grid. This eliminates the need to gather wood and to prepare and maintain a fire for keeping the iron hot. In many households, small and affordable electric fans were purchased and placed in bedrooms and kitchens, where women spent several hours a day preparing food. Another of the first items purchased is reasonably priced electric mixmaster, which saves time in grinding and mixing herbs and vegetables in food preparation. In middle and higher income families, washing machines saved considerable amounts of time in clothes washing and allowed for evening washing. The acquisition of a refrigerator, referred to as a 'time machine' by Shove and Southerton (2000), reduced the considerable amounts of time used in food shopping and meal preparation. In Guatemala, Grogan and Sandanand (2009, cited in Kohlin 2011) found that women in electrified homes spend 34 percent less time cooking. Time studies and the use of diaries across India and other parts of Asia show that men's participation in food preparation and cooking is negligible (Charmes 2006; Wilhite 2008). Two studies from South Africa (Annecke 2005 and Matinga 2010, reported in Matinga et al. in production) observed that before the arrival of electricity men would only rarely cook and never iron, but that after the arrival of electricity 'some men' began to engage in both cooking and ironing, thus freeing up time for their wives. Matinga et al. also review econometric studies conducted in the Philippines and India which found that women in electrified homes spend significantly less time on household chores than those in homes without electricity (referring to Khandeker et al. 2014 and van de Walle et al. 2015).

### **Health and food security**

Reducing the negative health impacts of the burning of wood, biomass and coal in rural households has been one of the main goals of international development programs focused on energy access. Globally, it is estimated that over 2 billion people are dependent on biomass for cooking. In both India and China, over 400 million people use coal for both cooking and heating. According to Kohlin et al. (2011), around 600 million people in Sub-Saharan Africa cook with biomass. Women are largely responsible for finding and carrying biomass to be used in their homes for cooking and heating. Gathering fuel wood is a time consuming activity. A study conducted by ESMAP in India in 1996 surveyed 5000 households in 180 villages. The researchers found that about a third of households collected wood for cooking and heating and that the women in these households spent on average more than 2 hours a day collecting wood (Kohlin et al. 2011). There is evidence from several countries that the carrying of heavy firewood loads is related to increased maternal mortality (Akbar et al. 2011; Matinga et al. 2013; Parikh 2011). The use of these fossil fuels for heating and cooking is estimated to result in about 4,3 million deaths annually due to indoor pollution. Women and children are affected more than men because they spend many hours in kitchens cooking and tending to fires. Also, the use of kerosene lanterns used to provide home illumination has negative health consequences due to the emissions of toxic particles, soot and odor. These pollutants contribute to child pneumonia, lung cancer, chronic pulmonary problems and low birth weight (Ezzati and Kammen 2002; Smith et al. 2000). There is ample evidence that electrification results in cleaner indoor air (Pokhrel et al. 2010) and reduces the risks of burns, fires and accidents (Peck et al. 2008).

The coming of electricity allows for the expansion of refrigeration in food chains, health services and homes. For hospitals and health clinics, this can increase the capacity to store vaccines and other

medications, many of which are beneficial to women and children. For those households who can afford a refrigerator for their home, it provides longer and safer storage of raw foods and allows for the storage of cooked foods that can be reheated and served at later meals, saving time and reducing wastage. Refrigeration and freezing allows for meat storage in shops and homes. There is evidence that the availability of refrigeration is associated with an increase in the consumption of meat in the global South, particularly in urban areas (Lyon and Duram 1999; Haves 2012). This provides the opportunity for increased protein in diets and improved health; however, in India, Wilhite (2008) found that the refrigerator is also related to an increase in the consumption of unhealthy convenience foods and soft drinks among low and middle income families. The effects of refrigeration on diet, health and gender are complex and deserve further study.

## **Education**

Electric lighting has been shown to be associated with improved literacy among women. In a study in Bangladesh, women's literacy was found to be significantly higher (by 22 percent) in electrified households than in non-electrified households (Barkat et al. 2002). As reported in Matinga et al. (in production) a separate study by the World Bank in Bangladesh also found that electricity increased girl's schooling by 20 percent (on average about one additional year) and that this was true for girls in both rich and poor families (World Bank 2012). In rural India, a study by Barnes and Sen (2003) found electricity was a factor in the amount of time women spent reading. A World Bank study from 2013 conducted in rural India showed that girls enrollment in school increased by 14 percent after connection to the grid, whereas there was no significant increase in boy's enrollment. The review by Haves (2012) found 'some evidence' that the longer day provided by electric light leads to improved school performance, because children are able to study longer.

In rural Asia and Africa it is common for the girls in the family to contribute to household chores. A study in Brazil found that girls in rural areas with access to electricity are 59 percent more likely to complete primary education by the time they are 18 years old than those without electricity (O'Dell et al. 2014). Matinga et al. (in production) report on a study from Madagascar (Daka and Ballet 2011) in which children's time spent studying was examined in 100 households. Girls were found to spend more time studying after electrification, although the amount of time they spent doing household chores was not reduced. Electric light made it possible to do homework in the evenings under better reading conditions than by using kerosene lamps or candles. It also gave mother's more flexibility in timing chores and helping their children with homework in the evenings. It should be mentioned that there are several studies of the effects of electricity on girl's education that do not find a positive relationship. A comparative study of the effects of electric light in Bangladesh and Viet Nam (Khandekar et al. 2009) did not find differentiated impacts in study time or grades after electrification between boys and girls, nor did a study by Gustavsson from Africa (2007). The relationship between energy access and women's education deserves further study.

Electrification improves conditions for both students and teachers, providing access to lighting, computers, digital educational tools, photocopies and scanning, as well as fans to improve comfort. Electric lighting allows for teachers to tutor in the evening hours. According to the World Bank (2016), over 60 percent of primary school teachers in the world are female. Kohlin et al. 2011 report that the improved teaching conditions brought by electricity encourage teachers to stay in their local communities.

## **Media access and communication**

Electrification allows for easy charging of mobile phones (replacing mainly car batteries in Asia and Africa). In parts of Indian and Africa, young women are discouraged from the unchaperoned use of the telephone. Access to a mobile phone allows for independent communication and provides women with more security by providing easy access to their parents and to members of support networks (Wilhite 2008; Tenhunen 2009; Winther 2014). On the other hand, studies from rural Africa show that women's use of the mobile phone can raise family conflicts precisely because of the increased freedom it provides women to engage in private communication (Maika and Bailur 2015).

Studies in Indonesia, Sri Lanka and Bhutan showed that access to television resulted in greater awareness among women of gender issues and women's rights (Matly 2003). A study in Bangladesh of households representing a range of families from rich to poor found that women in electrified households with televisions were less likely to display son preference, less likely to arrange marriages for their children, and less likely to suffer wage discrimination. The women in the study had higher levels of mobility, a greater say in family decision-making, and improved knowledge about gender equality issues (Barkat et al. 2002; Asian Development Bank 2010). Similarly, a study on the impact of cable television in rural India found lower son preference, more self-determination among women, and less acceptance of domestic violence (Jensen and Oster 2009). After electrification in Tunisia, media access provided women with a better understanding of their legal rights (Chaieb and Ounalli 2001). Matinga and Annegarn (2013) found that South African women with access to television had improved their understanding of their entitlements, voting processes and how to negotiate the government bureaucracy. However, access to television is not without its pitfalls. Matinga (2010) found that television soap operas in which characters had contracted HIV/AIDS through contact with multiple partners caused confusion on AIDs prevention among female viewers.

### **Physical security**

The lighting of roads and public spaces brings increased security for women. It allows greater flexibility in performing chores such as shopping for food in the evenings, but also enables women to attend night schools and participate in community activities, such as political meetings (Havet, 2003). A study from Tunisia found that families in areas with street lighting were more willing to let their girl children walk to school in the dark early morning hours (Cecelki et al. 2005). A study in a Tanzanian village showed that after solar electrification and the advent of street lighting, the village was able to reduce the size of its police force due to fewer instances of assault and burglary (Elverhøi et al. 2012). In her study of solar electrification in rural India, Standal (in progress) found that the combination of street and home lighting allowed women with children to leave their children at home in the evenings without having to worry about fires from kerosene lamps. Women reported that lighted streets reduced the likelihood of physical injury from tripping and falling on unpaved roads, as well as reducing the anxiety of encountering snakes and scorpions.

### **Empowerment**

The promotion of gender equality and the empowerment of women is one of the Sustainable Development Goals. In this section, I give attention to the longer-term gender-empowering aspects of energy access. Jonathan Friedman (1992) and Naila Kabeer (2001) are important empowerment theorists in the domain of gender and development. Friedman (1992) analyzes empowerment as having three dimensions: social, political and psychological. The social involves access to resources, including means of production, financial resources, information, skills, surplus time and participation in social organizations. By political, he means access to participation in decision-making processes both in the public and private spheres. Psychological power implies awareness of one's potentials and having the confidence to develop them. Kabeer draws on Amartya Sen's (1985) capability approach, originally directed at empowering the poor; applied to gender, development should provide women with the capability to improve their situations.

Electricity can contribute to capacity building and gender empowerment in a number of ways, including the above discussed health, education and economic opportunities. However, the potential of energy access to enable economic improvements in women's situations in many parts of the world is constrained by gendered legal rights. In parts of Asia and Africa, women do not have the right to home ownership, land ownership or ownership of household bank accounts. This structures and limits women's choices concerning how electricity is to be distributed within regional and village contexts, as well as how it is used in households. In places where rights are most strongly gendered, electricity's potential to empower is reduced. Studies conducted for the World Bank on energy, poverty and gender in China, Sri Lanka and Indonesia, all found that electrification only resulted in marginal improvement in women's rights and participation in community affairs (IDS, 2003; Masse, 2003). The arrival of electricity in Zanzibar had little effect on gender ideologies and power relations (Winther 2009). In Southern India, the advent of electricity and access to electrical appliances made appliances such as refrigerators, washing machines and microwave ovens popular in dowry practices, changing the composition of dowry without challenging dowry as a gender-biased institution (Wilhite 2008). The research consensus is that electrification can make an important contribution to empowering women in Asia, Africa and Latin America, but must be accompanied by broader public policy initiatives favoring women if deep, long-term improvements in gender inequalities are to be accomplished.

## **Conclusions**

In this concluding section I will summarize important findings on the relationship between energy access and gender, point to areas in which the evidence is mixed and which deserve further study and suggest implications for the EEG project's thematic areas. This review reinforces the findings of other recent reviews of the energy-gender relationship and my own work over a 30 year period of researching household energy practices in Northern California in the 1980s (Wilhite and Wilk 1987) and in Norway, Japan, India and Tanzania in the intervening years (Wilhite et al. 1996; Wilhite 2008; Elverhøi et al. 2012): the tasks involved with the production of energy services (such as light, heat, cooling, cooking, cleaning) in homes in both the global North and South continue to be strongly gendered. Women have greater responsibility than men for the work involved in producing light and heat, cooking, cleaning and many other household tasks. The most significant impact of electrification, emerging time and again in the studies reviewed in this report, is that it enables time-saving and better time management by women in the execution of these chores; however, Cowan's (1989) landmark research in post-War USA showed that these time saving benefits of household appliances were not exploited to their fullest because women's place remained in the home and much of the time saved was simply filled with other home related tasks. This insight is relevant to current situations in many parts of Asia, Africa and Latin America. This links back to the discussion on gender empowerment and the importance of efforts to broaden the field of opportunities for women in the workforce, politics and education. Access to electricity alone will not wipe over gender inequalities; nonetheless, in the rural South where physical work and significant amounts of time are spent collecting biomass, ironing, washing clothes and cooking, electricity has the 'power' to lighten women's daily load and in cases where public laws and regulations are in place that have the purpose of opening work forces and educational systems for women, freed up time can be used effectively to obtain work, income and better educations.

Another important insight from this review is that in the Global South, gendered ideologies and practices are deeply anchored in family and kin relations. This is often missed, underestimated or misunderstood in research designs formulated from a North American/European perspective. Whether living under the same roof (joint family household), or spread across large geographical areas in 'family-scapes' (see Appadurai 1994), the joint family is an entity and network through which money, assets and commodities move, creating obligations which are important to understanding social and gender relations. In many parts of Asia and Africa, the marshalling the funds to pay for a grid connection, for electrical appliances and for the electricity used is a joint family exercise. In India household appliances are often exchanged through a web of extended family obligations and gifts such as dowry, wedding gifts and many other extended family ritual practices (Wilhite 2008; Standal in publication). These and other studies reviewed in this article emphasize the importance of an openness of research on energy access to perspectives on the interrelationships between family, gender and the arrival of energy the services it provides. The analysis of these 'informal economies' (Hart 1973) will demand a research design consisting of mixed qualitative and quantitative methods.

While there are common themes emerging from the studies reviewed, it is also clear that women's benefits from electrification and economic growth are dependent on the gender ideologies, relationships and practices of the specific national and local geographies that are electrified. In the upcoming phase of the EEG project, a multi-sited, comparative study will be essential to highlighting commonalities and contextual differences in the relationship between energy access and gender empowerment. Regarding the research agenda of EEG theme one (linkages between electricity supply and economic growth), while the empirical evidence is thin and stems mainly from mini-grid electrification, it seems that women's participation in energy supply decisions can be advantageous for improvements in women's work and benefits, and can increase the priority given to electrifying industries and businesses which are important to women (such as cottage industries, milling, fabric and so on). This relationship between women's participation in electricity governance and electrification decisions that are beneficial to women could be tested in phase 2 of the EEG project. Another understudied issue is women's benefits from the electrification of the health sector, including hospitals and clinics. Health benefits have yet to be thoroughly studied and quantified. A point that deserves attention by both EEG theme two (financial and policy instruments) and six (innovative and appropriate design of energy infrastructures) is the relationship between the structure of grid connection costs and electricity tariffs on the one hand, and female-headed households' ability to connect and to manage expenses on the other. A point that has received considerable attention in research centered in rural areas, but deserves further exploration, particularly by EEG theme three in urban settings, is the time management advantages that follow from electrification, including the relationship between saved time and the acquisition of salaried work, income and improved education. A point relevant for all themes is that in socio-economically disadvantaged urban neighborhoods and in poor rural settings an electricity connection may not be sufficient in itself to encourage measurable economic growth, but even small changes in women's income brought by electricity may have a significant impact on the economies of families living below the \$1 dollar per day threshold.

Concerning research methodology, since gender ideology and practices are deeply embedded in the social relations of a given place, the use of close-up, qualitative methods is essential to generating insights on the relationship between energy access and women's situations. The vast majority of the studies cited in this review use one or another form for qualitative research design such as

participant observation, qualitative interviews, life histories and diaries. The textures of daily life emerging from these close-up methods reveal important aspects of how energy access affects gendered practices; however, as Matinga et al. (in publication) report in their recent review, only a few gender-electricity studies have been able to identify causality between electricity and changes in gender practices (referring to White 2008; Jensen and Oster 2009; Dinkelman 2011; Khandeker et al. 2014; Grogan and Sadanand 2013; vand de Walle et al. 2015). In urban areas, statements about causality are made more difficult because the coming of electricity often takes place in a context in which other non-electricity related changes are underway, such as the arrival of new products (produced elsewhere) in shops and retail outlets, new businesses, and government programs such as those dedicating quotas in educational programs to women. In rural areas, effects might be masked by climatically-related seasonal changes involving cycles of planting and harvesting. Making confident assertions about the energy-gender relationship will depend on a research design based on mixed methods and focused on multiple scales from neighborhood/village to nation. In future research, carefully selected cases in differing geographical regions should be used to secure both contextual information on energy-gender relationship, which would inform quantitative surveys and statistical/econometric analyses.

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