Nearly one fifth of humanity do not have access to electricity, and more than double this number still rely on the use of biomass for cooking\(^1\). Experience suggests that when a household or a whole community gains access to modern energy, defined here as electricity and improved cookstoves (see Appendix), there are many benefits to the economy and to people’s quality of life. However because of the different roles that are assigned to men and women, any major change in living situation such as energy access has the potential to affect men and women differently. While there are many anecdotes suggesting that gaining access to modern energy brings specific benefits to women, rigorous impact evaluation studies are harder to find. This paper reviews the evidence from available studies on how gaining access to electricity and clean cooking impacts women and girls.

\(^1\) OECD/IEA, October 2011. ‘Energy for all: Financing energy access for the poor’.
Introduction

Most of the people without access to modern energy are poor. Lack of energy access affects all aspects of life, from childcare, to subsistence agriculture, to earning a living. Without energy services, it is very difficult for people to move out of poverty and establish more viable and resilient livelihoods. It is for this reason that the United Nations General Assembly declared 2012 the International Year of Sustainable Energy for All, recognising that “...access to modern affordable energy services in developing countries is essential for the achievement of...the Millennium Development Goals and sustainable development.”

It is obvious that the effect of energy access on women is relevant when considering how the Millennium Development Goal on gender equality (MDG 3) will be achieved. Perhaps less obvious is that the effect of energy access on women is relevant to achieving the Millennium Development Goal on poverty (MDG 1). However, this is very much the case, because a disproportionate number of the world’s poor are women. While the claim by the United Nations Development Programme that women constitute 70% of the world’s poor has been disputed, it is widely accepted that poverty cannot be tackled without taking into account the needs of women. Therefore if energy is to play an instrumental role in tackling poverty, it must meet the specific needs of women as well as men.

There is ample anecdotal information on the benefits of energy access for women, but a surprising lack of hard evidence. A 2011 World Bank background paper on energy and gender highlighted the need for more evidence-based studies, stating that “overall, there is a great predominance of grey literature dealing with energy–gender relationships and strikingly few rigorous impact evaluations”. The first aim of this report is therefore to review the evidence on how access to modern energy services benefits women and girls. Our initial intention was to limit the review to peer-reviewed articles published in academic journals, but given the shortage of these we have also included studies from academic institutions and major multi-lateral organisations such as the World Bank and the Asian Development Bank. The review examines the impact of gaining access to electricity on women and girls, and also looks at the impact of switching from traditional cooking methods to cleaner cooking.

The second aim of this paper is to consider the implications of these changes on the lives of women. For instance are they making life easier? Reducing poverty? Reducing gender inequality? The framework that is used to analyse the gendered impact of gaining access to modern energy services is in terms of different types of gender needs. This framework, conceived by Maxine Molyneux, differentiates between practical needs (those which arise out of existing gender roles) and strategic needs (those which challenge existing gender roles). Meeting practical needs is essential, but inequality will not be addressed without challenging existing gender roles, hence the importance of considering strategic needs.

The most common first uses for electricity are lighting and television, and it is on these uses that there is the most evidence available. Electric light usually replaces kerosene lamps or candles, but television is often available for the first time. Another important use is for productive equipment; that is, equipment that processes or adds value to primary materials. Electricity can also be used for refrigeration, both for food and in health care, however no evidence-based studies documenting the effects of this were found.

Access to cleaner cooking methods is beneficial for the whole family. However, it is particularly beneficial for women and children who, because of their roles in the family, typically suffer more from the effects of cooking on open fires. Cleaner cooking can come in the form of more efficient stoves using less biomass; electric cooking appliances; using liquid petroleum gas (LPG); and biogas. Our main focus will be on studies of efficient biomass stoves and biogas.
Electric light

More time and how that time is used

When households are able to use electricity for lighting, this affects the whole family by effectively extending the day. For women, this is usually a very positive development. Many women around the world are short of time\(^7\),\(^8\) and a longer day helps to ease the constraints of combining housework and childcare\(^9\),\(^10\), roles that are typically assigned to women along with, in some cases, income generating or farm activities.

The extended day can be used to earn more. Matly’s 2003 study of two communities gaining access to electricity, one in Indonesia and the other in Sri Lanka, showed that some women used their time gain for home-based income generating activities such as processing nuts and wrapping cigarettes\(^11\), and Barkat’s 2002 Bangladesh study showed that women in electrified households were more likely to do handicrafts and sewing during the evening; 11.2% of women in households with electricity were involved in such activities compared to 6.6% of women in unelectrified households\(^12\). However, this extended day may sometimes be a mixed blessing. Lumampao et al found that a micro-hydro project in the Philippines actually had the net effect of increasing the time women spent working, and hence drudgery and time pressure, because having light available to do household chores at night meant that they could spend longer doing agricultural work during daylight hours\(^13\).

There is some evidence that the longer day leads to improved school performance, as children are able to study for longer. This was a reported consequence of the rural electrification programme in Tunisia\(^14\). There is anecdotal evidence that this is especially beneficial to girls, as in some situations they are required to do household chores once they return from school while the boys do homework, using most of the kerosene. However, more evidence on this subject is needed.

Electric lighting and a longer day can mean that women are more likely to read or have more time for socialising. This was the case both for women in rural India\(^15\) and Matly’s Asia study\(^16\).

Health and safety

Electric light in Tunisia had a particularly positive effect on female school enrolment, as lighting in public places gives families more confidence that their daughters will be safe on the way to and from school\(^17\). There is some evidence that the longer day leads to improved school performance, as children are able to study for longer. This was a reported consequence of the rural electrification programme in Tunisia\(^14\). There is anecdotal evidence that this is especially beneficial to girls, as in some situations they are required to do household chores once they return from school while the boys do homework, using most of the kerosene.

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There are other benefits from using electric lighting rather than kerosene lamps. These come in the form of reduced indoor pollution and lower risk of burns\(^18\), and also less cleaning work as there is no soot to dirty clothes and linen\(^19\).

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3. Ibid: 36
10. Matly, M. 2003:
11. Cecelski et al., 2005: 13
13. Lumampao et al., 2005: 36
**Economic stimulation?**

Some studies found that electrification increased women’s income generating activities, but did not determine the reasons for this effect; it is possible that in addition to women having more time, there is also a greater demand for labour stimulated by community electrification. A World Bank/ESMAP study in rural India showed that women in electrified households spent a little more time earning income than in non-electrified households and that this was true for both rich and poor groups. Dinkelman’s work on comparing electrified and non-electrified South African communities shows that women’s employment increases 13.5 percentage points after electrification, with only a corresponding 4 point increase for men.

**TV and Radio**

**Empowerment**

Electricity often leads to increased access to media such as television and radio, which can have major impacts on the lives of women and girls. One of the most significant effects is that exposure to media, and hence a variety of cultures and lifestyles, can change opinions about the role of women in society, both for women themselves and in the wider community. Matly’s Indonesia and Sri Lanka study and the Asian Development Bank’s Bhutan study showed that access to television resulted in greater awareness of gender issues and rights. The study of households in Bangladesh found that women from electrified households were less likely to display son preference, less likely to arrange marriages for their children, less likely to suffer wage discrimination and had higher levels of empowerment (consisting of three indicators: women’s freedom in mobility, participation in family decision-making process, and knowledge about gender equality issues), and this held true even when comparing electrified poor households to non-electrified rich ones. A study on the impact of cable television in rural India also found lower son preference, more self-determination, and less acceptance of domestic violence.

**Family size**

Another interesting finding of the study of the impact of television in India is that access resulted in lower fertility. It is suggested that this is because the families seen on television do not usually have large numbers of children, thereby changing opinions about the ideal family size. This is supported by the Bangladesh study, which showed that access to electricity resulted in smaller desired family size, and by a study in Brazil which found that exposure to soap operas reduces fertility. Lower fertility is good for maternal health, as increased spacing between births is associated with lower maternal mortality.

Having a television in the home can also make it a more desirable place to be, increasing the amount of time the family spends together. Both Cecelski and Matly document that men are less likely to go out in the evenings and more likely to watch television if this is available at home.

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20 Köhlin et al, 2001: 36
21 Barnes and Sen, 2004: 60.
23 Matly, M. 2003: 82
25 Barkat et al, 2002: pp. 104–113
27 Barkat et al, 2002: pp. 104–113
30 Cecelski et al, 2005: 13
31 Matly, M. 2003: 52

**Productive Equipment**

There is not much evidence available on how electricity used for productive equipment affects women and girls as it is rare for electricity to be used on equipment that is relevant to traditional women’s tasks. However, the study in the Philippines did find that when micro-hydro power was used to power a rice mill, this resulted in time savings and reduced drudgery for women and girls.\(^{32}\)

**Refrigeration**

Probably the most surprising thing about refrigeration is that it has been so little studied. While Cecelski mentions the advantages of having refrigeration for vaccines and medicines, the impact of this has not been studied or quantified.\(^{33}\) The gendered impact of refrigeration on commerce does not appear to have been studied at all.

**Other benefits of electricity**

**Migration**

Having electricity can also play an important symbolic role in society in addition to its practical uses. A study by the Institute of Development Studies of several rural communities in China found that access to electricity, and particularly lighting, was considered essential for the well-being of the village, as not having it was a severe social stigma that resulted in out-migration and difficulty in finding marriage partners.\(^{34}\)

**Cleaner cooking**

**Health**

Improved biomass cookstoves and biogas plants significantly cut indoor air pollution (see Appendix). Evidence shows that this can dramatically improve respiratory health as well as reduce incidences of headache and eye discomfort. A study of the effects of using the Patsari stove in rural Mexico found that the percentage of households with members suffering from acute respiratory disease (measured as cough) was reduced from 74% with the traditional stove to 30% with Patsari adoption. Eye discomfort was reduced from 70% in households using the traditional open fire to 8% when using the Patsari stove.\(^{35}\) Users of the Justa stove in Honduras reported symptoms of cough, phlegm, wheeze, headache during cooking, and shortness of breath less frequently than those using traditional stoves.\(^{36}\) A study on the use of biogas in Nepal showed that its use resulted in a 24% reduction in respiratory diseases, a 39.7% decrease in eye infections, 40.9% reduction in headaches, and 26% reduction in cough among women who had reported that they were suffering.\(^{37}\) There were also reductions among men and children.

In addition, a systematic review of the effect of indoor air pollution from household solid fuels on children concluded that risk of pneumonia in young children is increased by a factor of 1.8 by exposure to unprocessed solid fuels.\(^{38}\) Analysis of health data in India shows that persons living in households that primarily use biomass for cooking fuel have substantially higher prevalence of active tuberculosis than persons living in households that use cleaner fuels.\(^{39}\)

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\(^{32}\) Lumampa et al., 2005.


\(^{34}\) Lucas, R., 2003: 100

\(^{35}\) Garcia-Frapolli et al., ‘Beyond fuelwood savings: Valuing the economic benefits of introducing improved biomass cookstoves in the Purépecha region of Mexico’, Ecological Economics vol 69, 2010: 360


\(^{39}\) Mishra et al., 1999. ‘Biomass cooking fuels and prevalence of tuberculosis in India’, International Journal of Infectious Diseases, 3(3): 119
Time savings

Improvements in health bring with them savings in time. The study of the use of the Patsari stove used GTZ estimates for ‘the number of hours lost due to disease (inability to work, visits to health centres, nursing time, among others) when using a traditional open fire stove’ and compared this to using the improved stove. They found that families using the Patsari Stove saved 40.6 hours per year due to better health.40

Improved stoves and biogas plants cut the use of fuelwood (see Appendix), and this gives significant time savings for those responsible for collecting it, usually women and children. An ESMAP time use study in rural India found that among those women with an improved stove, the average time spent collecting fuelwood decreased from 2 hours 6 minutes to 1 hour 22 minutes per day41. The Asian Development Bank’s Bhutan study also showed a decrease in time spent collecting fuelwood after electrification. This showed that both men and women participated in collecting fuelwood, and hence benefitted, but women benefitted more. “For women, the reduction in time spent on fuelwood collection is 34% higher (27.6 minutes for women compared to 21.6 minutes for men per day)”42.

The installation of biogas in Nepal led to a large reported decrease in the time spent by women collecting firewood and preparing dung cake: this went from 3 hours 45 minutes per day to 1 hour and 22 minutes per day. While there was a new time demand in feeding the biogas plant, this only took 29.7min per day, leaving a net time saving of 51.8min per day43.

This study also asked respondents what they did with this extra time. Among women, the largest proportion (32.5%) said they used it for social and community work. Next came income generating activities (27.8%) and recreation/watching TV/listening to the radio (25.9%)44.

Saving money

Improvements in health mean that families do not have to spend as much money on health care: the Patsari study found that 31% of rural households’ healthcare spending was on acute respiratory diseases, which “decreased by 30% when households used the improved Patsari stove”45.

Discussion: practical and strategic needs

It is clear that gaining access to modern forms of energy brings benefits to the entire family. Some of these benefits accrue primarily to women; these are mainly those that relate to energy use in the household. In other areas, however, this is not the case, as there is anecdotal evidence that women’s needs are rarely considered when decisions are made about which electrical appliances to purchase, meaning those that would significantly reduce women’s drudgery (such as electric grinding mills) are not purchased.

Many of the benefits of modern energy for women lie simply in making their lives easier through better health, more time, and more money. These benefits of modern energy are considered to meet practical needs; that is needs arising from the existing roles of women. These benefits are very important in reducing women’s drudgery and improving their quality of life.

Health

It is clear that using an improved stove can dramatically reduce indoor air pollution. This has many positive health effects for eyes, headache, and the respiratory system. As it is women who are primarily responsible for cooking in most households across the developing world, it is women, and the young children who accompany them, who suffer most from the effects of indoor air pollution and therefore benefit the most from its reduction.

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40 Garcia-Frapolli et al, 2010: 2601
41 Barnes and Sen, 2004: 39
42 Asian Development Bank, 2010: 17
43 Katuwal, H. et al., 2009: 2673
44 Ibid
45 Garcia-Frapolli et al, 2010: 2602
Time and money

The evidence shows that having access to both light and productive equipment can significantly reduce the burden on women’s time. Enabling women to accomplish their allotted tasks more quickly and easily leaves more time for rest and relaxation, including reading. It is undeniable that this represents an improvement in quality of life.

The time and money savings that result from improved health and reduced need for firewood through access to cleaner cooking are also significant. However it should be noted that data for money saved through better health are only available for the Mexican communities studied, and this could vary considerably depending on local health care costs. The reduced burden of collecting firewood has many positive impacts similar to the time gain of having light into the evening provided by electricity.

There are also benefits of modern energy that extend beyond meeting practical needs into empowering women and changing attitudes about women’s roles. These are considered to meet strategic gender needs. Of course, some benefits can be both practical and strategic, such as increased opportunity for income generation activities and increased female education.

Income generation

Gaining access to employment or undertaking paid work meets both practical and strategic gendered need. For women, it is not only about increased incomes, but can also challenge stereotypes about women’s roles. This can result in greater gender equality. There is much work and evidence suggesting that when a woman starts to earn an income, it gives her more bargaining power in the home.46

This strategic affect can be increased if women take on traditionally masculine work. For example, electricity enabled the women in Barkat’s Bangladesh study to do handicrafts and sewing. However these are seen as traditional women’s activities, therefore doing them more effectively meets primarily practical needs as it does not challenge traditional gender roles. In contrast, engaging women in the production and provision of electricity can be an effective way of challenging gender roles and meeting strategic gender needs, as this is typically seen as a male area. While there have been some instances in which this has occurred, more evidence is needed. The World Bank working paper on energy and gender states: “Engaging women in the supply of electricity and motive energy can also increase their welfare but the evidence is scarce. There is a clear need for rigorous studies to identify key design elements to obtaining benefits for women in energy supply”.47

Education

The evidence that electricity can increase female school enrolment is encouraging. Not only does it increase girls’ chances of gaining employment, increasing female education and girls’ school enrolment is a key target of Millennium Development Goal 3 (promoting gender equality and empowering women) as it gives women increased confidence and more access to political power.

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46 See, for example, Kabeer, N, 2002 “Women, Wages, and Intra-household Power Relations in Urban Bangladesh”, Development and Change, 28(2)

47 Köhlin et al. 2001: 42
Media

One of the most striking effects uncovered by this review is the extent to which access to media can be a vehicle for women’s empowerment. The evidence shows that those women who had access to television were more aware of their rights and were less likely to hold views that promote the subordination of women. This clearly meets the strategic need to challenge existing gender roles and relations, showing that access to television can be an important tool in empowering women.

Lower fertility associated with access to television could also be an indication of empowerment, if it means that women feel less pressure to have large families. However more evidence on this topic is needed.

Conclusion

The evidence shows that gaining access to electricity meets significant practical and strategic needs for women. Access to good quality light can make performing childcare and household chores, tasks still typically assigned to women, easier. Gender roles can be challenged by women starting paid employment, especially if this is work not typically done by women. How this can be achieved through involving women in the provision of electricity, and in particular the opportunity for this provided by local provision of electricity, warrants further investigation. Expanding women and girls’ access to education and information through increased schooling and access to media contributes significantly to female empowerment, and is arguably one of the most important outcomes of gaining access to electricity. The use of cleaner cooking technologies has very positive impacts for women’s health, which in turn results in time and money savings. Increased fuel efficiency also means less of a burden in collecting wood, a task often allotted to women.

These were the effects documented in the studies reviewed. However it should be noted that there is a lot of additional anecdotal information about the benefits for women of access to modern energy collected by NGOs and others working in the field that has not been studied; for example the positive impact of birth clinics having electricity on maternal health. These effects are very important and rigorous impact evaluations are needed, as a more thorough understanding would enable energy interventions to be designed in a way that led to more positive gender impacts.

Finally, although the authors of this report conducted a thorough search for evidence, it is always possible that some evidence has been overlooked. We would welcome any comments directing us to relevant studies not included in this review.
Appendix

Meaning of ‘energy access’

This paper will use the definition of access to modern energy services used by the Sustainable Energy for All initiative, which is that ‘energy access is the physical availability of modern energy services, including electricity and improved end-use devices such as cookstoves, to meet basic human needs at affordable prices.’

Indoor air pollution

Traditional cooking methods vary from country to country and region to region. However most involve burning biomass and can cause dangerously high levels of indoor air pollution. Evidence shows that the use of improved stoves, which burn biomass more efficiently, reduces indoor levels of air pollutants with a diameter of 2.5 micrometers or less (PM2.5) and carbon monoxide. Different improved stove designs have different effects, but a study of the rocket stove in use in Ghana found average 24-hour PM2.5 concentrations decreased 52% and average 24-hour kitchen CO concentrations decreased 40% compared to using a traditional stove or open fire. A study of the use of the Justa stove in Honduras was associated with 73% lower levels of indoor PM2.5 and 87% lower levels of indoor CO levels compared to traditional stoves.

Use of biogas for cooking reduces indoor air pollution even more than using an efficient biomass stove. The Biogas User Survey in Nepal shows that, of users, 85.5% reported that smoke was reduced drastically in the kitchen after the biogas installation. The amount that smoke was reduced is related to the extent that households continued to use the traditional stove alongside the biogas.

Reduction in fuelwood consumption

Changing from an open fire or traditional cooking method to an improved stove, biogas, or using electricity for cooking reduces fuelwood consumption. Berrueta et al’s 2008 study of the Patsari stove showed that its use resulted in ‘an average reduction in energy consumption of 67% in households exclusively using fuelwood’. In Katuwal’s study of biogas users in Nepal, a reduction of 53% in consumption of firewood was observed, and the Asian Development Bank’s study of the impact of electrification on people living in rural Bhutan showed that ‘an average electrified household is likely to use about 583 kilograms less fuelwood per year compared to an unelectrified household’ (it should be noted that this data is not broken down to separate heating and cooking).

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14 Clark et al. 2009: 367
15 Katuwal, H. 2009: 2671
17 Katuwal 2009: 2672