

7. GENDER, POVERTY and THERMAL ENERGY SERVICES

Sustainable Thermal Energy Service Partnerships

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FOREWORD

In recent years, there has been a concerted drive in sustainable energy research to consider the effects of gender on energy, and energy poverty. Women in developing countries are often affected by the adverse effects of energy poverty more than men, whether through time burdens and drudgery in fuel collection, or pollution, particularly indoor air pollution.

Conversely, empowering women in developing countries has been shown to be a significant source of growth, particularly for sustainable energy, but also in a wider economic sense, and has significant co-benefits in terms of public health.

This working paper aims to examine the ways in which energy poverty affects women globally, but also the effects that empowering women, particularly in sustainable energy entrepreneurship, can lead to huge gains in terms of product dissemination, and business success and sustainability

- Xavier Lemaire & Daniel Kerr, 2017.

Acronyms

COPD	Chronic Obstructive Pulmonary Disease
DEEP	Developing Energy Enterprise Program
ENERGIA	International Network on Gender and Sustainable Energy
GVEP	Global Village Energy Partnership
LPG	Liquefied Petroleum Gas
TSP	Total Suspended Particles
WHO	World Health Organisation

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0. Introduction

In recent years, there has been a concerted drive in sustainable energy research to consider the effects of gender on energy, and energy poverty. Women in developing countries are often affected by the adverse effects of energy poverty more than men, whether through time burdens and drudgery in fuel collection, or pollution, particularly indoor air pollution. Conversely, empowering women in developing countries has been shown to be a significant source of growth, particularly for sustainable energy, but also in a wider economic sense, and has significant co-benefits in terms of public health.

This working paper aims to examine the ways in which energy poverty affects women globally, but also the effects that empowering women, particularly in sustainable energy entrepreneurship, can lead to huge gains in terms of product dissemination, and business success and sustainability.

1.0 – Defining the Problem: Intersections of Gender, Energy and Poverty in Developing Countries

In examining the role that improving energy supply can have on populations in developing countries, research has shown that women and girls are often significantly adversely affected by energy poverty in comparison to men. There are a number of reasons behind this, most notably the gender roles at the household level in the majority of developing countries.

The use of inefficient fuels contributes to indoor air pollution, a facet of energy poverty where women are adversely affected compared to men. Pollutants such as harmful gaseous combustion by-products, as well as particulate matters such as soot, can cause severe health issues with over-exposure, and the roles that women tend to take in developing world households expose them to these pollutants significantly more than men. Women in developing countries are also far more likely to devote their daily time to energy resource and water acquisition than men, as well as spending more time cooking, and in unpaid care roles, such as care for children or the elderly. Energy poverty, as defined through the use of inefficient fuel sources such as traditional woodfuels, impose a significant time burden on women through the need to gather fuel, as well as spend long periods of time on food preparation tasks such as cooking.

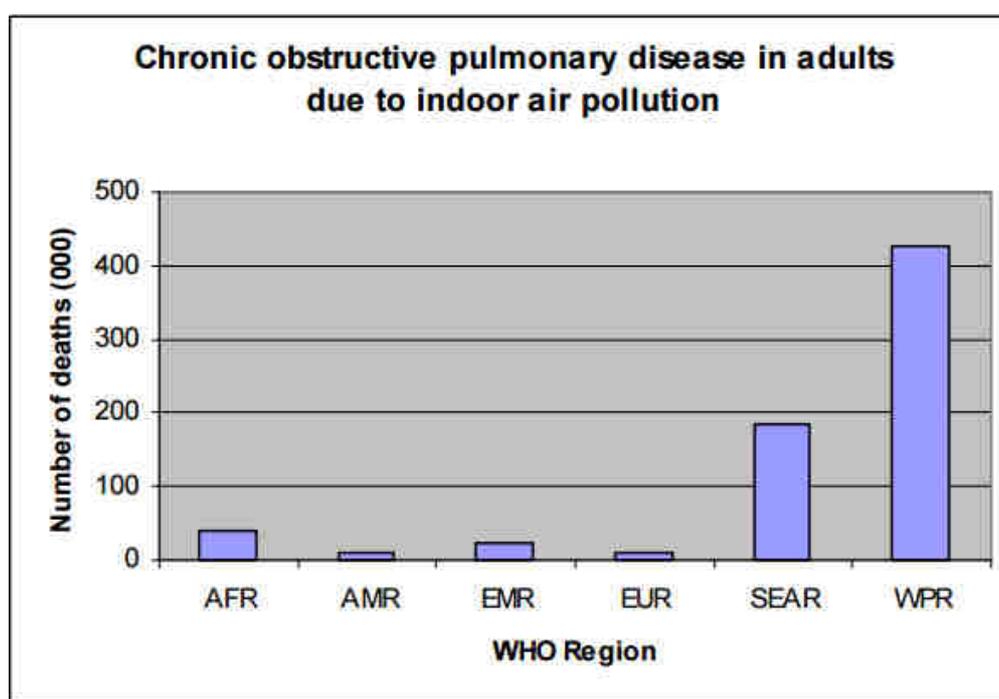
The burden on women's time in particular imparted by energy poverty leads to a third area where women are disadvantaged: employment and education. The lack of available daily time due to the high time burden incumbent in the use of inefficient fuels means women in developing countries are less likely to have available time for employment and income generation, and girls are less likely to have time for education past a certain level. This lack of opportunity for self-empowerment through employment or education leads to a self-perpetuating status: women in developing countries do not have time due to the use of inefficient fuels, and cannot change their socio-economic situation through employment because of this. This has been described in the literature as the gender-energy-poverty nexus.

1.1 Indoor Air Pollution

The effects that indoor air pollution can have on individuals in developing countries is now well documented (WHO 2012). Indoor air pollution contributes to diseases that are responsible for millions of deaths worldwide per year, particularly pulmonary conditions (diseases of the lungs) and heart diseases, as well as strokes. This polluted indoor environment that is prevalent in developing world households due to the use of traditional, inefficient fuels is a major contributor to early and preventable deaths.

Pollution in the indoor environment can take the form of smoke, which contributes to ill health through the inhalation of harmful gases such as carbon monoxide and nitrogen oxides, as well as soot and other particulate matter, which can cause irritations of the lungs and eyes, cancers, and inflammations of the respiratory system.

Figure 1. Chronic Obstructive Pulmonary Disease Deaths Annually due to Indoor Air Pollution



Source: WHO, 2012.

(AFR=African Region, AMR=American Region, EMR=Eastern Mediterranean Region, EUR=European Region, SEAR=South-East Asian Region, WPR=Western Pacific Region)

The WHO estimates that 3.8 million deaths are caused annually by preventable diseases attributable to indoor air pollution. Of these, approximately 700,000 women die annually from strokes attributable to exposure to indoor air pollution. Women who use inefficient, polluting fuels are more than twice as likely to suffer from chronic obstructive pulmonary disease (COPD), which accounts for one-third of premature deaths linked to air pollution annually. (WHO 2012, WHO 2016)

Women are at the forefront of exposure to indoor air pollution in the household. A number of surveys in developing countries analysing the composition of men's and women's days in the developing world have found that women devote more time to cooking, food preparation and tasks inside the home than men do to a large extent, and therefore are spending greater amounts of time exposed to the potentially harmful pollutants that exist in the indoor environment, if using inefficient, unclean-burning fuels.

There is significant scope for the supply of cleaner thermal energy sources to alleviate the burden of a polluted indoor environment for women in developing countries. Cleaner-burning cookstoves, using more efficient fuels, can contribute to an overall cleaner environment, reducing incidence of ill health from pollution effects. This improved combustion can come from two sources at a technical level, either a more efficient cookstove (for example, an insulated woodfuel stove, or a rocket stove), or from switching to a more efficient fuel (for example, replacing woodfuels with charcoal/LPG). (Differ Group/GACC 2012)

1.2 Time Burdens on Women in Developing Countries

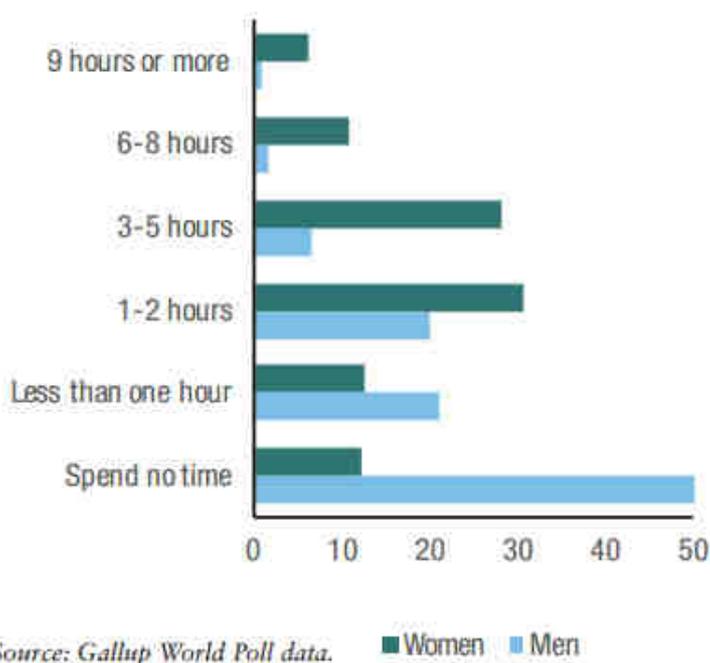
The time burden inherent in the use of inefficient, traditional fuels is another way in which energy poverty affects women adversely compared to men. As with the issue of pollutants, using traditional fuels for thermal energy uses in the home incurs a much higher time penalty in comparison to the use of modern thermal energy sources.

This is particularly true in household which still rely on traditional woodfuels, as the collection of firewood for cooking or boiling water presents a time burden in itself, in addition to the less efficient combustion these fuels offer, resulting in longer times spent using the thermal energy resource. A survey in Mozambique from 2015 found that women were spending an average of two hours per day accounting for water and energy resource provision to their household, in addition to around five hours in food preparation, which imposes a significant burden on their daily time, leaving little available for other activities, such as income generation. (FAO 2015)

Improving access to modern thermal energy sources has the potential to reduce this time burden to a large extent. This can be through improving access to energy resources in general, for example through providing easier access to improved biomass fuels like charcoal or wood pellets, or can be achieved through the use of cleaner cooking/heating technologies, such as improved cookstoves or solar water heaters.

Improved cookstoves can alleviate the time burden of cooking through being more time-efficient than traditional cookstoves, or through requiring a lower-maintenance cooking method. Solar water heating technologies can remove the need to heat water using traditional fuels, and frees up time spent on this task for other uses.

Figure 2. Time Spent on Household Work by Respondents in 46 Developing Countries (2005-2016)



Source: Hunt & Samman, 2016.

1.3 Time, Education and Employment

The net effect of the use of inefficient energy sources on women’s time in developing countries is a significant reduction in the amount of daily hours available for activities other than subsistence. The knock-on effects that this can have on overall levels of education and employment in the female workforce in developing countries are wide-ranging. Women’s participation in the workforce in developing countries is lower than that of men, and durations of education for girls are also lower than that for boys, meaning girls stay in school for less time, and are more likely to assist with subsistence activities such as fuel and water collection.

Education and employment are often seen as directly correlated, and if the use of modern energy sources can contribute to allowing women and girls to have greater time availabilities, then improving the availability of time and access to education or employment will assist dramatically in improving household incomes and livelihoods in the developing world.

There are a number of factors at play as to whether these benefits will translate to real-world experience, however, and whilst this section focuses on energy provision, social factors relating to women’s work and education, for example the perceptions of society, mobilities for women (both physical and virtual) in the developing world and prevailing socio-economic conditions also need to be accounted for. Overall, these factors contribute to a large reduction in the availability of income-generating time and activities for women in developing countries. Alleviating the burdens of time placed upon women through inefficient energy use, and also through providing clean, safe water supply, has the potential to contribute to levels of employment among women in the developing world, and also for education for girls. (Clancy et al. 2012)

Table 1. Gender Indicators for Selected East African Countries as of 2012

Gender Indicators	Kenya		Uganda		Tanzania	
	Male	Female	Male	Female	Male	Female
Primary school attendance ¹⁰	72%	75%	83%	82%	79%	82%
Youth Literacy (15-24 yrs) ¹⁰	92%	94%	90%	85%	78%	76%
Labour participation rate (2010) ¹¹	72%	61%	80%	76%	90%	88%
Seats held in national government (2011) ¹¹	90%	10%	65%	35%	64%	36%

Source: GVEP International, Clough 2012.

Table 2. Secondary School Enrolment for Women in Selected African Countries

Secondary School Enrollment, Females (% of Total Females, 2010-2012, latest data)			
Benin	13	Lesotho	37
Botswana	66	Madagascar	24
Burkina Faso	17	Malawi	29
Burundi	17	Mauritius	74
Cameroon	39	Mozambique	17
Cote d'Ivoire	14	Namibia	57
Ethiopia	11	Nigeria	22
Gambia, The	56	Senegal	19
Ghana	44	Uganda	15
Kenya	48		

Source: World Economic Forum 2013 Gender Gap Report.

2.0 – Women’s Empowerment through Sustainable Energy

Given the significant impacts that the use of inefficient thermal energy sources can have on women specifically in the developing world, solutions for breaking the cycle of energy poverty contributed to by the use of these energy sources are required, and must be aware of the need for a component of women’s empowerment specifically, given the disproportionate effect on women that energy poverty can have. (O’Dell, Peters & Wharton 2014)

Women’s status in terms of employment in developing countries is another limiting factor. Estimates from the Developing Energy Enterprise Program (DEEP) implemented by the Global Village Energy Partnership (GVEP International, Clough 2012) suggest that across East Africa, the majority of women work in subsistence or commercial agriculture, as well as making up approximately half of the micro-enterprises sector in the region. This is in contrast to men, who tend to dominate the formal employment market.

In addition, legal barriers such as land inheritance and other unnecessarily discriminatory policies have impacted the ability of women to engineer their own empowerment; a lack of right to land or ownership of land can significantly hamper economic growth in the region. The lack of right to land and discrimination in inheritance laws is not just an issue in the East African region: these issues have also been reported as a barrier to women’s empowerment in South Asian countries such as India, as well as in countries such as Indonesia, and some West African countries such as Ghana. (Lambrecht 2016)

2.1 How can Sustainable Energy Technologies Encourage Women’s Empowerment?

Sustainable energy technologies have the potential to have a transformative impact on the lives of women in developing countries. Modern energy services can have a wide variety of effects on the lives of their users in developing countries, dependent on technology, household energy use modes and household structure, including employment. In particular, access to modern energy services, particularly thermal energy services given the prevalent energy use modes of women in developing households (specifically cooking energy use, and lighting), has the potential to reduce the negative effects that the use of inefficient energy resources have on women.

The nexus of indoor air pollution caused by the use of inefficient biomass fuels, and the time burdens incumbent on women in developing countries through fuel collection, is one area that sustainable energy technologies can help in empowering women. Switching to more efficient methods of fuel use, through the reduction of smoke and particulate matter emissions, alleviates one of the main areas where women are adversely affected in developing countries compared to men by their energy use.

Children also suffer from increased air pollution: studies from the late 1990s have shown that increasing total suspended particles (TSPs) by 1% leads to a reduction in infants surviving to 1 year of age by 0.35%. Other studies, such as the RESPIRE program in Guatemala in the early 2000s, found significant qualitative evidence of health improvements from improved cookstove use reducing indoor air pollution. 52.3% of respondents who had received an improved cookstove under the program reported health improvements over the 16 month testing period, compared to just 23.5% for the control group. The evidence therefore suggests that reducing women’s and girls’ exposure to indoor air pollution reduces the incidence of adverse health effects such as pulmonary diseases or burns, enabling them, in general, to lead fuller, longer and more productive lives. (Duflo, Greenstone & Hanna, 2008)

Table 3. Indoor Air Pollution Emissions from IWA Stove Tiers

Indoor emissions Sub-tiers		
	Indoor emissions CO (g/min)	Indoor emissions PM2.5 (mg/min)
Tier 0	>0.97	>40
Tier 1	≤0.97	≤40
Tier 2	≤0.62	≤17
Tier 3	≤0.49	≤8
Tier 4	≤0.42	≤2

As defined by the International Standards Organisation. Tier 0 = least efficient, Tier 4 = most efficient. Traditional cookstoves general tier 0-1, improved 2-3.

Source: GACC, 2016.

However, the productivity increases that are often targeted through improving women’s sustainable energy access generally lie in the sphere of reducing the time burdens, and associated drudgery, that are inherent in the use of inefficient traditional biomass fuels. Limitations on women’s and girls’ time in developing countries are often linked to the inability to empower themselves, and focusing on time savings for women allows for greater time to be dedicated to other tasks, such as education or income generation, or rest and leisure.

Improving access to modern energy services for women in developing countries can help to alleviate these burdens on their time in numerous ways. Firstly, through fuel-switching or the use of an improved cookstove, women’s time burdens in fuel collection can be alleviated. This can amount to significant portions of women’s daily work, up to 5 hours in some cases, and transitioning to cleaner cooking technologies can reduce either the time needed to collect the required amount of biomass fuel per day, or enable the use of less time-intensive fuel resources, such as LPG. (Clancy et al. 2012)

Table 4. Reductions in Time in Fuel Collection

Study	Location	Sample Size	Type of Fuel/Stove Promoted	Time Savings as a result of Stove Use
Barnes & Sen 2003	Six Indian states	518 users and 4,528 non-users	LPG	Fuelwood collection time reduced from 0.78 hrs/day for biomass households to 0.58 hrs/day for LPG users.
Barnes & Sen 2003	Same as above	3,036 household users and 2,012 household non-users	Electricity	Fuelwood collection times reduced from 0.90 hrs/day for non-user households to 0.53 hrs/day for user households. Cooking times also reduced.
Chander & Tandon 2004	Lag valley of Kullu district, Himachal Pradesh, India	3,063 households	LPG	Fuelwood collection reduced from a daily activity (7 trips/week) to 1-4 trips/week to collect wood, of 2-6 hours/trip.
Eastconsult 2004	10 districts of hill regions and Terai of Nepal	200 households (100 biogas users, 100 non-users)	Biogas	111 minutes/day saved by women in Terai regions, 53.97 minutes/day by women in hill regions.

Reported from selected cases. Derived from Waris & Antahal (2014), adapted by Daniel Kerr.

Economic empowerment is another key area where women can benefit from sustainable energy development. A number of the factors that can constrain women’s economic empowerment in the developing world, such as a lack of access to education or training, the lack of available daily time, or other wider-scale factors such as access to land and property, or the policy and regulatory framework surrounding employment, can be addressed or influenced in part through the development of sustainable energy.

Sustainable energy development offers a tremendous opportunity for the economic empowerment of women, both as entrepreneurs and as consumers of products and services. To provide concrete figures to this empowerment, the SEWA Savera programme to provide small solar home and lighting systems to home workers and service providers has found that home workers earn approximately US\$125 more per year with energy access than without, and micro-entrepreneurs providing energy services in Bihar, India were able to earn up to US\$15 per month. (Clancy et al. 2012, Hunt & Samman 2016, Sankrit 2016)

As consumers, women’s economic empowerment can be directly associated with the use of sustainable energy, and this can apply in many different areas. The above factors associated with the reduction of time burdens leave more daily time available for employment or income generating activities. However, developing business is another area where sustainable energy can contribute, such as in the provision of sustainable electricity or cleaner thermal energy, enabling longer opening hours or more profitable business activities, through the provision of lighting after dark or the reduction in fuel overheads. (O’Dell, Peters & Wharton 2014)

2.2 Case Studies on Women’s Empowerment through Sustainable Energy

Empowering women through sustainable energy access is not just a “nice-to-have” factor: a growing body of research has shown that targeting women specifically in programs to promote sustainable energy access, either for electricity or other sources of energy, can significantly contribute to growth and sustainability of programs over time. Empowering women to take a more active role in sustainable energy provision across the energy enterprise sphere, for example as entrepreneurs or as consumers, has also been shown to be a clear route to improved market growth for sustainable energy products in developing countries.

2.2. A Kopernik, Indonesia

Figure 3. Female Entrepreneur in Indonesia, Part of the Kopernik ‘Wonder Women’ Program



Image: <https://kopernik.info/page/wonder-women-indonesia>

This effect is not just seen within the cookstoves sector: experiences from organisations such as Kopernik who operate in South-East Asia have shown that involving women in energy enterprise at all levels can lead to improvements in qualities of life for the entrepreneurs involved, as well as achieving sustainable energy goals in an expedient fashion. Kopernik, in conjunction with ENERGIA as a primary funder, have been engaging “wonder women” in Indonesia to promote solar technology access, particularly small solar home systems and solar lanterns. These entrepreneurs receive training in areas such as business management and budgeting, as well as a subsidised inventory for further resale by the entrepreneur. These entrepreneurs can take on this inventory without accepting risk or incurring debt, and then repay the cost price of the systems to Kopernik as the products are sold. (ENERGIA 2016a)

The Kopernik case demonstrates the effectiveness that focusing on women's empowerment in employment, specifically within sustainable energy sales in this case, can have. The Kopernik empowerment model focuses on training for poor women and independent women-led shops in the country, and through this training and targeting has achieved scale in its operations quickly, and since 2009 the organisation has reached over 175,000 people in 10 provinces in Indonesia with last-mile solar technology distribution. Another factor in the success of the Kopernik model is the use of existing retail operations and women's networks in the regions they operate in. Targeting existing women's networks allows easier and faster recruitment of distribution agents, again allowing the organisation to scale its operations well.

The innovation present in the financial model is perhaps the most important facet of the Kopernik approach. Providing women entrepreneurs will affordable sustainable energy products on consignment, then recouping cost through sales and allowing the entrepreneurs to earn a margin on every purchase, removes the risk and burden of debt from the entrepreneurs, and provides easier entry for new entrepreneurs into the system. (ENERGIA 2016b)

For more information on Kopernik, see: <https://kopernik.info/>.

2.2.B Ajima Farms - Nigeria

Ajima Farms are an agricultural organisation based in Abuja, Nigeria. Currently they are engaged in an innovative, pro-poor, pro-women waste-to-energy project, in partnership with ECO-WATT Projects and General Enterprises Nigeria Ltd, with funding from the United States African Development Foundation. The project aims to provide waste-to-energy facilities, as well as clean water and biogas fuels for cooking, from agricultural wastes from land in the Kuje area of Abuja. Approximately 260 off-grid villages are targeted under the project, which produce approximately 500 tonnes of organic waste daily. (Smart Villages 2016)

The first phase of the waste to energy project is nearing completion as of September 2016, and will provide 20 kW of electricity from a 124 cubic metre digester. Electricity sales to the surrounding off-grid villages are intended to pave the way for the next phase of the project, providing biogas stoves to the surrounding villages on an economic basis, as well as empowering entrepreneurs, particularly female entrepreneurs, as sales agents for this technology. The anticipated monthly expenditure for biogas from the project's projections will be US\$15, less than the US\$20 that households currently report they spend on cooking fuels monthly presently.

Women are directly involved at all levels of the project, from management to consumers, and the model has been designed to improve the economic livelihoods of women farmers under the Ajima organisation by improving their agricultural productivity by providing electricity access, as well as their overall quality of life through the provision of clean cooking fuels and water. (The Authority 2016, Ajima Youth Empowerment Foundation 2016)

For more information on the Ajima Foundation, see: <http://www.ajimafoundation.org/>.

2.2. C Solar Sister – Uganda, Tanzania, Nigeria

Solar Sister is a network of women in Uganda, Tanzania and Nigeria that uses a pro-women business model to empower women in terms of energy access, and also energy entrepreneurship. Empowering women with economic opportunities is at the core of this model. Through a drive to promote energy access for the poorest consumers, Solar Sister is empowering women entrepreneurs to provide solar lighting products, mobile phone chargers, and fuel-efficient biomass cookstoves to hard-to-reach rural communities, taking advantage of existing women’s networks to distribute these products more effectively than traditional top-down programs.

Since 2010, the organisation has assisted over 2,000 entrepreneurs in setting up small clean energy businesses, and over 370,000 people are estimated to have benefited from solar or clean cooking technology through these entrepreneurs. The business model entails women entrepreneurs purchasing products, such as affordable solar lanterns, from the organisation, and then selling these products on to family, friends and neighbours. This women-to-women contact has been attributed to the successful scaling of the model, providing a reputation for the knowledge of entrepreneurs among beneficiaries, and helping to grow business, improving the economic and social status of the entrepreneurs involved in the program, and making becoming an entrepreneur under the program more attractive.

Figure 4. Solar Sister Entrepreneurs with Solar Lighting Products

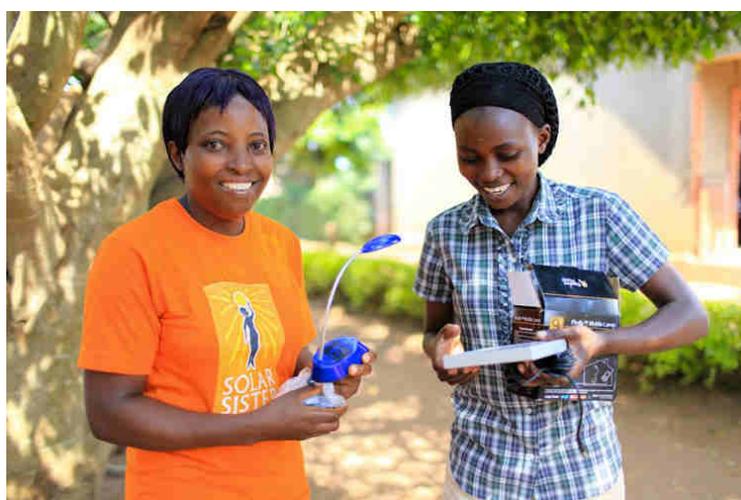


Image: Solar Sister, <https://www.instagram.com/iamsolarsister/>

An International Center for Research on Women (ICRW) report on the organisation notes that incomes for women with energy access in rural communities are more than double that of women without access to energy, with comparable levels of self-employment, and the Solar Sister model is directly improving women’s livelihoods, through the combined efforts of improving energy access for rural women, thus improving their livelihoods, as well as empowering women directly as entrepreneurs. (ICRW 2016, Soria, Farley & Glinski 2016)

For more information on Solar Sister, visit: <https://www.solarsister.org/>.

3.0 – Conclusions

Over the last decade, the research on the subject of gender, energy and poverty has shown that fundamentally, energy poverty is a gender issue (Smart Villages 2016). Women are adversely affected by the use of inefficient energy sources, particularly thermal energy resources. This is due to the combined effects of indoor air pollution, and its attendant effects on public health, as well as the significant time burden inherent in the use of traditional thermal energy resources.

However, it has also become clear that involving women in energy enterprise, at every level of the clean energy value chain, is a route to improving the sustainability of businesses, as well as market growth. Projects in a number of developing world contexts, as shown above, have demonstrated that empowering women, in terms of business and entrepreneurship training and enabling, as well as in education for clean energy and empowerment in the household decision-making environment, is a crucial step in ensuring the continued growth and sustainability of clean energy markets.

In terms of how policy-makers can support women's empowerment and entrepreneurship, it is important to consider gender issues and the unequal effects of energy poverty on women in energy policy planning. This applies across all levels of policy planning, from household-scale energy technology provision programs, such as clean cookstove dissemination or fuel-switching, to electrification, to market-building activities such as entrepreneur training, business creation and improving access to finance. Neglecting the gender dimension in energy provision and alleviating energy poverty is neglecting a critical growth area, and source of market stability and growth.

Questions and Answers

What benefits can targeting women with sustainable energy interventions have on the consumer side?

From the cases above, it is clear to see that specifically targeting women and girls in sustainable energy interventions can have a wide variety of benefits, both in terms of programme goals at a policy level, and in terms of business development and scaling. There are a number of reasons that these interventions can have such wide-ranging benefits, both for women consumers and for business or projects.

From the consumer side, women's roles in energy access in the developing world often adversely affect their lives and livelihoods to a much greater extent than men, and alleviating the combined burdens that a lack of access to clean energy have on consumers will directly benefit women. These burdens can be in the form of time, either spent collecting traditional woodfuels or in unpaid household work, such as cooking or caring for children/elderly household members, or in the form of indoor air pollution and other health effects (such as burns) from the use of inefficient biomass fuels. Women in a number of developing world contexts have been shown to spend significantly more time on these time-consuming tasks than men, and given the duration of daily household work experienced, women are most affected by indoor air pollution, with the associated effects that inhalation of harmful gases and particulate matter can have on health.

The benefits that women in developing countries experience from having access to improved energy are significant. Shorter-term benefits include more daily time available to the individuals, which could be used for other tasks such as income generation, or as potential time for further education. Longer-term benefits include the health benefits from transitioning to cleaner-combusting, efficient fuels, and the reduction in health issues experienced as a result of indoor air pollution.

What benefits can targeting women with sustainable energy interventions have on the business/project side?

There are a number of benefits to involving women directly in sustainable energy interventions at a project level, as well as in business development activities such as encouraging entrepreneurship. There are a number of successful cases of companies or organisations that are focused on empowering women through entrepreneurship as a vehicle to improve sustainable energy access, such as those detailed in the cases above.

At a project level, women in developing countries are often heavily involved in energy provision to households, whether this is through the collection of fuelwood or purchasing of other fuels (Clancy et al 2012). Programs that target women specifically in their activities can take advantage of women's decision-making power in the household, or encourage greater agency in energy access for women if the decision-making power lies with male heads of household.

In addition, community networks have been highlighted in the research (FAO 2015, GVEP International/Clough 2012, Hunt & Samman 2016) as an important factor to consider in targeting sustainable energy interventions and designing interventions for success, and women are often heavily involved in their local communities in contrast to men.

Involving women in energy entrepreneurship, and empowering women through employment in sustainable energy activities, has the potential to have a transformative impact on sustainable energy markets in the developing world. There are a number of cases, including the cases of Kopernik and Solar Sister above in particular, where involving women in energy entrepreneurship has been shown to provide significant benefits in terms of scaling of business, and the sustainability of businesses. In addition, evidence from programs such as the Developing Energy Enterprise initiative (DEEP) suggest that women-led businesses and female entrepreneurs in the clean cookstoves sector in Kenya, Tanzania and Uganda were more likely to achieve scale with their operations quicker, and top-selling entrepreneurs in the program were more than twice as likely to be female. (GVEP International/Clough 2012)

What technologies should be targeted when establishing women-centric businesses or programs? What business/Financing Models should be targeted?

To date, experiences with women-centric sustainable energy businesses have primarily focused on electricity technologies, such as in the case of Kopernik above (see section 2.2.A), with the majority of 'wonder women' being involved in the solar lighting and solar home system businesses, as well as in the case of Solar Sister above. However, programs such as the DEEP program in East Africa found that clean cookstove businesses are a key area to target women's involvement in, with the program finding that women are more likely to engage new customers and scale their businesses more effectively than men in the cookstoves sector. These experiences suggest the necessity of ensuring women are trained equally to men when providing business or entrepreneurship training, and that programs take advantage of the natural social networks and opportunities that women in the developing world may have in designing their activities. This can take the form of community meetings, as well as empowering entrepreneurs within communities.

Some innovative financial models have been used to help empower women in energy entrepreneurship to great effect. The most success has been seen with sales representative models, where women entrepreneurs acquire cost-price sustainable energy technologies from providers, and then sell these products on to their community, family and friends, retaining a share of the profits, and allowing them to purchase more equipment. The most critical factor in developing these businesses through engaging entrepreneurs is ensuring that they can afford to establish themselves, overcoming the barrier that accessing consumer financing can be for women in developing countries. Providing means to access credit, or low-cost purchasing, widens the base that can be targeted for engagement.

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Other Resources for Women's Empowerment through Energy

Ajima Foundation: <http://www.ajimafoundation.org/>

ENERGIA (International Network on Gender and Sustainable Energy): <http://www.energia.org/>

Energy Sector Management Assistance Program: Energy and Gender: <http://www.esmap.org/EnergyandGender>

Global Alliance for Clean Cookstoves: <http://cleancookstoves.org/impact-areas/women/>

Inter-American Network of Academies and Sciences: Gender and Energy: <http://www.ianas.org/index.php/programs/women-for-science/88-programs/women-for-science/434-gender-and-energy-wfs>

Kopernik: <https://kopernik.info/>

Solar Sister: <http://www.solarsister.org/>

