# Women and Sustainable Energy

## How the work of Ashden Award winners impacts the lives of women and girls

**February 2015**

**Authors:**

Anne Wheldon, Chhavi Sharma, Emily Haves, Ellen Dobbs, Sam Wheldon-Bayes (Ashden)

**Reviewed by:**

Joy Clancy (Energia)

**Note: this is a public summary of a more detailed internal report.**

Department for International Development

Ashden Sustainable solutions, better lives

ENERGIA INTERNATIONAL NETWORK ON GENDER AND SUSTAINABLE ENERGY

**Contents**

## Executive summary

This Ashden report was commissioned by DFID, to inform the major DFID research programme on energy and gender - led by Energia - and to feed into DFID's other existing and future work. The report draws upon the experiences of Ashden Award winners and has two aims. The first is to identify how access to energy affects the lives of women and girls. The second is to identify to what extent women are involved in the Award-winning enterprises and programmes, and the impact this has.

Information about Award winners was obtained from a range of sources, mainly Ashden internal documents (such as reports from judging visits), studies provided by winners about the impact of their work on women and girls, structured discussions with 2014 Ashden winners and finalists and data from winners' websites.

The review showed that energy access provided by Ashden winners benefits both men and women, but women are likely to benefit more. This gendered impact relates, in part, to the traditional roles of women – as responsible for cooking, cleaning and other chores – and the greater time that they spend in the home. Ashden found a significant easing of these burdens through cutting the time and reducing the intensity of domestic tasks, and making the home a healthier, safer and more comfortable place. 'Time' was a notable benefit of increased energy access: saving time, making the use of time less arduous, extending the useful day and allowing women more choice in how to spend their time. Many women benefited disproportionately from technologies like TV and phone charging that increased their contact with the wider world. Access to electricity and agricultural technologies gave some women more opportunity for productive activities that increase their income, which is also important in changing gender roles.

Formal employment in an energy access enterprise or programme may provide women with a greater income than they could earn through informal productive activities at home. This, combined with the status of having a 'proper job', most likely challenges gender roles. However, the income and working conditions of women who work as sales agents or in the supply chain are less clear. We found that the representation of women in Award-winning enterprises and programmes was low at all levels – particularly in leadership, but also in the workforce and supply chain. Discussions with 2014 winners suggested they had positive experiences of employing women and the low numbers were often not for a lack of trying. Barriers identified to employing women include cultural factors (eg husbands not allowing wives to work) and practical factors (eg safety travelling to work). One strong message that came from many 2014 Ashden winners was the value of involving women in the design process; they said that technologies to be used by women should be designed by women.

This report identifies research gaps for further investigation, including more detailed studies on the employment and outsourcing of work to women by energy access enterprises, and a study of the long-term impact of energy access on women. We have also noted work related to the health impacts of stoves and educational impacts of solar lights.

# 1. Introduction

**Electricity from a micro-hydro plant enables both employment and entertainment (Practical Action, Peru)**

Across the world, many people lack access to clean, modern energy. This can have huge impacts on health, education, economic circumstances and general quality of life. Three billion people rely on open fires and simple stoves for cooking and heating, which are a major contributor to indoor air pollution. The World Health Organisation (WHO) estimates that this pollution causes around four million premature deaths per year – six times more than caused by malaria.

Access to electricity, even when available, is often unreliable and expensive, with people having to rely on intermittent grid electricity, or private charging services. As with so many aspects of human society, lack of energy access has a gender dimension. Gendered divisions of labour within families often result in women suffering disproportionately from the lack of access to clean energy.

Having clean energy can transform lives. Safe, bright solar lights can replace smoky kerosene lamps; efficient stoves can replace open fires and traditional stoves, decreasing the time spent collecting firewood or cooking and cutting indoor air pollution. Access to mobile phones and TV provides valuable information and contact with the outside world. Fridges cut food waste and address healthcare needs through refrigeration of vaccines.

Sociologist Marine Molyneux[1] differentiates between practical needs – easing the burdens that are the result of existing gender roles – and strategic needs – which challenge and transform those roles. Many domestic tasks can be extremely time-consuming and undervalued. Reducing the amount of time these tasks take addresses both practical needs and strategic needs. With more time, women are more able to earn an income and therefore have the opportunity to be more influential in decisions made in the home, for example about how money is used.

[1] Molyneux, M, 1985, 'Mobilisation with emancipation? Women's interests, the state, and revolution in Nicaragua'. Feminist Studies, 11, no.2

Clancy et al. have argued[2] that practical needs should be broken down into practical and productive needs, because of the particular significance of energy as an input into productive activities. Addressing the practical, productive and strategic needs of women in this manner is thus a vital component of poverty reduction and raising living standards.

The expectations and time burdens for women are often passed on to girls as well. When domestic tasks become too much for one person, anecdotal evidence suggests it is often girls who take them on, missing days of school and potentially falling behind. Education is a vital tool in both empowerment and development, so ensuring that girls do not miss schooling through improved access to energy can promote gender equality.

Women's empowerment and place in society can also be advanced by employing them in the delivery of energy. Women working in a traditionally male sphere can change perceptions of their capabilities and potentially challenge existing norms surrounding the gendered division of labour.

This report seeks to contribute to a better understanding of the impact of access to modern energy on women and girls and of the role women can play in delivering energy services.

**About Ashden and this research**

Ashden is a charity that champions and supports the leaders in sustainable energy to accelerate the transition to a low-carbon world. Since 2001 Ashden has rewarded over 170 organisations across the world, including 91 in developing countries who are providing access to clean energy through electricity, clean cooking, and other sustainable energy technologies. These winners are collectively saving more than 8 million tonnes of greenhouse gas emissions every year, and improving the lives of over 45 million people. Winners receive a prize fund of between £20,000 and £40,000, are celebrated at the annual Ashden Awards Ceremony and Conference, and their work is promoted in the media and specialist networks.

Ashden works with winning organisations to help them increase the scale of their work. This support is tailored to their needs and can include, for example, business, technical and financial advice, on-site mentoring from professional business consultants, sales training and introductions to investors.

Ashden encourages the wider adoption of sustainable energy, promoting the work of winners so that others can learn from their example. We also encourage collaboration between winners so that they can more powerfully advocate for change in policies affecting the sustainable energy sector. For example, Ashden supports the Ashden India Renewable Energy Collective, a group of over 20 Indian Ashden Award winners that have come together to advocate for policies favourable to sustainable energy in India.

[2] Clancy, J. S., M. Skutsch and S. Batchelor. 2003. The Gender-Energy-Poverty Nexus: Finding the Energy to Address Gender Concerns in Development (DFID).

## 2. The research: aims and methodology

**Producing clay pots for ceramic water filters (Hydrologic factory, Cambodia)**

### The aims of this report

DFID supports research to understand and better address women's needs for modern energy services through its energy and gender research programme, led by the international gender and sustainable energy network, ENERGIA. This report was commissioned by DFID to feed into existing and future work and to inform ENERGIA's larger research programme. Ashden is in a unique position to carry out this research because it can analyse information from 91 past Ashden International Award Winners (See Appendix 2 for a list of those mentioned by name in this report).

The terms of reference, agreed by Ashden, DFID and ENERGIA are as follows:

"This research is to be a study to review past Ashden award winners and analyse the extent to which they have had an impact on women and girls, as well as to what extent these impacts have been instrumental to their success or otherwise. Using this lens the study will ask what involvement girls and women have had in winning enterprises/programmes, what was the detail of their activities, what was unique, why were they successful, and how many have gone on to fail or scale up? What can we learn from this type of analysis?"

DFID, ENERGIA, and Ashden recognise that there is a lack of peer-reviewed studies on the impacts of access to modern energy services, as discussed in a 2011 World Bank paper[3] and Ashden's 2012 report[4]. This study will therefore draw primarily on other types of resources that Ashden has collected from our winners and highlight where more information and research is needed. These resources are largely qualitative. Ashden winners generally

[3] Köhlin et al, 2011,Energy, Gender and Development: What are the Linkages? Where is the Evidence? The World Bank Policy Research Working Paper 5800: 45. Available at https://openknowledge.worldbank.org/bitstream/handle/10986/3564/WPS5800.pdf?sequence=1

[4] Ashden, 2012, Does energy access help women? Beyond anecdotes: a review of the evidence

don’t collect quantitative gender-disaggregated data and the various technologies employed are too diverse for systematic numerical analysis of their usage. Equally, analysing employment quantitatively across a range of countries, technologies and business models is unlikely to produce meaningful results.

**Sources of information and methodology**

The first resource is existing information held internally by Ashden. Much of this comes from the process of applying for an Ashden Award, which is currently as follows:

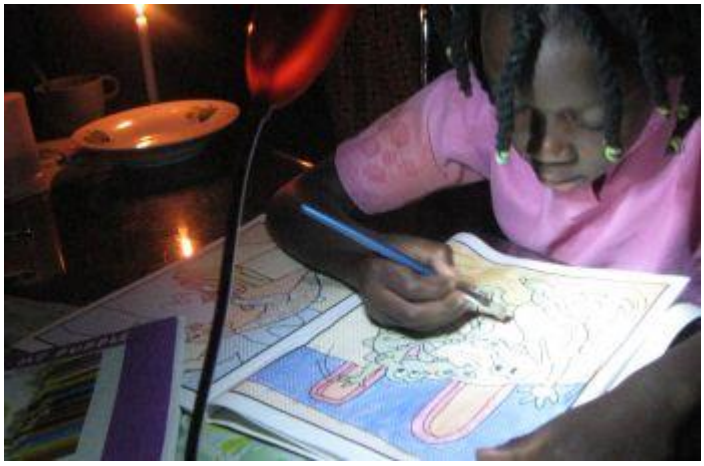
- Applicants complete an application form. These are screened by Ashden staff and judges and a longlist of about 25 applicants is selected for more detailed investigation.
- Applicants provide financial accounts and answer individually tailored questions.
- Specialist assessors review the longlisted application forms and answers to questions and prepare an assessment report for the judging panel.
- A first judging meeting is held to review assessments and select about ten finalists to be visited.
- Visits are conducted by a judge or assessor. Visitors have generic areas to review and specific questions from the judging panel. They speak to different people in the organisation, and also interview a number of beneficiaries to prepare a visit report.
- A second judging meeting is held; to review information from visits and select winners.

Information for this study comes from many different Ashden resources. In addition to the above, during the 2014 Ashden Awards process we took the opportunity to ask more specific questions relating to women and girls to our finalists and winners.

Ashden mapped documents available and drew out information that specifically concerned women and girls. We also asked past winners to send any information or studies on the gendered impacts of their work.

The sections that follow summarise a more detailed report provided to DFID and ENERGIA. Some information from the detailed report has been anonymised, but other examples give the name of a winner. If these examples are not already in the public domain, they are given with the permission of the winner. A list of organisations named in this report, and links to Ashden case studies on their work, can be found in Appendix 2. While the research focuses on the benefits to women and girls, we have tried to highlight their position relative to men and boys in order to understand gendered impacts of energy access in its full sense

## 3. Findings and discussion: how women and girls benefit from electricity



**Doing homework by the light of a solar-powered lamp (Barefoot Power, Uganda)**

Having electricity in homes, workplaces and public buildings makes life easier and brings new opportunities. Many Ashden winners are providing access to electricity, mostly using solar energy but some using biomass and hydropower.

The scale at which they provide electricity varies enormously. The smallest solar systems are single, portable lamps, sometimes including phone charging. The next step up is solar home systems that can power several lights, radios and sometimes TVs. Larger systems can supply a group of homes and businesses through a mini-grid (See Appendix 1 for a summary of technologies used by Ashden Award winners).

### Saving time and extending the working day

In the areas of the world targeted by the Ashden International Awards, women and girls are primarily responsible for domestic tasks. Without electricity, these must be completed during daylight hours. Electric lighting can therefore transform the structure and length of the working day. A number of winners reported that housework could be spread throughout the day and evening, and no longer needed to take place intensively during the middle of the day. For example, a primary school teacher who had bought a solar home system financed by one winner said that lighting made it much easier to clean, make food and mark homework when she got home from work.

The ability to spread work throughout the day was generally expressed as a positive, despite potentially increasing the total daily time spent on domestic tasks. The Ashden visiting assessor to one programme noted that there was more time to go to the clinic or market during the day and do embroidery and even start businesses at night. Electricity gives women more choice about how they structure their day.

Some rural electrification systems – particularly hydroelectric mini-grids – supply enough power to run appliances like refrigerators and washing machines. These reduce the human input needed for traditionally labour-intensive tasks, freeing up time for women and girls in particular. One winner said that butter churning, traditionally done by women, requires

several hours of hard labour. Electric butter churning vastly reduces this. Another mentioned that electric heating elements can reduce the time needed for boiling water, freeing up time for relaxing, studying, helping children with homework and praying.

Phone charging is an area where domestic electrification can benefit women disproportionately. Off Grid Electric (which uses mobile money to sell affordable solar power as a daily service in Tanzania), noted that men, who are likely to be working outside the home, can usually visit a phone charging booth at some point during their day. In contrast, women may have to make a specific trip to charge a phone, sometimes travelling long distances to do so.

Overall, while saving time was a common theme amongst winners, what this extra time was used for varied considerably and included income-generating activities, leisure, childcare or other domestic responsibilities. This is discussed in more detail in Section 4. One winner found that there had been no reports of women receiving additional duties to fill the extra time. However, another reported that having an electric iron meant that a greater amount of clothes were ironed: the chore increased to fill the time available.

**Reducing task intensity**

One of the more subtle ways in which electrification can improve lives is simply by reducing how physically arduous a task is to perform, or how much concentration is required. In a 1998 study[5], Jackson and Palmer-Jones demonstrate that lower work intensity is associated with a variety of positive health outcomes. One winner found that having an electric oven meant women did not have to tend constantly to a fire, reducing the physical intensity of cooking. Another found that electrification meant women could enjoy watching soap operas while doing domestic tasks in the afternoon.

**Generating income**

Without electricity, the time spent on domestic tasks can prevent women from earning any form of income. For some women, electricity represents an opportunity to undertake paid work, sometimes for the first time. Activities mentioned by winners included making shawls and clothing at night, producing traditional cloth and dried apricots, knitting and handicrafts. Ashden's visiting assessor found that rural families who had solar home systems financed by one winner could work in the evenings and earn more. This is particularly useful to women. The main cottage industry in the area is fine embroidery, for which bright light is a real benefit. Ashden’s assessor met one woman and her daughters who were earning additional income equivalent to half the average daily income in the region through this traditional embroidery.

While these activities do not take women too far out of traditional roles or generate a large income, they could potentially be significant for symbolic reasons. A report produced for AKRSP (which provides rural micro-hydro electrification services in Pakistan) found that

[5] C Jackson, R Palmer-Jones, Essential Matter: Work Intensity, Gender and Well-being, UNRISD, 1998

women in northern Pakistan who earned an income as a result of electrification felt proud and were more respected in their families and communities.

Several Ashden winners said that women often spent their additional income on education for their children, paying school fees and, in some cases, putting them through university. One winner noted that having a small amount of extra income meant women were now able to spend more on their daughters, and not favour their sons so much. Another winner reported that, in their culture, women were expected to support their family 'and not be selfish' with money. This meant that women were more likely than men to spend additional income on their children.

**Improving social opportunities and safety**

Electrification can bring social benefits too. In many areas, people, especially women and girls, feel unsafe being out after dark. Many winners reported that women felt much safer with electric lighting and had greater freedom of movement.

Having electricity often means people can watch TV, something with social implications. One winner reported that for many women this was virtually the only source of information from outside the village and, with it, came a feeling of empowerment. Another winner said that having access to TV made women feel less isolated; they get together with 'TV friends' to watch programmes. Here, TV was also used by the government to promote a specific social mission. For example, some programmes had phone helplines where women are encouraged to report rape.

One solar lighting winner in India found that women whose husbands were migrant workers benefitted from their solar lanterns' phone-charging capabilities. Being able to speak to their husbands regularly helped them feel safer and less stressed.

**Removing barriers to education**

The impact of electric lighting on education, and in particular how it allows children to study after dark, is mentioned by many winners. For example, SolarAid (which works with head teachers in rural areas to promote solar lights across East Africa) found that children can study one hour extra each night with a solar light. Importantly, however, few winners comment on how improved ability to study impacts women and girls as distinct from men and boys. This requires further exploration.

There were a number of comments about electrification boosting opportunities for informal education too. The report produced for AKRSP found that women had a chance to learn more Urdu from television dramas and educational programmes, increasing their ability to interact with the outside world. However, the report emphasised that changing social attitudes via TV requires funding for the programming and TV sets for the villagers, not to mention the difficult task of creating programmes that simultaneously influence values and attract viewers.

**Enabling health improvements**

Electrification of health facilities can have a positive impact on procedures specific to women and girls. According to several winners, reliable electric light was very important for mother and child care in rural health clinics, particularly for childbirth during the night. One winner

mentioned anecdotal evidence that infant and maternal mortality had been cut as a result of light and power in clinics. Another said that women were more willing to give birth in hospital – potentially safer than a home birth – if it has electric light. Solar lighting can also be important for daytime for procedures, such as smear tests, where visibility is crucial.

GIZ/Integration (which set up an electrification programme in rural Afghanistan) found that, alongside the aspects of electrification that benefit everyone (such as the ability to refrigerate vaccines and medicines), there are two key areas in which it contributes specifically to female health. Firstly, men were more likely to allow women to go to a well-lit clinic and, secondly, women with lighting in their homes found it easier to balance their domestic responsibilities and have time to visit the clinic.

Electric light also improves health and safety in the domestic setting by reducing fires and smoke caused by kerosene lanterns. Although most of the smoke in households comes from cooking, there is a significant contribution from kerosene lamps. Several winners reported that women in smoky environments can suffer long term respiratory and eye problems. One rural electrification project found that women reported less eye-irritation, fewer lung and throat problems and fewer headaches when kerosene use declined and, across a study of both men and women, 63% confirmed the positive influence of electricity on health.

**Other benefits**

One winner mentioned that new technology can alter social attitudes towards domestic work, with men being more willing to engage in kitchen activity due to the ease of the task and a reduced stigma surrounding it, something which could have a longer term impact on gender roles.

## 4. Findings and discussion: how women and girls benefit from clean cooking

**A biogas plant provides clean gas for cooking (BSP, Nepal – photo credit Martin Wright)**

Worldwide, about three billion people rely primarily on open fires and simple stoves for cooking, most of which burn biomass. This has significant impacts on health, climate change and deforestation. Across the world, women are primarily responsible for cooking, along with other associated duties, such as collecting water and firewood. It is women who suffer most from unclean and inefficient cooking, making the dissemination of clean cookstoves very much a gender issue.

Many Ashden finalists and winners tackle these impacts of cooking by providing cleaner and more efficient stoves and fuels. The solutions provided are often very location-specific, depending on local cooking practice and culture. Many winners have provided improved charcoal stoves that are quite similar in appearance and use to existing designs, or improved wood-burning stoves that replace open fires or mud hearths. Others have introduced clean cooking gas from waste materials like manure or food waste (biogas) to eliminate solid fuels altogether.

### Improving health and safety in the home

One of the main benefits of improved stoves is reduced indoor air pollution, now thought to be a globally significant contributor to respiratory disease (in particular childhood pneumonia), cardiovascular disease and the premature deaths they cause.

Many Ashden winners report reductions in symptoms associated with these diseases, such as coughing and headaches, when women use improved cookstoves. Research in Mexico by the Grupo Interdisciplinario de Tecnología Rural Apropiada (GIRA), which set up a clean stove programme in Mexico, suggests that respiratory disease decreases by 30% and eye infections by 50% in women using their improved stove. A reduction in burns is another noted benefit. The visiting assessor to one winner providing improved cookstoves noticed that women have scars on their arms as a result of the excess heat of the traditional stoves that they previously used.

**Reducing firewood collection**

Efficient cookstoves cut wood consumption, often significantly. Biogas plants can eliminate the need for wood altogether (although they sometimes increase the need for water collection). In most rural areas, wood is gathered by hand – a time consuming and arduous task which often falls to women. Many winners report that reducing the amount of wood needed saves time and may prevent injuries. For example, a study by Greenway Appliances (which produces affordable, desirable cookstoves in India) found that, on average, 20 minutes per day were saved on collecting firewood.

Reducing the demand for firewood collection gives women the opportunity to use their time in different ways, and frees girls from domestic chores. Gaia Association (which provides ethanol stoves to Somali refugees in Ethiopia) found that the daughters of refugees had initially missed out on school due to gathering firewood and had to catch up later in life. Now that they have the ethanol stoves their daughters can go to school.

In places where women are at particular risk of sexual and physical violence, reducing the need for firewood collection, which often occurs away from concentrations of people, can bring safety benefits. For the refugee women with whom the Gaia Association works, this risk is heightened due to competition over scarce wood resources between refugees and the host population. Gaia Association, along with other Ashden winners, reported that women felt less at risk as a result of the improved stoves.

**Reducing cooking time and intensity**

As well as the health benefits, cooking with biogas is substantially quicker than using an unimproved stove or fire, because the biogas lights immediately and the flame can be easily controlled. A survey of biogas users by MARD/SNV (which provides biogas from animal waste for household cooking in Vietnam) found that the total time saved per day from the biogas stoves was around 105 minutes. Improved wood stoves very often cook more quickly too. Another winner estimated the savings at about 90 minutes per day. Many winners said that time-saving was the number one benefit cited by women using their stoves.

Efficient stoves often burn more consistently and use less fuel. This means that they need less attention. One winner found that, since their new stoves were so easy to light, women were able to heat water and wash clothes in batches, less strenuous than doing them all at once. Greenway Appliances found that women in Kerala, India, were now able to read newspapers while cooking, something which reportedly increased their social engagement.

As noted in Section 3, the time saved is used in many different ways, from childcare and housework to productive uses and relaxing. One winner reported that women using their efficient stove spent their extra time tending the fields, making clothes and shoes for their children, socialising with friends and relatives and even, in one case, singing opera. Another winner found that, although time saved was not enough to allow women to earn additional money, they did have control over the money they saved on fuel because these savings took place in the area of the family that is managed by women and deals with nutrition and childcare.

**Creating cleaner, more pleasant, homes**

A point made by many winners is that cleaner cookstoves save women from having to spend a substantial part of each day in a hot, smoky, uncomfortable environment. For example, one winner noted that, with an improved stove, the house requires far less cleaning, the responsibility for which falls to women, and that women appreciated getting less smoke in their hair and clothes. Another winner said that users appreciated the reduced sparks produced while cooking with char briquettes. Interestingly though, they found focusing on the health and safety benefits of reduced smoke and sparks to be an ineffective marketing tool. Focusing, instead, on the damage to clothing appeared to be much more effective.

On several occasions, women reported that having less smoke around the cooking area meant that they could keep their children close by when cooking. For mothers in the refugee camp in Ethiopia where the Gaia Association worked, this was of particular benefit, as girls could be subject to violence if wandering alone in the camp.

## 5. Findings and discussion – benefits to women and girls from other sustainable energy technologies

The majority of Ashden Award winners are involved with providing access to electricity and clean cooking. A few have successfully introduced other sustainable energy technologies that have a positive impact on the lives of women and girls, including treadle pumps, water filters and efficient greenhouses. Proximity Designs, providing drip irrigation and treadle pump solutions in Myanmar, is one of several examples.

**Saving time and reducing task intensity**

Proximity Designs wanted to find a solution to the problem that hand-pumping or carrying water for irrigation is time-consuming and arduous. Its treadle pumps and drip irrigation kits are much easier to use, particularly for women, and reduce the length of time required for collecting water. In places like Myanmar, where many men migrate for work, designing for women so that they are able to carry out essential agricultural work is particularly important. Proximity Designs involve women extensively in the design process. The Ashden visiting assessor to Proximity Designs also found that 'women cite health benefits of exercise from treadle pumps. While hand pumping is seen as drudgery, the treadles are viewed more positively as giving good exercise'.

**Creating the opportunity to earn an income**

Proximity Design's improved system has made it possible to increase crop production and thus to increase family income. Proximity Designs noted that, as women control the household budget, for the most part, they accrue the benefits and decide how to spend them. Whilst the tendency is often to favour boys' education, girls can now benefit too. This echoes the findings in Section 3. Sometimes increased income means girls are able to get decent schooling for the first time. It also found that solar lighting introduced alongside treadle pump technology, allowed women to earn an extra US$1 a night, weaving, sewing, threshing; things they would normally struggle to fit into daylight hours.

## 6. Findings and discussion: women's involvement in the delivery of sustainable energy

**Assembling efficient charcoal stoves (Ugastove, Uganda – a business supported by Ashden winner Impact Carbon)**

While the previous sections dealt with the benefits to women from using sustainable energy technologies, this section will look at how women are playing a role in delivering sustainable energy. To what extent are women agents of change as well as beneficiaries?

### Rates of employment and types of roles

Looking at all organisations for which we have data, women make up on average 30% of those directly employed. As well as direct employment, sustainable energy organisations can create work for women in other parts of their supply chains. Across a smaller number of organisations for which we had access to information, women make up an average of 29% of those employed in the supply chain. The only examples we found with particularly high figures were those that specifically set out to include a high proportion of women. For example, Fruits of the Nile (a Ugandan enterprise that sells solar driers to producers and buys and exports the dried fruit) regards provision of employment to women as one of its key goals. 55% of its factory workers and 70% of its drier operators are women.

Other organisations mention that they employ women in manufacturing processes like production and assembly. One winner said that most women in its organisation work in accounts and administration, as well as some in less heavy production work. Another said it has a reasonable balance of male and female workers, although there are more women doing unskilled manual work, such as sorting.

### Barriers to employment and their removal

Some winners have given indications as to why rates of female employment might be low in their case. The specific examples given relate to cultural factors, safety concerns and terms of employment.

- **Cultural factors and safety concerns**

In many of the cultures in which Ashden winners operate, domestic duties leave women with limited time for productive activities. A study carried out by one winner, for example, found that 91% of women in its region see themselves primarily as housewives, with only 3% as animal breeders, 4% as teachers and 2% as tailors or weavers. All domestic duties combined add up to a mean average work time of about 10 hours per day, seven days a week.

Cultural factors are often cited as a reason why organisations find it difficult to recruit female employees. One winner found it impossible to attract women to work in parts of the factory that are mostly male (like the metal workshop). Another explained that it employed no women primarily because many local people do not approve of women working outside the home, and husbands may not allow it. Other organisations have trouble attracting women to roles that necessitate travel, particularly sales agent roles where safety may be a concern.

- **Terms of employment and employer attitudes**

We found several examples of organisations whose terms of employment are attractive to women. This may have an influence on rates of female employment. For example, all employees at SGFE are given flexible hours for childcare, maternity leave (unusual in Cambodia) and health insurance. Under an agreement with an NGO partner, all SGFE employees must also ensure their children are educated. Several organisations stressed they were keen to employ women not just on grounds of equality but because they are found to be good workers. However one emphasised how challenging it is to try to change culture when the first priority has to be to make the business successful.

**Benefits to women and their families from employment**

We collected anecdotal evidence on how women benefit from employment in sustainable energy organisations. Many of the female workers in one organisation were earning an income for the first time, and it was well above the government minimum wage. Another organisation found that giving women the opportunity to become freelance sales agents meant their income typically increased by about 40% and they were able to acquire transferable business skills. SolarAid observed even wider social benefits of employing women, saying that the women and the female teachers that work with them are potential role models for girls, enabling them to aspire to employment opportunities provided by the growing solar energy market.

One winner explained how the organisation used employment to build women's confidence and encourage them to be independent. This is in areas where the cultural norm is for women to be shy and unassertive. Gaining greater respect from their community was similarly mentioned a number of times. Another winner explained its focus on employing women in community terms. It felt that social changes should come through women because they are the main force linking a family or a community together and suggested that empowering women means empowering the whole community. These positive changes are often happening alongside broader social trends in women's empowerment. One woman who had supervised female entrepreneurs for many years said: "In 1994-95, when we first went into the villages, we couldn't talk to the women without their husbands' permission. And

they used to stand in front to hear what we were going to say. Now we can just say, 'OK, all the men out!"

**Benefits to organisations of employing and involving women**

Several winners suggested that involving women contributed to the success of their organisation, particularly with regard to sales, marketing, distribution and design.

- **Sales, marketing and distribution**

When it comes to sales and marketing, female employees and sales agents are sometimes favoured above men. This is particularly true when women make up a high proportion of the end-users. One organisation found that, in 72% of cases, it is the woman of the household who makes the purchasing decision on energy efficiency products. It is therefore important to have women as the 'resource people' who work on commission to promote and sell the products. Grameen Shakti (which provides clean energy technology and affordable finance on a local level in Bangladesh) also recruits and trains local women engineers and technicians who can build a rapport with potential clients. While it is usually a father or husband who pays for and owns a system, women are the primary users. Another winner said they used to follow the local practice of requiring a husband's signature to authorise the cost of their improved cookstove. An internal policy change allowed an exemption to this requirement that led to a significant rise in sales.

- **The design process**

Though not directly linked to employment, involving women in the design of products to be used in the home was cited by several winners as an important factor in the ultimate success of those products. Greenway Appliances, for example, carry out extensive testing with potential end users, mostly women, who are in charge of the cooking, making adjustments according to their real life preferences (as opposed to just the technical performance of the stoves in the laboratory).

**Women in leadership positions**

We have used information available on organisations' websites to look at the number of women in senior positions, specifically those in management positions or on the board of directors or trustees. Of those with available information, we found that over 80% of boards of directors/trustees contain at least one woman and 54% of senior management teams contain at least one woman. However, women make up only 20% of all individual board members/trustees and just 16% of all senior managers.

Though there are exceptions, the pattern of women in leadership seems to be the same as employment of women in general - it tends to be high only where female employment and empowerment is a specific objective of the organisation.

## 7. Conclusion

**Installing a solar home system (Grameen Shakti, Bangladesh)**

In the conclusion to this review, we reflect on the report findings and on where these findings lead. More detailed suggestions for future work are given in Section 8.

This report largely draws on existing documents which do not explicitly deal with gender. It is therefore interesting that so many points relating to women had in fact been raised and documented. While we might have found out more had we, in the past, framed our questions to award applicants in more gender-specific language, this might also have distorted the replies that were given. Equally, although only a few winners were able to provide gender-related studies of their work, those that were received were detailed and very useful.

**Impacts on women and girls from using sustainable energy technologies**

This review suggests that the energy access that Ashden winners provide to households, through sustainable energy technologies, benefits everyone, but that women benefit more. This is, in part, due to traditional roles of women in societies.

Women tend to spend more time in the home than men and bear the brunt of cooking and other domestic chores. Most Ashden winners provide technologies that are used in the home and therefore have more impact on the lives of women. Using Molyneux's terminology, these technologies meet practical gender needs by easing the burdens of existing gender roles. And, as this review shows, easing these burdens is significant, cutting the time needed for cooking and other chores, reducing the intensity of tasks, making the home a healthier, safer and more comfortable place.

Time was a benefit that came across as important in many different ways; saving time, making the use of time less arduous, extending the useful day and allowing women more choice in how to spend their time. The time-saving benefit that clean energy access can bring is substantial. Saving 50 minutes each day on collecting wood and cooking (the figure from Greenway Appliances) is equivalent to nearly two years saved over a lifetime.

Another aspect of traditional roles is that women have less contact with the wider world than men. This means that they benefit more from things like TV and phone charging that expand their mental horizons, even if their physical lives remain restricted. This is a contribution,

even if small, to meeting strategic gender needs by helping to challenge existing gender roles.

Access to electricity and agricultural technologies gave some women the opportunity to earn an income for the first time, or to increase their income. What impact this has depends greatly on local context and culture, and was beyond the scope of this review to analyse. Kabeer[6] argues that income generally influences power relations within the household; however there is much disagreement over the extent of this influence. We found examples where earning even a modest sum changed gender dynamics by increasing the status of women. We also found several cases where women's income was put towards children's education, which tended to bring extra benefit to girls since they were more likely than boys to be missing out on education. It is worth noting that earning income without any say in how it is used could just increase the pressure on women's lives. The impact of earning income depends very much on the cultural context.

In most cases we looked at, the type of work that energy access enabled was undertaken at home, for example handicrafts like embroidery or drying flowers. Such work is labour-intensive and generally poorly paid. In addition to cultural factors, this probably relates to the fact that many Ashden winners deliver energy access at a household-level, rather than at a community or larger scale, that might open up more income-generation opportunities. Energy access is a certainly a necessary factor opening up such opportunities to women, but not sufficient on its own. For example, two winners that focussed on community-scale electricity reported that men were able to earn more as a result of electrification but local culture frowned on women working outside the home, so they were unable to benefit in the same way. It is interesting to note that, whilst some of our winners comment on the way energy access can improve opportunities outside the home, for example making it possible to operate individual shops and restaurants, almost none of them spoke of these benefits in gendered terms. It is therefore hard to comment on how these benefit women and girls, as distinct from men and boys.

The examples where energy access led to larger increases in income for women were those where it increased agricultural production, especially in cases where men had migrated from rural areas for work.

**Impacts of involving women in the delivery of sustainable energy**

We found that the representation of women in Ashden Award-winning enterprises and programmes was low at all levels, even when the main beneficiaries of those organisations were female. We found around 20% female involvement at board and senior management level, and the situation is only slightly better in the workforce and the supply chain where about 30% of the workers are female.

Though we have information on the types of jobs done by women in sustainable energy organisations and examples of the level of income they earn, this doesn't allow us to make any broad conclusions. Formal employment in an enterprise or programme *probably*

[6] Kabeer, N, Women, Wages and Intra-household Power Relations in Urban Bangladesh, Development & Change, 1997

provides more income that women can achieve from working at home and this, combined with the status of having a 'proper job', *probably* changes gender roles. The income and conditions of women working in the supply chain or as sales agents is less clear. Our impression from assessment visits is that only a limited number of sales agents do really well.

Our discussions with 2014 winners suggest that nearly all would like to employ more women, not just on principle but because they are good workers. Several noted that women are particularly useful in sales roles when the target customers are predominantly female. Barriers to employing women cited by our winners include cultural factors (eg husbands not allowing wives to work) and practical considerations (eg safety travelling to work).

One message that came strongly from many of the 2014 winners was the value of involving women in the design process if the technology provided was to be used by women.

**Value of this review**

We were aware from the outset that this review was as much about identifying important questions as it was about finding evidence. While a more formal research study (with a clearly defined research question, methodology and analysis) would have provided a reliable answer to one question, it would not have identified whether the question was worth asking. Our approach, of drawing together different strands of information, provides a useful backdrop to consider 'what are the important questions to ask?' and also 'by whom?' and 'for whom?'.

Our information suggests that sustainable energy technologies can bring enormous benefits to women in terms of fulfilling practical needs, that is to say, making everyday life easier, cleaner and safer, and they can also bring the potential for productive work and income. However, there are many unanswered questions concerning the extent of these benefits (like 'how much income is earned?' and 'how much does a clean stove increase life expectancy?'). There are also questions about how these benefits meet more strategic needs (like 'how does this income change gender relations within the family and the community?'). Answering questions of this type could be very valuable for policymakers, for example when seeking to engage public health professionals in the promotion of cleaner stoves.

The question of who should be undertaking this research then arises. It would be valuable, where possible, for energy access organisations themselves to integrate the collection of basic gender-disaggregated information into their processes (for example, noting down the number of entrepreneurs or direct customers who are women), since this information is of interest to many external bodies (like governments, grant-makers and investors). However, given the many other time pressures on energy access organisations, it is likely to be funding institutions, NGOs and policy organisations which undertake more in-depth research.

Our findings concerning the delivery of sustainable energy suggest that women are significantly under-represented. Organisations that do an excellent job of meeting women's practical gender needs (through providing energy access), generally, have not yet been able to make significant inroads into changing gender roles and thus meeting strategic needs. Women are missing out on opportunities to earn an income and participate in decision-

making and leadership. There are some really important questions to ask here, which will be discussed more in the final section of this report.

One question that we were unable to answer was how the involvement of women impacts the success of an organisation. Ashden monitors the sales and income of winners for several years after an Award is made and so has information on the progress of different winners. We could, in principle, relate the progress of a winner's enterprise or programme to the involvement of women in it, to see whether this brings success. We have not done this because we have too little information to draw any conclusions on causality. In particular we do not have appropriate data on the many other factors that might contribute to success, like investment, customer demographics, technological developments, business model, organisational management, quality and price of product and the wider social context.

## 8. Priorities for further research

**Cooking tortillas on an efficient wood-burning stove (TWP/AHDESA, Honduras)**

Through compiling this report, we have identified a number of research gaps, some of which Ashden is able to explore and others which will need to be undertaken by others. We also plan to revise elements of the Ashden Awards application and monitoring processes to take a more deliberate approach to gender, for example by including additional questions relating to women and girls where appropriate. This will help us to understand more fully gender issues as they relate to our applicants and winners, to build a base of useful data and to be able to share our findings externally.

This review found anecdotal examples of benefits to women and girls from energy access. But, as noted, there is a lack of good quality, quantitative evidence. We also found that women are under-represented in energy access enterprises and also among their suppliers and sales agents. However, it was beyond the scope of this review to identify the detailed reasons for this. Ashden's priority is to undertake research that leads very directly to positive change, and we have this in mind in suggesting research areas that warrant further investigation, below.

**1: Improving employment opportunities for women in energy access enterprises and programmes**

Since formal employment is a key way to empower women, it would be useful to study a number of energy access organisations in terms of their experiences of employing women. This research should take into account the whole employment process including recruitment, retention, performance and job progression, identifying, at each stage, the reasons for differences between women and men. It should also ask what impact women have on the organisation, whether the organisation has tried to recruit more women, what approaches have succeeded or failed, and why. It is also important to establish whether women are content with the type of employment they have achieved and, if not, what they would prefer.

**2: Outsourcing work to women – sales agents and independent entrepreneurs**

Many organisations that provide energy access outsource aspects of their work. There is a view that this is particularly helpful for women, enabling them to fit paid work around other

tasks and maybe take first steps towards formal employment. In our experience, the experiences of out-workers vary considerably. Some women do very well, but many achieve much less.

There would be value in exploring this more thoroughly. Are these schemes effective from the point of view of the out-workers themselves, in particular women, or are expectations of income raised and then dashed? Is it cost-effective for the enterprise to manage such programmes and what business models exist? It would be useful to compare working conditions and earnings with those in other sectors where out-workers are used.

**3: Long-term impact of access to electricity and improved cooking**

Many organisations have now been active in providing energy access for ten years or more. There would be value in working with some of them to track down female early adopters of their technologies, and find out about the long-term impacts. What did the technology initially enable them to do? What did that lead to? Has it increased their employment opportunities or their income? Have they continued to use the technology or have they moved to something else, and why? Have the impacts been on practical gender needs, productive or strategic gender needs, or all three?

This research should include finding out the impact of energy access technologies on the lives of their children, in particular their daughters. Anecdotally, what difference did energy access make to their children and is there evidence of impact – for example, did school grades or employment opportunities improve? What level of energy access do their grown-up children have and what opportunities arise from it that differ from those of their mothers?

**4: How are changes in technology influencing the opportunities for electricity access?**

Fifteen years ago, the priority for electricity access was to provide better lighting, mainly through the use of compact fluorescent lamps (CFLs). A ‘small’ solar-home-system would use a 20 Wp photovoltaic panel to supply two lights and a radio. Everything has changed. LED lights are now more efficient than CFLs. Access to mobile phones is growing rapidly and their power consumption has decreased. PV prices have fallen significantly and battery technology has improved. 20 Wp solar-home-systems can now supply five LED lights, two USB sockets for charging phones or tablet computers, and a socket for a 12V TV.

What does this opportunity for ‘more with less’ mean in terms of priorities for electricity access? This research would be valuable, both in general terms and to look at specific impacts of technological improvements on women and girls.

**5: Significance of user-reported health benefits from improved cookstoves.**

This review, and our wider experience, indicates that women report health benefits from using stoves which, according to current WHO evidence, will have minimal impact on life expectancy. This creates a dilemma. Many interest groups (rightly) champion the idea that cooking should not kill, and promote the highest-performing stoves in emissions terms. But a great number of women, in particular those on the lowest income, will not be able to access such stoves. It is worrying if these women miss out on potential benefits, because all effort is directed to the highest-performing stoves.

One challenge in addressing this dilemma is the lack of high quality evidence on user-reported health benefits.  Another problem is how to compare different types of impact. One of the main reported benefits from 'somewhat' improved stoves is a reduction in persistent coughing, something which improves quality of life. But how should that be compared with the increase in life expectancy that the highest-performing stoves bring?

**6: Educational benefits of electric light**

Many Ashden award-winners regard improving education as a major reason for promoting solar-powered lighting. While there is evidence that many children use solar-powered lights for studying, it is less clear is how much additional study is undertaken and, crucially, what the impact on learning and educational achievement is. With the rapid growth in use of solar lights, there is potentially a large dataset of school results that could be investigated.

## Appendix 1 – Technologies used by Ashden Award winners

### Electrification

- **Portable solar systems**

Organisations including d.light (global), SolarAid (East Africa) and Barefoot Power (mainly Africa) have won Ashden Awards for their success in manufacturing and distributing very small solar systems. Such systems are popular because they are portable, cheap and require little or no installation. The cheapest retail for as little as US$10 and typically consist of a very small solar panel mounted directly onto a lantern which incorporates a LED light and a rechargeable battery. Larger systems may have multiple lights or one brighter light, as well as phone charging capability. The small capacity of the solar panel (around 1 Wp) limits the use of portable systems to lighting and mobile phone charging, but these are highly valued and can have significant impact on lives. The low cost of portable systems means that many users buy them with cash and recover the cost from savings on kerosene lighting within a few months. With appropriate financing they can be made available to even some of the poorest users.

- **Solar home systems**

Many systems use larger solar panels (around 3 to 100 Wp), which are usually fixed permanently to a roof, and connected to rechargeable batteries that are housed indoors. Such systems are most often used in homes but can also provide useful amounts of power for community buildings like clinics and schools, and for some types of small business.

Small solar home systems are used mostly for lighting and phone charging, and cost US$100 or less. As the capacity (and thus the cost) of the system increases, households can add more lights and extra appliances, such as fans and radios. The largest systems can power devices with higher power consumption, like TVs and small refrigerators and – increasingly - laptops and tablet computers.

A large number of Ashden Award winners are involved in providing solar home systems including Barefoot Power and SolarNow (Africa), Grameen Shakti and Rahimafrooz (Bangladesh), SELCO (India), Azuri Technologies (Kenya), Zara Solar and Off-Grid:Electric (Tanzania), Solar Energy Foundation (Ethiopia), and TECNOSOL and ECAMI (Nicaragua). Because the price of a solar home system is significant, many winners provide some type of financing to help with the purchase. Winners Aryavart Gramin Bank and SKDRDP (India) both work specifically on financing.

- **Larger fixed installations, mini-grids and grid extensions**

Larger renewable energy plants (usually 1kW or larger capacity) can provide power to several users via a mini grid, or can boost the supply on an existing grid. Winners AKRSP (Pakistan), CRERAL and CRELUZ (Brazil), GIZ/Integration (Afghanistan), IBEKA (Indonesia) and Practical Action (Peru) provide electricity from small-scale hydro power; Saran Renewable Energy and Husk Power (India) use biomass generation; Rahimafrooz (Bangladesh) and ECAMI (Nicaragua) use larger-scale solar systems.

Such systems usually supply mains-voltage a.c. (rather than the low-voltage d.c. of small solar systems) so that users can buy standard a.c. appliances. Provided the distribution of electricity is well managed, they also enable higher power appliances like washing machines, freezers and power tools to be used, giving greater opportunities for households and small businesses.

**Clean cooking**

The wide variety of clean cooking technologies reflects the range and complexity of the practical and cultural factors involved in cooking.

- **Improved charcoal stoves**

Charcoal is the main cooking fuel in many towns and cities in the developing world, because it is (usually) cheaper than fossil fuels or electricity, and easier to transport and use than wood. Most charcoal stoves are simple: the charcoal burns in metal or clay container that has holes in the base for air supply. Such stoves can be made more efficient by using an insulated ceramic liner, proper design of the pot support, and careful size and arrangement of holes to control the air supply. Improved charcoal stoves have been provided to large numbers of households through the work of winners GERES (Cambodia), Toyola (Ghana), D&E Green Enterprises (Haiti), WWF-DRC, and Impact Carbon (across Africa). These stoves usually cost around US$10. Although more costly than the simple stoves they replace, many households can afford them and quickly recoup the cost through savings on charcoal.

- **Improved stoves for wood and agricultural residues**

Wood and residues like corn cobs are widely used for cooking in rural areas, particularly when they can be collected at no (monetary) cost. Many households cook on ‘three-stone’ wood fires and simple stoves. A variety of stove designs have been developed, reflecting local cooking preferences, to cut wood use and reduce air pollution. This involves holding the burning wood within an insulated container and controlling the flow of combustion air through the wood and around the cooking pot. Ashden winners Aprovecho (now trading globally through EcoZoom) and Greenway Appliances supply portable wood stoves. TWP-AHDESA (Honduras), HELPS (Guatemala), and Grameen Shakti (Bangladesh) provide stoves that are built permanently into a home and include a chimney to remove pollution from the kitchen.

- **Improved solid fuels**

Indoor air pollution can also be reduced if solid fuels are processed into briquettes or pellets of uniform consistency and size, which burn more evenly. SGFE produces briquettes from char-residues to replace wood charcoal. KJS (Uganda) and Abellon (India) produce briquettes and pellets from agricultural residues.

- **Fluid fuels – biogas and ethanol**

Even with improvements to stoves and fuels, it is hard to reduce pollution to levels currently thought low enough to eliminate all risk to health. This requires the use of clean fluid fuels.

Many households and institutions now cook with biogas, produced on site from the decay of wet agricultural residues like animal manure, human sewage and food waste. Biogas plants are built from masonry or pre-fabricated from plastic, and need careful design, construction, and user training. If these conditions are achieved, a very clean cooking gas is produced, which lights quickly and is easy to control. A biogas plant can also help improve hygiene and sanitation for both humans and livestock, and the residue left after the gas is produced is a useful fertiliser. Ashden Award winners BSP (Nepal), MARD-SNV (Vietnam) and SKG-Sangha (India) have brought biogas to substantial numbers of homes. Biotech (India) has also supplied institutions with larger biogas plants. Biogas plants are quite costly because of the construction materials and labour needed: even a domestic plant usually costs US$300 or more, so most users require finance to enable them to buy one.

Renewable fuels can also be produced in liquid form: they burn cleanly and are easier to transport and handle than biogas. Ashden Award winner Gaia Foundation provided stoves to refugee households in Ethiopia that were fuelled with ethanol produced from molasses – a by-product of sugar production.

**Other technologies provided by Ashden Award winners**

Proximity Designs (Myanmar) and IDEI (India) sell foot-operated treadle pumps that are used for irrigating agricultural land. Although the pumps require manual work to operate them, this is far less time-consuming and arduous than carrying water by hand. And the US$20-40 cost of a treadle pump is cheaper than a diesel pump and fuel.

GERES' work in India made use of solar energy, by providing very efficient greenhouses in mountainous areas, which previously produced no vegetables in winter because of the very low temperatures.

iDE/Hydrologic (Cambodia) sell locally-produced ceramic water filters. This work was regarded as suitable for an Ashden Award because the filters replace the need to use firewood for boiling water in order to make it safe to drink – they are, effectively, an energy-efficiency technology

## Appendix 2 – Hyperlinks to Ashden Award winner case studies

The Ashden Award winners referenced in this report are listed here, in alphabetical order. Click on their name to access an Ashden case study on their work. Case studies of other Ashden Award winners, many of whose experiences were drawn upon in this report, can be found at www.ashden.org.

| Hyperlink to winner case study | Award Year | Country/ region | Technology |
|---|---|---|---|
| Abellon-CleanEnergy | 2011 | India | Fuel pellets |
| AKRSP | 2004 | Pakistan | Micro-hydro |
| Aprovecho - SSM - EcoZoom | 2009 | USA/China | Clean cookstoves |
| Aryavart Gramin Bank | 2008 | India | Solar home systems |
| Azuri Technologies | 2013 | Africa | Solar home systems |
| Barefoot Power | 2012 | Africa | Solar homes systems and lamps |
| Biotech | 2007 | India | Biogas |
| CRELUZ | 2010 | Brazil | Micro-hydro |
| CRERAL | 2008 | Brazil | Micro-hydro |
| D&E Green | 2013 | Haiti | Clean cookstoves |
| D.light | 2010 | India | Solar lamps |
| ECAMI | 2009 | Nicaragua | Solar home systems |
| Fruits of the Nile | 2008 | Uganda | Solar drying |
| Gaia Association | 2008 | Ethiopia | Clean cookstoves |
| GERES Cambodia | 2006 | Cambodia | Clean cookstoves |
| GERES India | 2009 | India | Greenhouses |
| GIZ/INTEGRATION | 2012 | Afghanistan | Micro-hydro |
| Grameen Shakti | 2008 | Bangladesh | Solar and clean cookstoves |
| Greenway Appliances | 2014 | India | Clean cookstoves |
| Grupo Interdisciplinario de Tecnología Rural Apropiada (GIRA) | 2006 | Mexico | Clean cookstoves |
| HELPS International, Guatemala | 2004 | Guatemala | Clean cookstoves |
| Husk Power Systems | 2011 | India | Biomass gasification |
| IBEKA | 2012 | Indonesia | Micro-hydro |
| iDE/Hydrologic | 2012 | Cambodia | Water filters |
| IDEI | 2009 | India | Treadle pumps |
| Impact Carbon | 2013 | Africa | Various |
| MARD/SNV | 2010 | Vietnam | Biogas |
| Off Grid Electric | 2014 | East Africa | Solar home systems |
| Practical Action | 2007 | Peru | Micro-hydro |
| Proximity Designs | 2014 | Myanmar | Treadle pumps |
| Rahimafrooz Batteries Ltd | 2006 | Bangladesh | Solar home systems |
| Saran Renewable Energy | 2009 | India | Biomass gasifiation |
| SGFE | 2014 | Cambodia | Charbriquettes |
| SKDRDP | 2012 | India | Various |
| SKG-Sangha | 2007 | India | Biogas |
| Solar Energy Foundation | 2009 | Ethiopia | Solar home systems |
| SolarAid | 2013 | East Africa | Solar lamps |
| TECNOSOL | 2010 | Nicaragua | Solar home systems |
| Trees, Water and People / AHDESA, Honduras | 2005 | Honduras | Clean cookstoves |
| WWF-DRC | 2013 | DRC | Clean cookstoves |
| Zara Solar | 2007 | Tanzania | Solar home systems |