



# SMART VILLAGES

New thinking for off-grid communities worldwide

## Smart villages: the gender and energy context



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*Key words:*

Gender, Equality, Empowerment, Cook-stoves, Energy Access, Entrepreneurship

## Smart Villages

We aim to provide policy makers, donors and development agencies concerned with rural energy access with new insights on the real barriers to energy access in villages in developing countries - technological, financial and political - and how they can be overcome. We have chosen to focus on remote off-grid villages, where local solutions (home- or institution-based systems, and mini-grids) are both more realistic and cheaper than national grid extension. Our concern is to ensure that energy access results in development and the creation of 'smart villages' in which many of the benefits of life in modern societies are available to rural communities.

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## SUMMARY

Whilst gender inequality is not something that can be solved purely by energy access, with the Smart Villages Initiative's integrated vision for energy in rural villages, we can aim towards a coordinated and effective approach to gender in rural development more broadly and have a positive effect on the fight against gender inequality. This report gives an overview of how energy can make a difference to gender equality and the burdens of women. Issues addressed include time and labour saving, entrepreneurship, health, education, gender awareness, and safety from violence against women.

Two key concepts for gender equality are women's empowerment and their bargaining power. Empowerment is a process commonly seen as concerning women's agency: their ability to make real choices as well as having access to resources. Women's bargaining power (influencing their role in intra-household decision-making) is determined both by an individual's resources (that they can control) as well as women's and men's own perceptions of their worth.

Achieving gender equality and empowering women and girls is one of the proposed Sustainable Development Goals. Women are often left out of household and community decision-making due to prevailing gender norms, restricting their ability to make real choices about the course of their lives. A key area where energy must hope to make an impact if it is to contribute to the fight for gender equality is in facilitating women's empowerment and bargaining power both within and outside the home.

Of the 1.3 billion poorest people in the world 70% are women. Women's experience of poverty, and energy poverty specifically, can differ greatly from men's due to their different roles in the household: women take on large amounts of unpaid survival activities such as firewood collection. For any project or initiative aiming to provide energy, gender issues/factors need to be taken into account throughout project formulation and implementation, as impacts of actions may differ depending on gender. What may benefit a man may not necessarily benefit a woman due to differences in

### Abbreviations

**ADB** Asian Development Bank

**AU** African Union

**ENERGIA** Network for Gender and Sustainable Energy

**ESMAP** Energy Sector Management Assistance Programme

**HDRC** Human Development Research Centre

**IEG** Independent Evaluation Group

**MRFCJ** Mary Robinson Foundation - Climate Justice

**NRECA** National Rural Electric Cooperative Association

**ODI** Overseas Development Institute

**UN Women** United Nations Entity for Gender Equality and the Empowerment of Women

**UNDP** United Nations Development Programme

**UNIDO** United Nations industrial Development Organisation

**USAID** United States Agency for International Development

roles, positions, needs and experiences. For a project's success to be maximised and the benefits of modern energy provision to be felt by all, a gender sensitive approach needs to be taken.

## Key areas of interaction for energy and gender

### Time and labour-saving

Women often bear the predominant burden in unpaid care work and survival activities such as firewood collection, cooking, water collection and food processing. These activities take up large amounts of women's time and energy. Technologies such as clean cook-stoves, water pumps and grinding machines can help save women's time and labour, freeing them up for other productive activities (education, paid work and/or entrepreneurship) or for leisure time and community participation. Division of labour along gender lines (a key cause of women's lack of economic autonomy and their difficulty in gaining access to paid activities) is at the heart of gender inequality. However, the labour of women in different contexts needs to be properly quantified. Time-use studies have been an important method to provide a real indication of how women expend labour.

### Entrepreneurship

Through improving the productivity of existing redundant space in micro-enterprises and enabling the creation of new ones, energy access if appropriately constituted can stimulate new entrepreneurial opportunities, in particular for women whose knowledge of the community and their needs can help make projects more successful. Entrepreneurship schemes can help women to earn their own income and in turn women's increased income, particularly when women have control over it, can increase their bargaining power and therefore their ability to influence

household decisions, and potentially improve their status in the community as well as the household. Entrepreneurship also may act to increase women's self-worth and confidence and challenge traditional gender divisions of labour. However, energy entrepreneurship initiatives need to be integrated with gender sensitive redundant space in finance/credit programmes as well as training and capacity building for the full benefits to be realised.

### Health

The health benefits of electricity include cleaner air, reduced risk of burns, fires, and accidents, better nutrition and food safety from refrigeration, and improved health knowledge from access to mass media. The reduction of indoor air pollution by replacing smoky traditional cook-stoves with clean cook-stoves benefits women and girls in particular due to their time spent cooking. Women's health is also indirectly impacted by energy through the reduction in the drudgery of their daily tasks through time and labour saving technologies. In addition, electricity can enhance the safety and effectiveness of health clinics, and particularly for women may help to reduce the maternal mortality ratio (for example, through lighting for night time deliveries). Improved access to information and communication enabled by energy access can also increase health related knowledge so that informed choices can be made on key issues such as family planning.

### Education

Education can affect outcomes directly and indirectly, impacting a woman's outside options and thus her bargaining power. Women account for two-thirds of the world's 774 million illiterate adults – this has remained unchanged over the past two decades. Electricity enables access to educational information and information communication. The

quality of schools can therefore be improved. Access to light also means increased time for studying and ability to participate in adult evening classes. Girls who are no longer required to help their mothers with survival activities can attend school.

### Gender Mobility

By allowing more time for leisure activities, women's mobility and participation in the community can be enabled. One of the most simple ways this can be achieved is through improved street lighting, making it safer for women to move around at night.

### TV and Gender Awareness

Ability to access television broadcasts can heighten gender awareness, with women becoming more aware of gender equality issues by seeing images of empowered women and what gender equality may look like.

### Violence against Women

Electricity and energy provision can restrict the area of vulnerability to sexual violence and assault by reducing the need for firewood collection (involving long journeys to remote areas) as well as by providing street lighting, allowing for a greater sense of security. Greater access to information and communication can also provide support for victims of violence. However, the key area in which energy can make a difference is by increasing women's bargaining power through resource ownership and entrepreneurship. Resource control can provide protection in some ways from spousal abuse, increasing women's ability to negotiate and strategise in the household and in the community.

The vision of gender in a smart village where energy can alleviate some of the problems of

gender inequality as outlined above may be summarised thus:

In a smart village, reduced need for firewood (due to clean cook-stoves) and labour-saving technologies for tasks such as food processing can reduce the heavy burden of labour placed on women in their domestic, unpaid tasks. It can also reduce their time spent on such activities and give them the time to pursue other employment/enterprise as well as to socialise, participate more productively in community activities and have some leisure time. A smart village can improve women's health due to the reduction of smoke pollution through clean cook-stoves as well as enhancing health services. It can also improve the quality of education (women in the developing world suffer more from illiteracy) and access to information on gender equality issues and health, amongst other things, through television and other media. The opportunity to engage in energy entrepreneurship in smart villages can also improve women's agency, through skills development and training, and access to resources, by enabling them to earn their own income, which in turn can increase their bargaining power.

A bottom-up, off-grid approach allows gender concerns to be more easily integrated into programmes at all levels than would perhaps be possible in a large-scale grid extension programme. Other interventions in different sectors may also be necessary for the full benefits of electrification to be realised for women. The integrated approach that smart villages take allows for this.

The Smart Villages Initiative believes in the fundamental importance of gender concern and sensitivity in rural energy projects, not only for policy makers and project organisers but also for technology developers, academics and young entrepreneurs starting at the root of energy development initiatives.

## 1. INTRODUCTION

In smart villages modern energy access acts as a catalyst for development, harnessing and developing entrepreneurial capacities to provide and effectively use the energy services to support and enable education, health, food security, productive enterprise, clean water and sanitation, environmental sustainability and participatory democracy (Van Gevelt and Holmes, 2015). The aim of this report is to review the literature on the gender impacts modern energy provision can have, and on what gender sensitive energy provision and entrepreneurship can do to improve the lives of women in particular, and to help facilitate women's empowerment.

Through this report the Smart Villages Initiative aims to increase the awareness of policy makers and other stakeholders of the gender issues associated with energy access in rural areas. Energy solutions that are deployed should be more sensitive to the real and specific needs of both women and men, and the benefits of energy provision can be fully realised by both genders.

To achieve these outcomes, women need to be viewed as agents of change as well as beneficiaries. 'Women as agents of change' is an issue that will be explored in the context of entrepreneurship, as well as education and health, later in the report. Due to gender norms, women are often left out of household decision-making and their degree of choice about the kind of lives they lead is constrained. Facilitating women to have more agency (expanding their degree of choice) and bargaining power within the home and in the community is key for energy to contribute to gender equality.

Achieving gender equality and empowering women and girls is one of the proposed Sustainable Development Goals being developed in 2015. Energy provision has the capacity

to contribute to this as well as to other goals including poverty and food security (UN, 2015). UN Women in their 2014 world survey of the role of women in development note that access to basic electricity services "is a prerequisite for gender equality and not just for overall development alone" (UN Women, 2014). Gender equality is also part of global measures of quality of life (AU, 2014). "An examination of the UNDP's Gender-related Development Index (GDI) versus per capita energy consumption shows that the relationship is close, and even modest increases in energy and electricity consumption could be associated with much larger improvements in gender-related development defined as equality in life expectancy, literacy and school enrolment" (Energia and DFID, 2006).

However, despite such connections, "Women's specific contribution in energy decision making is not explicitly recognized. Males at policy and technical and professional levels also dominate [the] energy sector" (Muchiri, 2008). This can lead to policy having an inadvertent male bias (UNIDO and UN Women, 2013).

The issue faced in establishing smart villages is that the kinds of interventions and approaches that will benefit men will not necessarily have the same impact on women (Cecelski, 2000). It is necessary to determine what rural women want and need with regard to energy and development, as well as men, so that the action taken is appropriate to gender needs and does not result in a disparity of outcomes. The Smart Village Initiative's holistic bottom-up concept provides the leeway for thinking about women and men within their specific socio-cultural contexts, and acknowledges the diversity of women.

The data surrounding gender and energy are still limited, and more research is required.

Energia has launched an extensive research programme on the links between gender, energy and poverty whose motivation is expressed as follows: “currently, independent empirical evidence is lacking on differences in the impacts on men and on women related to characteristics of energy supply and access, and also in the use of end-use equipment”, such knowledge is required to create insights into how to enhance the positive impacts for all (Energia, 2014). There is a need to substantiate claims that a gendered approach to energy supply with women in the supply chain and involved in decision making has a beneficial impact on increasing sustainable access (Energia, 2014).

Due to the surprisingly few robust studies of impacts of rural electrification projects, in particular the gender-differentiated impacts, it should be borne in mind that not all potential benefits have yet been backed up by evidence (Köhlin et al, 2011). Indeed, most behavioural changes occur in the medium to long run, so the ability to immediately gauge the impacts on empowerment and gender equality of projects is limited (ADB, 2010).

However, there are certain key areas where the literature indicates that improved energy access can play a role in improving the lives of women. Benefits of clean energy provision for women include “reduced drudgery and time savings, improved health, family relations, as well as new opportunities for additional income, employment, leisure, education and productivity improvements” (Pachuri and Rao, 2013). The technology that comes with energy provision can have an important impact. Women’s tasks are “often made more difficult because of inadequate infrastructure for water, energy, and transport, as well as women’s lack of access to productivity-enhancing technology that is responsive to their specific needs and work burdens” (Blackden and Wodon, 2006).

Energy access can also indirectly play a role in fighting violence against women.

In a smart village, reduced need for firewood (due to clean cook-stoves) and labour-saving technologies for tasks such as food processing can reduce the heavy burden of labour placed on women in their domestic, unpaid tasks. It can also reduce their time spent on such activities and give them the time to pursue other employment/enterprise as well as to socialise, participate in community activities and have some leisure time. A smart village can improve women’s health through the reduction of smoke pollution through clean cook-stoves as well as by improving health services. It can also improve the quality of education (women in the developing world suffer more from illiteracy) and access to information on gender equality issues and health, amongst other things, through television and other media. The opportunity to engage in energy entrepreneurship in smart villages can also improve women’s agency, through skills development and training, and access to resources, by enabling them to earn their own income, which in turn can increase their bargaining power.

All of these elements when viewed together have the potential to help trigger women’s empowerment and improve their quality of life. It has also been emphasised by some commentators that “complementary interventions, in sectors other than energy, are likely to have a bearing on whether benefits to women from energy related interventions are realised” (Pachuri and Rao, 2013). “Energy projects should be integrated in a holistic way with other improvements relating to health, education, agriculture and job creation” (Lambrou and Piana, 2006). The decentralised approach to energy provision which is the focus of the Smart Villages Initiative may lend itself more readily to aid the empowerment of women, as gender issues may more readily be incorporated into local energy planning and implementation, working from

the bottom-up. In projects focusing on grid extension, empowerment of women may not always be a realistic goal (Lambrou and Piana, 2006). End-users in poor and remote areas in particular are often overlooked as stakeholders in large-scale energy projects (NORAD, 2011)

This report will first outline the connections between Gender, Energy and Poverty and why gender concerns are of importance. Secondly it will deal with concepts of Empowerment and Bargaining Power, which are central to considering how energy can have a long-lasting

positive impact on women. Thirdly it will outline the key areas of Impact for Energy Provision on women and gender equality, namely: time/labour saving, entrepreneurship, education, health, gender awareness, safety and violence against women. Finally, some concluding remarks are drawn together on the importance of including gender concerns in energy access initiatives and on the implications for smart villages. A bibliography of the literature which has informed this review is provided at the end.

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## 2. GENDER, ENERGY AND POVERTY

Gender is not synonymous with sex: sex is biologically determined while gender is “socially determined and based on social, cultural, political and economic expectations” (Rojas et al, 2012). As gender is shaped by society it can take different forms in different settings. The balance of power between men and women defines the relationship between the genders (Rojas et al, 2012). The effects of differences in power operate at the household, community, organisation, national, and, international levels.

Women, however are not a homogenous group and gender is not easily defined as encapsulating certain characteristics, “culture, income, social class, religion, family status and geographical location also need to be incorporated into a more integrated view of energy as a factor in promoting social and economic development” (Lambrou and Piana, 2006). The village level, bottom-up approach of the Smart Villages Initiative means that the concept can be adaptive to women’s diversity.

Gender inequality is institutionalised in formal and traditional laws as well as unwritten norms and values (Khamati-Njenga and Clancy, 2003). On the other hand, “Gender

equity means fairness of treatment of women and men, according to their respective needs” (Muchiri, 2008). Within the development context “a gender equity goal often requires built-in measures to compensate for the historical and social disadvantages of women” (Muchiri, 2008).

Whilst this report focuses predominantly on women, this is due to their particular experiences and the significant disadvantages they may face as a result of their gender in comparison with men, as well as their particular relationship with energy. Drawing this focus is not meant to imply that the conditions of men and their situation do not also need to be analysed. “Gender is about reaching a better understanding of how communities work from the perspective of relationships between men and women” (Khamati-Njenga and Clancy, 2003).

Men’s roles also need to be taken into account, not just the constraints imposed on women. There may be instances where policies or projects discriminate against men (although unintentionally) and these should also be considered parallel to those of women (Lambrou and Piana, 2006). To make a change to a community we need to understand the

community itself and how the experiences of men and women differ as well as their relationships. By understanding what men and women need, and the overall context of community life and relationships, and by considering how to address household needs as well as productive and entrepreneurial activities, we can hope to make energy projects as effective as possible (Lambrou and Piana, 2006).

Of the 1.3 billion poorest people in the world 70% are women (Muchiri, 2008). Women's experience of poverty in general can differ greatly from men's. Women in rural areas in the developing world undertake a large amount of unpaid labour as part of their daily routine that is not reflected in national statistics (UNIDO and UN Women, 2013). Women's unpaid work includes: "performing daily maintenance tasks, such as shopping, food preparation, cooking, laundry, and housecleaning; raising and caring for children; growing food and caring for livestock; making or acquiring household goods such as pottery, clothing and medicines; caring for the sick, elderly and disabled; and providing voluntary community services for schools and other organisations" (Energiya, 2015). In Asia poverty "tends to threaten more women than men because of gender biases within their societies that limit opportunities for education, employment and land ownership", "Gender disparities are evident also in the intra-household allocation of food and resources" (Lambrou and Piana, 2006).

Men may migrate to the city to work and send money home while women may often be left managing the household/food production, with too much work and too few resources (Standing, 2002). Migration can lead to women increasingly being heads of households and in some places female-headed households are more likely to be poor (Köhlin et al, 2011). An IFAD poverty assessment in eastern and southern Africa noted that an estimated 25-60% of rural households in countries in the region were headed by women,

either widows, single, divorced or separated women or wives of male migrants (IFAD, no date; Lambrou and Piana, 2006). This serves to give rural energy poverty a gender bias (Cecelski, 2000).

As women experience poverty differently to men they "may need different energy policies to help them escape energy poverty: new energy technologies can even have unintended negative consequences for women, as has happened in the past with other technologies" (Muchiri, 2008). Access to energy services also "generally favours men's rather than women's roles, needs and priorities", for example "only a small proportion of energy sector investment addresses cooking energy needs" (NORAD, 2011).

Cook-stoves are also a key area of importance when it comes to energy improving women's lives. Traditional biomass burning stoves, particularly when used indoors are the primary contributor to household air pollution (UN Women, 2014). "Globally, such pollution is responsible for over 4 million deaths, and household air pollution and ambient air pollution, jointly, are now the leading global environmental health risk" (UN Women, 2014). As it is often the social norm for women to do the daily cooking for their families, it is women and children who suffer disproportionately from exposure to harmful smoke emitted from biomass burning cook-stoves (UN Women, 2014). Cook-stoves are therefore a key focus area for many energy initiatives (for example, Practical Action, no date).

The collection of the fuel itself for such cooking practices is also a concern. In rural poverty there is often a high level of dependence on biomass and human energy (Cecelski 2000). Women spend a significant amount of time and effort cooking, collecting water, fuelwood and other biomass resources (Cabraal et al, 2005). In terms of fuel collection "men become involved where fuel has to be collected over long distances, where fuel is purchased, or there are social restrictions on

women leaving their homes” (Khamati-Njenga and Clancy, 2003). However, women generally bear the predominant burden for household energy provision, for example biomass for cooking, but more than this; “Women bear the invisible burden of the human energy crisis – women’s time and effort in water-pumping, agricultural processing, and transport.” More modern and more efficient energy sources are required to improve their work and quality of life both within and outside the home (Rojas et al, 2012).

“Many of the benefits that stem from modern energy services disproportionately benefit women more than they benefit men” (Cabraal et al, 2005). For example, in Indonesia “Women are the primary beneficiaries of electricity in the home, first because it makes home life more convenient, notably by easing chores and offering new possibilities and more time for entertainment” (Madon and Oey-Gardiner, 2002). However, women may only be able to benefit partially from any energy intervention due to “overriding’ factors such as lower levels of education, mobility and access to information” (Rojas et al, 2012). This highlights the need for an integrated approach to energy initiatives considering multiple areas.

Men’s and women’s experiences of energy and poverty differ, and therefore their needs also differ. “Energy planning that is implemented in a gender neutral way misses important issues and inadvertently discriminates, usually against women” (UNDP, 2004). The following paragraphs give some examples of how needs and priorities differ across genders, although it should be borne in mind that differences are cross-cut by multiple other factors and that women themselves are not a homogenous group.

As already noted, women in most developing countries experience energy poverty differently and more severely than men (UNIDO and UN Women, 2013). Men and women are

affected differently by energy policies wherever their home, work and community roles differ (Energia, 2015). Policies that are gender blind could reinforce gender inequalities, for example, extending the working day for women while increasing leisure time for other family members (Energia, 2015). Attention has to be paid to differences to achieve effective and equitable distribution of energy and development services (Energia, 2015). To do this the differential activities, roles, preferences, constraints, participation, and access by women and men need to be ascertained (Cecelski, 2000). For example, in terms of perceptions of benefits, men may “measure the benefits of electricity in terms of leisure, quality of life and education for their children”, while women “consider electricity and modern energy options as ways of lightening their workload, reducing expenditures, improving health conditions and cleanliness, and boosting their own self-esteem” (Lambrou and Piana, 2006).

Men and women can value energy differently and for different reasons, partly due to the gendered division of labour. Standing (2002) found that women valued a reduction in smoke on health grounds and because it reduced their daily drudgery in cleaning the pots, but men valued fuel saving above other considerations. “It is not only the gendered division of labour which creates different energy needs, but there are also different perceptions of the benefits of energy and the capacities to access those benefits based on gender” (Khamati-Njenga and Clancy, 2003). For example men “may choose to locate a light outside the house for security reasons (such as protecting livestock from theft) while women may choose to locate the light in the kitchen” (Khamati-Njenga and Clancy, 2003).

Gender differences also exist in how leisure time is spent. For women, any leisure time is often spent “first on performing other household duties, and only then on leisure, if at all”, although this is not true in all cases (Panjwani, 2005). While, in some studies, men “made use of the solar lighting to

pursue leisure activities in the evening, such as watching television, reading religious books, or gathering together for a chat” (Wong, 2009).

The subdivisions among men and women need to be recognised, and opportunities and constraints in local cultural practices for planning processes also need to be taken into account (Clancy et al, 2007). Failure to consult women in project planning in Pakistan meant that latrines ended up being sited next to a mosque, where women were prevented by cultural norms from using this resource which was intended to be beneficial to them (Clancy et al, 2007).

Priorities among women themselves also vary and gender interests are not always obvious and neither are potential impacts of project interventions (Khamati-Njenga and Clancy, 2003). Emphasis is often placed on cooking and firewood collection, but some studies have shown different priorities for women such as water collection and market trips (Khamati-Njenga and Clancy, 2003). For effective energy service delivery “beneficiaries – both women and men – must actively define the end uses that are most important for them, decide what they are willing to pay for different levels of service and, based on a wide range of choices, plan for future needs” (Lambrou and Piana, 2006). Therefore particular impacts should only be emphasised if identified as important by the community themselves.

“Applying gender analysis to energy plans and programmes can help ensure the full inclusion of the social dimension of energy initiatives and lower the risk of project failure by identifying gender sensitive factors that can affect the success of an activity or technology in a specific context” (Lambrou and Piana, 2006). Formulation and implementation of energy programmes need to be gendered, by properly focusing on specific gender needs to ensure the achievement of the full benefits of energy provision (Muchiri, 2008). By championing the incorporation of

gender, the Smart Villages Initiative can be more effective in the context it is being applied to.

Gender mainstreaming in energy projects requires positive action at three levels (Lambrou and Piana 2006):

- 1 At the policy level “to ensure that the challenge of gender equality becomes a visible and key concern”;
- 2 At the programme level “to ensure that all energy interventions create opportunities for women’s empowerment and gender equality”; and
- 3 At the organisational level “to ensure that space and opportunities are available to women as well as men”.

It also requires data collection on how women and men perceive their energy needs, as well as “what actions they perceive as most beneficial” (Lambrou and Piana, 2006). In terms of tools for gender analysis, Clancy et al (2007) have developed a useful toolkit on gender analysis for energy projects which involves four key steps:

- analysing stakeholders from a gender perspective;
- finding out more about the context, problems and priorities to be addressed from a gender perspective;
- looking at opportunities for ensuring that women are able to participate fully in all aspects of the project not only as end-users;
- with the final step requiring a return to analysing the gender goals or stakeholders in the first step.

The concerns of men and women need to be integrated into all levels of energy policies and



The women of the mountain villages in Rajasthan, India, carry 30Kg. of wood on their heads every day for their cook fires. (Engineering for Change on Flickr)

programmes (NORAD, 2011). A gender-sensitive programme strategy may include:

- setting targets for women to become clean energy employees and entrepreneurs;
- carrying out research to evaluate interventions and the impacts of key design elements on gender-sensitive project design;
- implementing gender-targeted promotion and marketing strategies; and
- taking account of gender aspects in energy infrastructure solutions amongst other elements.

Financing of energy access programmes also needs to be gender sensitive. Gender equitable financing is needed to meet both women and men's needs (NORAD, 2011). "Investments need to be increased for improved cooking options and other needs that correspond to women's energy consumption and productive activities", although discussions are needed on how this should be financed (NORAD, 2011). "Gender-responsive energy financing can contribute

to basic human rights, economic efficiency and gains for private investors" (NORAD, 2011).

For small energy systems cooking, studying and television often compete for the limited electricity (UN Women, 2014). This has repercussions if women's influence on household decision-making is restricted, as women's needs may not be prioritised. It may be the case that a higher capacity than 'pico' will be needed in order for electricity services to actively promote gender equality (UN Women, 2014).

However, the solution cannot lie only in supplying enough energy to meet the needs of both genders (this may not always be possible, and certainly a household will have limitations to what it can spend on energy provision). Instead, the household dynamics and decision making structures should be examined in order to identify how women can have more say in what energy is used for and what technologies should be purchased.

For modern energy provision some key concepts are women's empowerment, bargaining power and intra-household decision-making: what these entail, why they are important for energy projects and how energy can help are considered in the next section.

### 3. EMPOWERMENT, BARGAINING POWER AND DECISIONMAKING

The notion of gender equality is inextricably linked with women's empowerment. Two of the most commonly emphasised components of empowerment are resources and agency (Torri and Martinez, 2011). Empowerment is a process and in terms of agency "women themselves must be significant actors in the process of change that is being described or measured", women should be able to define "self-interest and choice, and consider themselves as not only able, but entitled to make choices" (Torri and Martinez, 2011). Economic empowerment is "a process whereby women's and girls' lives are transformed from a situation where they have limited power and access to economic assets to a situation where they experience economic advancement and their power and agency is enhanced" (Taylor and Perezniето, 2014). Changes have to occur within the individual ("capability, knowledge and self-esteem"), in communities/institutions (including norms/behaviours), in markets/value-chains and in the wider political and legal context (Taylor and Perezniето, 2014).

Sustainable development should enhance the capabilities of women and girls, so they are able "to lead the lives they value – and have reason to value" (UN Women, 2014). "No development pathway can be considered 'sustainable' if it reduces women's capabilities" (UN Women, 2014). Therefore, potential negative impacts of energy provision on women's capabilities (e.g. extending women's burdens by increasing hours available for work) should be considered in order to ensure the effectiveness of energy initiatives.

The Capabilities framework as championed by Sen (2005) and Nussbaum (2003), emphasises "choice in addition to outcomes of well-being... it is only indirectly linked to specific bundles of goods and services" (UN Women, 2014). For energy to be gender sensitive, women need to be

more empowered to make choices about energy (Lambrou and Piana 2006). Enabling choice is "linked to issues of sustainable livelihoods and poverty alleviation, including access to income generating activities" (Clancy and Skutsch, 2002). "Women should be able to act upon the energy choices open to them, and their scope for this type of action is linked to decision making within households" (Clancy and Skutsch, 2002).

Empowerment cannot be delegated or imposed by project planners; the power must be claimed by the women themselves (Wong, 2009). This is why providing choices and opportunities through entrepreneurship, for example, is important as it is through such means that women can empower themselves.

Rather than dictating to women and men how they should use energy, what form it should take and which technologies are best, villagers should play a key role in the conception and establishment of smart villages, and choice should be emphasised. Choices must come from the community by providing training and increasing awareness. Initiatives can build on women's own knowledge and experience, introducing new ideas for change, but not imposing them (Torri and Martinez, 2011). The types of support needed are likely to be context specific and dependent on the needs and priorities of the women concerned (Torri and Martinez, 2011). Women's energy needs can only be met once they have a voice in determining options and priorities (Lucas et al, 2003). Consequently, women need to be empowered: their lack of voice and role in decision-making in contrast to men is one reason for focusing on women in this report.

"The right to access energy services for women is realized at the household level" (Danielsen, 2012). The power-relations within households "can be a barrier to the dissemination of clean cooking facilities because investment in

cooking technologies – that first and foremost benefit women – might not necessarily be first priority for male decision makers” (UNIDO and UN Women, 2013). “Investments to improve stoves, kitchens and cooking fuels tend to be considered as marginal items when men make the decisions about household purchases” (Lambrou and Piana, 2006). In some instances, in order for women to gain benefits of energy technology they need “access to and control over their own income, or a sympathetic husband” (Lambrou and Piana, 2006). Intra-household decision-making is therefore key to understanding the barriers and possibilities for women to access the energy they need (Danielsen, 2012). Intra-household relations can be complex, not only involving negotiations between spouses but also between parents and children and various other members of the household (Doss, 2013).

One of the ways to increase women’s role in decision-making is to increase their bargaining power. Bargaining power within the household may be determined by “the resources individuals can control independently from their membership of the household and also by women’s and men’s perceptions of their respective worth and contributions” (Danielsen, 2012). Activities that increase women’s access to resources, self-worth and confidence or indeed men’s perceptions of them can help increase women’s bargaining power and improve their status in the home, empowering them through agency as well as resources. In terms of resources: “most rural women have limited economic control at the household level while men control household income” (Muchiri 2008).

Factors influencing bargaining power also include prevailing social norms, access to groups/coalitions, laws and rights – and women’s agency – their motivations, preferences. Education is often highlighted as another important aspect (Pachuri and Rao, 2013) (Doss, 2013). More specifically in terms of modern energy provision, factors such as

“access to resources, women’s own preference, women’s income-generating opportunities, and their active participation as ‘energy entrepreneurs’ in the development and operation of energy systems and technology” can play a key role in determining bargaining power (Pachuri and Rao, 2013). However, with regard to increasing resources through entrepreneurship, we should bear in mind not only whether women and girls have increased their access to income/assets but also whether they have more control over them and are able to use them to have greater control over other areas of their life (Taylor and Perezniето, 2014).

Energy has a part to play in the empowerment of women and their bargaining power. “The literature on gender and energy suggests that providing electricity to communities and homes and motive power tasks considered women’s work can promote gender equality, women’s empowerment, and women’s and girls’ access to education, health care, and employment” (Köhlin et al 2011). Energy can provide women with direct employment through energy entrepreneurship, as well as with the time and in some cases means to pursue other forms of labour. Women can gain access to resources through enterprise as well as confidence through training and support, improving their ability to negotiate in the household and perhaps take a greater role in decision-making, bargaining power being key to their empowerment.

To change household relations completely is not a task that can be achieved purely through energy provision, however, energy provision and the Smart Villages Initiative may indirectly be able to increase opportunity for women to expand their bargaining power. This can have a knock-on effect on women’s social status and gender equity as a whole. How energy can impact bargaining power specifically, and have a positive impact for women more generally, will be discussed in the following section of the report.

## 4. IMPACTS OF ENERGY PROVISION

This section of the report focuses on the most relevant areas of impact for energy provision when thinking in terms of gender: labour and time saving, entrepreneurship, health, education, gender mobility, gender awareness and violence against women. The impact of energy provision also can be usefully broken down in terms of rural women's practical, productive and strategic needs. It is through meeting the real needs of women in these areas that energy initiatives can hope to make a positive difference to the quality of life not only of women but rural communities as a whole. The table below outlines some possible impacts in terms of needs.

### 4.1 Time-saving and women's labour

The Commission on the Status of Women emphasised the need for “governments to value, reduce and redistribute unpaid care work by prioritizing social protection policies, accessible and affordable social services and the development of infrastructure, including access to environmentally sound time and energy-saving technologies” (UN Women, 2014). Energy and technology can help reduce the burden of un-paid care work for women.

Gender equality in energy access can, through time and labour-saving contribute to economic efficiency (NORAD, 2011). “Access to modern forms of energy for lighting, cooking, heating and cooling, refrigeration, pumping, transportation, communications and productive uses give both women and men more time and physical energy for productive work” (NORAD, 2011). Improving the efficiency of productive work and “savings in both energy and health expenditures can improve household economies, which again can lead to improved access to education and the empowerment of both young girls and boys” (NORAD, 2011). In turn educated men and women are “better

equipped to take an active part in society, to be efficient and productive actors and to influence decision-making processes in households and society that can improve economic efficiency and the well-being of all” (NORAD, 2011). However to do this we need to enable women to participate in paid activities easing the burden on women as a result of the gendered division of labour.

Division of labour along gender lines (“the main cause of women's lack of economic autonomy and their difficulty in gaining access to paid activities”) ‘is at the heart of gender inequality’ (UN, 2013). However, the labour of women in different contexts needs to be properly quantified. Time-use studies have been an important method of providing a real indication of how women expend labour. Performing time-use studies, periodically measuring women's and men's unpaid work can also help such work become more visible and its value to be recognised (UN, 2013). Time-use surveys “are a useful instrument for analysing work in the light of the links between the public and private spheres, and for studying the ‘social contract’ governing day-to-day relations between men and women within the home and in society” (UN, 2013). They are therefore an important part of implementing agendas on gender equality.

The division of labour in many rural areas is heavily gendered, affecting men and women differently. “Women generally work in both productive activities and in tasks associated with child-rearing, food-processing and cooking, care of the sick and caring for the house” (Standing, 2002). Women also bear the main responsibility in gathering firewood and cooking and basic subsistence tasks (Gupta and Köhlin, 2006).

The drudgery and backbreaking work involved in many daily activities sap women's health and strength (Energia, 2006b). Women also work longer days than men providing human energy for survival activities (Rojas et al, 2012). Standing (2002) also notes that the poorer the household, the greater the time, and the physical and health burdens associated with these tasks. For example, a study conducted in rural Flagstaff, South Africa found that the total time spent on unpaid care work by women was around 7 hours, and the total time spent on daily mobility (e.g. travelling to the river/forest to collect water/firewood) was around 4.5 hours (Uteng, 2011). Evidence from a review of studies by Energia and DFID suggests that there are "time and effort savings of 1 to 4 hours daily in cooking, fuel collection and food processing, when energy is made available for these tasks" (Energia and DFID, 2006). Time

spent on such tasks can constrain women from accessing decent wage employment, educational opportunities and livelihood enhancing options as well as limiting their options for social and political interaction outside the household (UNIDO and UN Women, 2013).

Education and paid work may be key to enhancing women's status (Barnes and Sen, 2003). It is such status enhancement that is necessary to empower women and enable them to make real choices about their lives. Electricity can provide this time. Labour saving devices and clean technologies could help relieve the burden of some of the drudgery women face as well as open up time for doing other productive activities (Standing, 2002). A World Bank project study in Sri Lanka on electrification found that the major benefit for women was

Energy Form	Women's Needs		
	Practical	Productive	Strategic
Modern Biomass	<ul style="list-style-type: none"> <li>Improved health through better stoves</li> <li>Less time and efforts devoted to gather and carry firewood.</li> </ul>	<ul style="list-style-type: none"> <li>More time for productive activities</li> <li>Lower cost to process heat for income generating activities</li> </ul>	<ul style="list-style-type: none"> <li>Can allow for improved monitoring and control of natural forests in the wider context of community forestry management</li> </ul>
Mechanical	<ul style="list-style-type: none"> <li>Milling and grinding reduces drudgery</li> <li>Easier to transport water and crops</li> </ul>	<ul style="list-style-type: none"> <li>Increases variety of enterprises</li> </ul>	<ul style="list-style-type: none"> <li>Transport allowing access to commercial, political and social opportunities</li> </ul>
Electricity	<ul style="list-style-type: none"> <li>Water pumping reduces need to haul and carry water</li> <li>Lighting improves the working conditions at home</li> <li>Mills for grinding reduce drudgery</li> </ul>	<ul style="list-style-type: none"> <li>Increased opportunities for activities during evening hours</li> <li>Provide refrigeration for food production and sale</li> <li>Power available for specialised enterprises such as hairdressers and internet cafés.</li> </ul>	<ul style="list-style-type: none"> <li>Safer streets allow participation in a wider range of activities (meetings, courses, etc.)</li> <li>Improved access to information through radio, TV and internet</li> </ul>

*From Lambrou and Piana, 2006*

represented by the time they saved (Lambrou and Piana, 2006).

What the saved time is used for will of course vary across households. In the EnPoGen study in Sri Lanka, “Twenty-nine per cent of the female household members said that the time they saved was spent on extra housework, while less than 5% reported using it for productive activities” (Massé and Samaranayake 2002). While a study into the socioeconomic impacts of rural electrification in Namibia showed that women did stay up later than men, not working but socialising (Clancy and Skutsch, 2002). A number of studies have found time-savings can lead to more time resting and socialising (Panjwani, 2005). A study in South Africa found that “women benefited from having more time to do what they enjoyed doing. They preferred not to spend the time saved on taking on new, or other activities. This resulted in women being less tired and harassed” (Panjwani, 2005). Whilst some studies note men especially benefit from electricity through leisure time to watch TV, socialise, listen to the radio and drink, others have noted that women also have increased access to TV/radio with electrification (Panjwani, 2005). This in turn can have positive effects on gender awareness, which will be elaborated on later in this report.

Overall, many case studies show that women choose to devote extra time procured from access to energy to other productive/reproductive work. Although women do increase time for leisure, entertainment or social recreation, often it is more likely that men do this than women (Energia and DFID, 2006). Studies in South Africa and Guatemala have attributed increases in female employment to “the fact that electricity frees up women’s time by increasing the efficiency of domestic chores, especially cooking” (Köhlin et al, 2011).

The reaction of men to this freed time for their wives can vary. Some men may express concern

about how their wives would make use of saved time while others see it as an opportunity for wives to undertake more productive activities (Clancy and Skutsch, 2002). This is something which needs to be monitored, not only taking into account men’s needs and situation but their potential reactions to changes in the situation of women.

However, some studies have suggested that women’s “work burden can actually increase, as household activities can be carried out in the evening, allowing more working hours on other activities” (IEG, 2008). Electrification can improve quality of life for some members and extend the working day for others – men and children may use the light for reading and entertainment, while women continue with daily work (UNDP, 2004). Yet, this does not have to be seen as wholly negative: “if as a result of improved lighting, women themselves choose to work longer hours to increase their own income, this could be seen as an indicator of empowerment rather than as a loss of welfare” (Clancy and Skutsch, 2002).

Some of the key areas of work in which energy can make a significant difference to time and labour is in firewood and water collection, food preparation and transportation.

### Firewood

As women bear the main burden of providing and using fuels, their situation can be made worse by fuel scarcity which both heightens the burden and reduces opportunities for income-generating and educational activities (Muchiri, 2008). Rural households are also highly labour-constrained during peak agricultural seasons, and the time to collect fuelwood has high opportunity costs (UN Women, 2014). A study in Guatemala showed that women spend on average “8-11 hours per day on energy related activities such as fetching water, firewood, cleaning and cooking. Men spent on average 1-2 hours per day, and this

was mainly providing firewood” (Lambrou and Piana, 2006). In terms of firewood specifically, “in rural sub-Saharan Africa, many women carry 20 kilograms of fuelwood an average of five kilometres every day. The effort uses up a large share of the calories from their daily meal” (Lambrou and Piana, 2006).

There is some evidence that improved stoves lead to decreased firewood collection (Köhlin et al 2011). Time spent collecting firewood reduced substantially with electrification in Bhutan (ADB, 2010). While both men and women benefitted from this reduction, women benefitted more than men: for women the reduction in time spent on fuelwood collection was 34% higher (ADB, 2010). Through initiatives providing clean cook-stoves, the time that would have been used to collect fuel can then be used for other productive and economic activities (MRFCJ, 2012).

Additionally, the income effects of efficient stoves are likely to be consistently positive “many improved stoves burn between 30 per cent and 60 per cent less fuel than their unimproved counterparts; this can be a significant saving for rural households that spend nearly 10 per cent of their monthly income on energy” (UN Women, 2014).

## Water

“Where there is no pumped water, women and girls also go to wells, springs, lakes and rivers to carry back water for drinking, washing, cooking and sanitation” (Energia, 2006b). According to the UNDP in 2006, Sub-Saharan African women spend “40 billion hours a year collecting water – the equivalent of a year’s worth of labour by the entire workforce in France” (Rojas et al, 2012). “Mechanical or electrified water pumping relieves women’s burdens and makes basic household sanitation and subsistence activities much healthier and less time consuming” (UNDP, 2004). Women are

primarily responsible for boiling water to make it safe to drink - increasing the time burden collecting firewood and boiling water, and increasing exposure to smoke when water is boiled over a traditional wood fire. Improving access to clean drinking water by making alternate water purification options available, for example simple ceramic filters, reduces this time, fuel and health burden on women.

In remote rural areas solar, micro-hydro and wind equipment amongst others can be used to pump water and provide electricity (UNDP, 2004). In a photovoltaic powered water pump project in Brazil where small-scale farmers are severely affected by variations in water level, the pumps not only reduced the drudgery of the women but also contributed to increased economic activity and better health and living conditions (Energia, 2006b). Solar water pumps for irrigation can increase women’s ability to manage farming activities themselves. When introducing solar water pumps to women in East Java, Indonesia (where diesel-powered pumps are widely used), women were very enthusiastic about the pumps, because they would be able to start the pumps by themselves, rather than having to ask a man to start the pump for them. Women say they struggle to start the diesel pumps themselves, and typically they rely on their husbands to start the pump. If the husbands are away, the women must pay a man to start the pump for them - paying 30,000-50,000 Indonesian Rupiah (US\$ 2.2-3.6) for this service.

## Food preparation and agriculture:

Food preparation presents another key area of time and labour saving when the burden is diminished through energy provision. According to the FAO more than 70% of economically active women in the least developed countries work in agriculture (MRFCJ, 2012). Women produce between 60 and 80% of food in most developing countries (Energia, 2015). This means agricultural technologies for processing

and productivity could ease the burden, women being a key group affected by such changes (Energia, 2015). “The preparation of many staple root crops and grains takes upwards of an hour of vigorous pounding” (Clancy and Skutsch, 2002). Energy interventions like a milling machine could reduce the drudgery involved in such activities (Clancy and Skutsch, 2002).

“Labour saving domestic technology relating to food processing is likely to have a greater immediate impact in raising the productivity and reducing the time burdens of many women” (Blackden and Wodon, 2006). Blackden and Wodon (2006) writing on Sub-Saharan Africa highlight the considerable time and effort spent transforming and processing agricultural and food products “a time expenditure often greater than the time required to grow and harvest the crops in the first place”. In addition to reducing time burdens and drudgery, crop processing and storage can lead to better quality products and to higher cash returns, leading to reduced vulnerability and increased food security (Clancy and Skutsch, 2002).

The economic potential of women farmers is further undermined by lack of access to essential resources, in particular water and the energy needed for irrigation (MRFCJ, 2012). A field survey by an Indian NGO revealed rural women were using around 40% of energy resources for water pumping and irrigation. “Creating clean, affordable, sustainable sources of energy such as solar-powered drip irrigation systems can free up household income to invest in other productive activities” (MRFCJ, 2012).

The SELF Solar market garden project used solar powered drip irrigation systems to support women’s collectives in Benin to maintain their crops and vegetable gardens, using 40-80% less water than traditionally needed (MRCFJ, 2012). The women were able to feed their families three to four more servings of vegetables each day

during the project’s first year and women often use extra income to buy staples for their families (MRFCJ, 2012). In turn, expanding women’s access to resources and income earning activities may help expand their bargaining power within the household.

### Transportation

The “transport burden of rural women is more accentuated than men – it is best illustrated by the dominance of head-loading and the transport of firewood and water by rural women” (Uteng, 2011). “While travel burdens are often shared between men and women for agricultural travel, women are almost entirely responsible for all domestic travel, which is by far the most energy and time consuming category in rural areas, accounting for one third to over two thirds of all travel” (Uteng, 2011). The notion that “the most common means of transport in Africa are the legs, heads and backs of African women” still holds true today (Uteng, 2011).

If the work of transporting heavy loads can injure and wear out women, the time taken in transportation also restricts their ability to engage in other enterprises and take care of household tasks (UNDP, 2004). “Mechanised transport, even bicycles, would be a great boon to women, not just for fuel transport but also for carrying other goods, such as harvested crops from field to storage and market” (Clancy and Skutsch, 2002). Small business enterprises need transportation so they can obtain materials and access markets and communications equipment – “Without these energy-related services, they will not be able to pursue the kinds of economic activities that could revitalise their lives and transform poor, rural communities” (Lambrou and Piana, 2006).

Ultimately, we still need to consider women’s lack of bargaining power and role in decision-making before time and labour saving technologies can be introduced (if the household is

to purchase them themselves): a cook-stove has to be purchased before the need for women to collect firewood can be reduced. While women still benefit from TV and radio (which may be priorities for men), many of the labour saving devices that are of greater benefit for women are not considered a priority by men (Cabraal et al, 2005).

A smart village needs to not only have labour saving technologies available, but the women in those villages should have the ability to influence purchase decisions for the full benefits of energy to reach women. Although this is not something energy alone can achieve, entrepreneurship can be a positive starting point, working to increase women's bargaining power.

## 4.2 Entrepreneurship

“Stimulating female entrepreneurship is seen as having important ‘trickle down’ effects on wider poverty alleviation and gender inequality through the expansion of female employment and stimulation of the local economy” (Torri and Martinez, 2011). “Energy services must focus far more on the livelihood opportunities for poor women to enhance self-reliance, since this will invariably lead to an improvement in their social conditions” (Ramani, 2002). Women's ability “to save and access bigger income would give them an economic role not only within the household but, maybe, outside it as well” (Torri and Martinez, 2011). Furthermore, decreasing opportunities for men to earn a ‘family wage’ can mean many households are no longer able to meet their needs from male wages alone (Torri and Martinez, 2011).

“Modern energy services (e.g. from multifunctional platforms) can increase agricultural productivity and women's incomes. Electricity and fuels for lighting, refrigeration, entertainment, and a host of other purposes permit women to develop small enterprises and increase their income and social power” (Cabraal et al

2005). Encouraging productive use elements in energy access programmes can also feed back into energy access developing income-earning opportunities to generate revenues to pay for energy services (NORAD, 2011).

Electrification in general can have a positive impact on employment. One study in Nicaragua estimated “that rural women have a 23% higher probability of working outside the home as a consequence of electrification in Nicaragua” (Pachuri and Rao, 2013). In Bhutan an ADB study found that employment rates were “0.9 percentage points lower for men and 0.1 percentage points higher for women in electrified communities”. These results are particularly notable as over the same time period national employment rates fell (ADB, 2010). In Khandker et al's study (2012) in Bangladesh the gain in total income due to electrification was about 21 percent. Of course such studies are context specific, which makes generalisations difficult, but they are nonetheless suggestive of the potential of energy to enable women's employment outside the home (Pachuri and Rao, 2013).

There is some evidence to suggest that when a woman starts to earn an income outside the home, it gives her more bargaining power in the home. This is particularly likely if “the wages received are higher than men's labor, or higher than the value they place on the time spent doing domestic chores” (Pachuri and Rao, 2013). As Doss (2013) argues: “Earning money may give women direct bargaining power; if women control the money that they earn, then they may have the ability directly to influence outcomes that require expenditures. In a cooperative bargaining framework, even the potential to earn money increases women's outside options and this gives them more bargaining power”.

Increased income can also (as a result of bargaining power) raise social and political status as well as impact household dynamics (UNDP, 2004). Access to “financial services can empower

women to become more confident, more assertive, more likely to participate in family and community decisions, and better able to confront systemic gender inequalities” (Littlefield et al, 2003). Economic empowerment can enable women to realise self-worth and gain self-confidence (Ramani, 2002).

Energy provision can also, in some cases, alter the gendered division of labour (Panjwani, 2005). For example, “when women start earning an income and so become co-providers of the family, it is seen that men become more involved in domestic tasks, or start helping women out in their business” (Panjwani, 2005). In Bangladesh husbands were also noted to share household duties in some instances to enable women to take on work outside the home (Panjwani, 2005). A micro-hydro project in Nepal found that “men are more involved in household duties, such as carrying grain to the nearest mill, or by looking after the babies while women are being trained by the project as managers” (Panjwani, 2005).

However, it is important to bear in mind that men’s reactions may not always be favourable. For example in relation to violence in India it has been suggested that an escalation in violence against women in India, may be attributed to male resentment following changing gender roles (doubling of women in Delhi’s workforce, and visibility in public) and erosion of cultural and traditional norms (e.g. western attire) (IBT, 2012). Furthermore, in a micro-credit programme in Bangladesh it was found that while programmes can reduce vulnerability to men’s violence (through strengthening economic roles), when women challenge the gender norms in place it can actually provoke violence from their husbands (Schuler et al, 1998).

The following paragraphs examine two broad areas in which energy can aid women’s entrepreneurship and their ability to gain an income

and subsequently positively impact women’s lives as outlined above. The first is by increasing the productivity and ability of micro-enterprises to generate an income. The second is more directly through energy entrepreneurship itself.

### Micro-Enterprises

“In most developing countries, the majority of informal sector enterprises are owned and operated by women, with women making up the largest proportion of the work force” (Clancy and Skutsch, 2002). Such enterprises, although they are largely unreported in national economic statistics include “knitting, beer brewing, dress making, crocheting, palm oil processing, soap making, hairdressing, metal working, pottery making, basket weaving, cane work, spinning and textile production and retail trading” (Lambrou and Piana 2006). Low rates of return “prevent inward investment, hindering innovation and expansion which are regarded as key factors in enterprise sustainability” (Clancy and Skutsch, 2002).

Women’s micro-enterprises are an important factor not purely because of what they may offer household income but also in terms of women’s welfare and empowerment (Cecelski, 2000). These enterprises tend to be heat-intensive (food processing) or light intensive (labour-intensive home industries with work in the evenings) (Cecelski, 2000). Without adequate energy supply and other coordinated support for such activities, women’s ability to operate these micro-enterprises profitably and safely can be impacted (Cecelski, 2000).

Availability of mechanical and process heat technology can be a stimulus to the start-up of various small-scale enterprises (sawing, food processing etc.), and improved technology for charcoal production can boost sustainability and incomes (Clancy and Skutsch, 2002). Additionally the extension of work hours in the evening (possibly through solar lanterns) can improve

the efficiency of home based cottage industries (Lambrou and Piana, 2006). “When electricity is used to support small home-based enterprises, the extra income earned can make the service affordable for household as well as business uses, thereby improving the family’s quality of life and their prospects for escaping poverty” (Energia, 2006a).

Energy projects that deal with the household level should integrate and support these economic activities specific to women (Lambrou and Piana, 2006). Renewable energy options can support the creation of additional home based entrepreneurial activities in rural areas and provide a dynamic engine for rural economic development (Lambrou and Piana, 2006). Energy can also not only support enterprises but also provide entrepreneurship opportunities within energy provision itself.

### Energy Entrepreneurship

Energy provision can directly provide employment opportunities for women as energy entrepreneurs. “Energy access provides opportunities for women entrepreneurs to make an income and enhance their social status by creating and disseminating sustainable energy solutions” (UNIDO and UN Women, 2013).

Opportunities for local people in the production and distribution of energy technology and services can enable community members to earn income at the same time as helping to expand economic opportunities for the whole community through more reliable energy supplies (UNDP, 2004). It is estimated that the green technology economy will be worth \$4.2 trillion annually by 2020 (UN Women, 2014). In particular, off-grid systems specifically are highlighted by UNIDO as a positive catalyst for entrepreneurship: “stand-alone systems of wind and solar energy can provide communities with affordable energy, promote productivity and help in creating employment by empowering

enterprises for both the rural and urban poor” (UNIDO and UN Women, 2013). This resonates with the Smart Villages Initiative’s off-grid approach to energy provision.

It is important to consider women not just as recipients and beneficiaries of energy entrepreneurship opportunities but as positive actors for social change. The Commission on the Status of Women has urged governments to “promote the full and equal participation of women and men as agents and beneficiaries of people-centred sustainable development” (UNWomen, 2014). Women are potentially a valuable knowledge resource due to their role in energy provision and consumption (UNIDO and UNWomen, 2013). As women are often the primary energy managers in households and communities in low and middle-income countries, “involving women in the various steps of the energy value chain can expand both the scale and the quality of sustainable energy initiatives” (UNIDO and UNWomen, 2013).

Investing in women and gender sensitive financing does not just provide benefits for women themselves but potentially for investors as well. “Private investors risk missing out on an important market if female consumers are not specifically targeted” (NORAD, 2011). A survey in Botswana found that “the number of female-headed households in ten villages connected to the grid was only half the rate of male-headed households” (NORAD, 2011). Targeting such women, as a result of lower access to credit and lower literacy may require specific promotional strategies (NORAD, 2011).

Women are also “key buyers of solar lighting systems, representing up to half of this vast and growing market.” “Without considering women’s specific needs, obstacles and resources, the marketing strategy would fail” (NORAD, 2011). Private investors also gain from gender responsive financing of energy by “attracting... a broader competent workforce, an improved

base for developing sustainable solutions and a productive and engaged, safer and healthier, environment in which to work” (NORAD, 2011). In this sense it is as much about women helping energy provision and sustainable development as it is about energy helping women and men. Programmes can learn from local women to make their initiatives more successful.

For energy providers it is necessary to have local technicians and business people in place in rural areas (Clancy and Skutsch, 2002). Energy entrepreneurship therefore does not just help rural people but energy businesses who want to expand in the rural market, where distribution might otherwise be tricky. Energy entrepreneurship in this sense can feed back into companies and aid the companies’ sustainability, whilst improving energy access at the same time. There is a great need for “agents in rural areas who can distribute such equipment on a commercial basis, albeit with some support in the short term” (Clancy and Skutsch, 2002).

Women can draw on “their influencing capacity within households and communities” (MRFCCJ, 2012) and their natural circles of “family, friends and community for customers, which has been shown to be an effective way of distributing solar technology to rural households” (UNIDO and UN Women, 2013). This can help contribute to the success of energy initiatives. With initiatives that are “successful in the new energy space, women are often in the driver’s seat as entrepreneurs and providers of sustainable energy solutions at the community level” (UNIDO and UN Women, 2013). Stove programmes may be more successful because women can more easily approach their customers, and can be more effective in selling to other women due to fewer social constraints (Clancy and Skutsch, 2002). Furthermore, by engaging women in distribution and marketing we may be able to help “encourage the use of sustainable energy services by providing other women with comfortable spaces within which to learn

about technologies and discuss their particular concerns” (UNIDO and UN Women, 2013).

It is also not just in distribution and sales where women can make a difference. Energy access projects have more opportunity for success if women are directly involved throughout the decision-making process and project development (Lambrou and Piana, 2006). Deployment of stoves in India in the past has had mixed results, possibly in part because “the stoves have often failed in many aspects to meet the actual requirements and constraints that women face” (Clancy and Skutsch, 2002). Often, stove programmes are more successful when local women are involved in the design of the stove as well as the dissemination process (Clancy and Skutsch, 2002). We need to know what women themselves consider important before trying to persuade them that a particular clean cook-stove is in their interest (Clancy and Skutsch, 2002).

Greenway Grameen Infra, a cook-stove project based in India, holds focus groups with women and conducts field trials, seeking and responding to user feedback for stove design, balancing customer requirements with performance (Energia, 2014). For example, low maintenance and simple operation were noted as important concerns, so the ‘Smart Stove’ that was developed has no consumable parts (Energia, 2014). In other projects solar cookers have been objected to on the basis that “cooking at midday does not coincide with the time of eating the main family meal in many cultures” – many cooks also prefer to cook indoors (Clancy Skutsch, 2002). Outdoor cooking can also produce a loss of social capital as in many societies the cooking fire is the social hub of the family and women can socialise with their families while cooking (it has been suggested that solar cookers could lead to the breakdown of this web) (Clancy and Skutsch, 2002).

By involving women in the design of energy solutions, we can help to ensure they are tailored

not only to men's but to women's needs. This in turn can make initiatives more effective and result in higher uptake of energy solutions (UNIDO and UN Women, 2013). It has previously been shown that taking women's needs into account "as a key variable in energy interventions makes it more likely that energy will have a significant impact on household and community poverty on gender equality" (UNIDO and UN Women, 2013). Women can be key in the creation and dissemination of energy solutions, they can gain the "opportunity to take part in and drive sustainable development of their local communities, thereby enhancing their economic autonomy and social status" (UNIDO and UN Women, 2013).

Rural energy entrepreneurship is increasingly being focused on by NGO's. This includes initiatives by Barefoot College, SEWA in India, Grameen Shakti in Bangladesh and Solar Sister in Africa (Pachuri and Rao, 2013). Practical Action recently proposed a project in Kenya with Energia to establish 750 small-scale women entrepreneurs in solar lanterns, improved cook stoves and briquettes, with the aim to "strengthen women's capacity to effectively participate in, and benefit from, the energy markets as both actors and beneficiaries" (Energia, 2014).

In order to address barriers to entrepreneurship and women's access to energy for productive use, an effort needs to be made to break down gender stereotypes which are pervasive from a young age at home, in schools, and in social attitudes (UN Women, 2014). It is the social norms that view modern energy technology businesses as 'men's work' as well as barriers like lack of training and education that limit women's opportunities to engage in sustainable energy entrepreneurship (UNIDO and UN Women, 2013). "Many people view operating machinery as men's work, not appropriate for women": by making technical training

accessible to women we can counteract this perception (UNDP, 2004).

In many developing countries women are known as effective entrepreneurs, but may need support to overcome barriers to energy access (NORAD, 2011). An IFC study of World Enterprise Survey data in five African countries showed that women-owned businesses had greater difficulty in obtaining an electricity connection than men-owned businesses (NORAD, 2011).

In a study in Indonesia it was found that delivery of electricity services was defined as masculine (Madon and Oye-Gardiner, 2002). In Zimbabwe men have also reportedly in the past rejected the use of solar cookers by their wives "since technology and its development are seen traditionally as a male preserve" (Clancy and Skutsch, 2002). The value of including women in energy entrepreneurship, training and education would be to break down these stereotypes in the community in general as well as the benefits rendered to women's perceptions of themselves. UNIDO notes that "More women in formal energy institutions can act as role models and result in a positive change of attitude towards women in other social institutions such as households and communities" (UNIDO and UN Women, 2013).

Therefore by encouraging female entrepreneurship in the field of energy we can hope to counteract perceptions of energy being a male domain and women as unsuited for technical jobs. In Bangladesh as part of a rural electrification project through solar home systems, "women were trained to install and repair solar panels and electrical outlets, serving as 'rural electricians' in ways that are revolutionary by traditional labour market standards" (UN Women, 2014).

Perceptions of both men and women of women's work need to be changed, and women given real opportunity to take on roles not traditionally associated with their gender. As well as social

### Case Study – Solar Sister

Solar Sister’s goal is to provide clean energy access to 10 million Africans by empowering 5000 Solar Sister entrepreneurs in the coming ten years (Energia, 2014). Over the next three years they will be working with Energia, enabling them to scale up their network. Solar Sister provides a sustainable solution to the challenges of energy access/climate change faced by African women and their communities. It works with clean technology providers as well as grassroots women’s networks, strengthening clean energy value chains by actively engaging women.



norms, practical barriers to women’s entrepreneurship include access to finance and training

Women in general also have less access to means of generating and accessing income such as labour, loan guarantees, credit facilities, information and training (Standing, 2002). Barriers like this can limit possibilities for women to develop and use energy-based technologies (UNIDO and UN Women, 2013). When it comes to entrepreneurship (a central tenant of the Smart Villages vision) to improve “women’s access to the energy services they need, programmes will need to address their unequal access to the necessary ‘livelihood assets’, including credit, extension and training” (Lucas et al, 2003). Training and credit in turn can enable women to own energy solutions, and improve their skill set for other enterprise opportunities. It has also been found that “women have been shown to be more credit-worthy than men, repaying loans more reliably” (NORAD, 2011).

Financing of enterprises is therefore a parallel concern for any energy entrepreneurship

scheme. “Generally research in small and medium-scale enterprise sustainability indicates that a lack of working capital is one of the two most common causes of enterprise failure” (Clancy and Skutsch, 2002). Access to micro credit can also improve women’s autonomy in decision-making (Pachuri and Rao, 2013). Challenges for financing include shortage of capital available for funding small-scale decentralised energy systems, as well as the cultural and legal barriers women face applying for bank loans (Lambrou and Piana, 2006).

Financing of energy projects more broadly also needs to be gender responsive. “Gender responsive energy financing can contribute to basic human rights, economic efficiency and gains for private investors” (NORAD, 2011). As we have seen men and women have different needs and benefit from services differently, budgetary allocations may not necessarily reflect these differences (NORAD, 2011). Institutions that are gender-aware are more able to attract and make use of the competences of both men and women, through this they can enlarge their human resource base (NORAD, 2011). Public

institutions, NGO's and private sector organisations “that undertake participatory stakeholder consultations with empowered men and women in communities affected by energy developments are in a better position to ensure efficient and sustainable solutions” (NORAD, 2011). This in turn can improve access for women enabling them time for productive enterprises as well as the means to make them more efficient.

Gender equitable financing is needed to meet both women and men's needs (NORAD, 2011). “Investments need to be increased for improved cooking options and other needs that correspond to women's energy consumption and productive activities”, although discussions are needed on how this should be financed (NORAD, 2011). By taking a gender responsive approach to financing, women's energy access can be expanded where it matters to them and enable them to engage in the productive income-generating activities that can enhance their bargaining power.

However, increases in household income do not necessarily mean an increased capacity for women to decide its allocation between the different expenses: “Women generally only control income with male permission, which may be withdrawn” (Torri and Martinez, 2011). This extends to micro-credit access as well, with concerns over the extent to which women are fully able to utilise credit “and what degree of control they retain over the loans once disbursed” (Khamati-Njenga and Clancy, 2003).

Some women may control some of their income but this varies by culture and within cultures by social groups and even households within the same family (Torri and Martinez, 2011). The problem is both the opportunity to generate income and women's subsequent control of their resources once they are produced. In both cases we face tackling entrenched social norms of gender behaviour. Here integration

with training/skills building initiatives as well as finance is important so that women can be helped with skills and self-confidence to enable them to empower themselves within the household; improving their ability to negotiate, increasing their role in decision-making and ultimately influence/control of the use, and ownership, of resources.

Training and skills building “have been highlighted as an important prerequisite to women's participation in energy projects and as a means to improve women's status in their own right” (Pachuri and Rao, 2013). Access to training and information is important as “the fact that women have an income and can work outside the household provokes a change in mentality and changes the image and treatment of women” (Panjwani, 2005). Specifically it can improve the confidence of women themselves – this can have “a positive effect on women's position, status and role in society, ultimately resulting in women's empowerment” (Panjwani, 2005). UNIDO have cited enhancing women's leadership and participation in the energy sector and developing targeted training programmes for women as being essential in formulating plans for off-grid rural electrification (UNIDO and UN Women, 2013). In addition, by providing education and training on energy options and technologies, women's ability to contribute to solutions, and feed positively back into energy projects can be increased (UNDP, 2004).

Capacity building initiatives can involve new skills in defining community problems and formulating solutions, as well as technical skills such as bookkeeping, managing energy plants, marketing and learning about new technologies (UNDP, 2004). Capacity building “may mean promoting and facilitating the involvement of women's organisations in decision-making processes and expanding the development opportunities for their members” (UNDP, 2004). “Collective approaches through self-help groups or cooperatives have also been mentioned as

effective ways to organize women and empower them to own and manage businesses” (Pachuri and Rao, 2013). For men, capacity building also means “sensitization and assurance that women can meaningfully participate in programmes while respecting their traditionally accepted space and roles” (UNDP, 2004). There is a need for willingness on the part of men to participate in social empowerment process of women (UNDP, 2004). On the other hand, care should be taken not to restrict the field of entrepreneurship opportunity and skill development to women alone and so to produce an inequality of opportunity (Sovacool et al, 2013).

Focusing on women in projects “can result in a backlash of resentment by men against what they see as excessive emphasis on women in development programmes” (Wamukonya, 2002). In a credit-programme in Bangladesh for example, in some cases programme participation led to “an increase in domestic violence. However, over time men and families became more accepting of women’s participation, which eventually led to a decrease in violence” (Littlefield et al, 2003). It is still advisable that opportunities need to reach both men and women in villages. The need for income generation is not unique to women.

As encouraging entrepreneurship is a central element of the Smart Villages Initiative, the approach to this needs to be viewed through a gendered lens so that differences in resources and capabilities can be taken into account and women given appropriate access to opportunity. We need to enhance the motivation of women and enable them to engage in energy business (Pachuri and Rao, 2013). “Without measures to address gender inequality, such as capacity building initiatives, enterprise development may merely increase women’s workload responsibilities without increasing their control over income” (Torri and Martinez, 2011). Women’s negotiation skills and access to resources for energy enterprises need to be increased in order

to make a real difference to women’s empowerment. Training and access to finance as part of energy entrepreneurship can play a role in increasing women’s access to resources as well as their self-confidence and agency, which can in turn impact their bargaining power, allowing them to empower themselves and make real choices.

### 4.3 Health

Energy can also enable women to pursue productive activities by reducing the many health risks they face. “The health benefits of electricity stem from cleaner air, reduced risk of burns, fires, and accidents, better nutrition and food safety from refrigeration, and improved health knowledge from access to mass media” (Köhlin et al, 2011).

Lack of women’s empowerment and gender inequality have a direct impact on women’s health. Cabraal et al (2005) indicate “It is not an exaggeration to say that maternal death is the outcome of a chain of events and disadvantages throughout a woman’s life”. Girls are often subjected to “heavy work both within and outside the house at an early age and, when ill, are less likely to receive medical help” (Cabraal et al, 2005). For example, the time and physical burdens of fuel collection can lead to “serious long-term physical damage from strenuous work without sufficient recuperation time” (Muchiri, 2008). Women also have the worry of “falls, threats of assault, and snake bites during fuel gathering” (Muchiri, 2008). Energy, by aiding women’s empowerment through reducing drudgery and improving services, can also indirectly impact woman’s health issues (Cabraal et al, 2005)

One of the most commonly highlighted health benefits of energy provision is the potential impact on indoor air pollution. Globally “almost 3 billion people rely on solid fuels for cooking and heating; 78% of this population is rural, according to Sustainable Energy for All” (UN Women,

2014). Indoor air pollution (globally) “is responsible for over 4 million deaths, and household air pollution and ambient air pollution, jointly, are now the leading global environmental health risk” (UN Women, 2014). Smoky cooking environments formed by traditional biomass predispose women and girls in particular (due to their disproportionate exposure to harmful smoke emitted from biomass stoves) to the burdens from diseases from black carbon and inhaled particulate matter, acute respiratory infections (ARI), tuberculosis (TB), low birth weights, lung inflammation and cardiac events (Muchiri, 2008; UN Women, 2014). Cooking with biomass also, according to a meta-analysis of 25 studies, increases the risk of pneumonia by 80% (Köhlin et al 2011).

Electricity also enhances the safety and working of health clinics. A World Health Organization survey of available data in 11 Sub-Saharan countries indicated that about a quarter of clinics had no electricity, and less than one-third had what could be called ‘reliable’ electricity (UNIDO and UN Women, 2013). Health workers in electrified clinics “even with very small PV systems” have reported results such as fewer infections, fewer delays in providing life-saving care, more timely blood-transfusions, and more successful child deliveries (UNIDO and UN Women, 2013). “Access to electricity improves health-care infrastructure in general because clinics can function after sunset, vaccines can be kept cold and childbirth need not take place in the dark. The maternal mortality ratio in particular is strongly correlated with access to electricity” (UN Women, 2014).

Deliveries in the absence of light are known to be a significant cause of infections and death: women aged 15-34 die in disproportionately high numbers on account of maternal mortality (UN Women, 2014). In Bangladesh a higher proportion of child deliveries in electrified households were assisted by medically trained persons (36%) compared to that in the non-electrified

villages 23.1% (Barkat et al, 2002). Higher proportions of electrified households were also reported in antenatal care, pregnancy check-ups by medically trained personnel, receipt of tetanus injections during pregnancy and post-natal check-ups after delivery (Barkat et al, 2002).

Electricity can also impact the burdens of care and quality of life for HIV/AIDS sufferers. “Given the importance of rest, hygiene, and practices such as eating cooked foods and boiling water, adequate energy availability is likely to be important in improving the quality of life for persons living with HIV/AIDS”, it may also be helpful in reducing the burden of care for person’s living with HIV/AIDS (often women and girls), and enabling self-care for women living with the condition (Energia and DFID, 2006; Lambrou and Piana, 2006).

There is a further indirect benefit for health that electricity provides due to improved communication technologies and access to information. Energy can help demographic transition to longer lives and informed decisions on family size, providing information about choices on health, reproductive rights and opportunities for women through communications methods that use modern energy carriers (Lambrou and Piana, 2006). Evidence from a range of studies suggests electrification reduces fertility rates in rural areas, with positive impacts for women (Köhlin et al 2011).

For 22.5% of family planning users in electrified households in Bangladesh, TV was mentioned as the most influential factor prompting family planning use (Barkat et al, 2002). An IEG rural electrification impact evaluation has also argued that a “multivariate analysis of the determinants of women’s knowledge of health and family planning provides very strong evidence that access to television significantly increases this knowledge” (IEG, 2008). One survey in Bhutan suggested that electrified households have 0.05 fewer children within 5 years and 0.04 fewer



The impact of energy access can be as simple as providing light for activities such as studying after dark. (TRF/Leopold Obi)

children within 3 years of the survey, and the probability of having a child decreases 5% within 5 years of the survey and 4% within 3 years (ADB, 2010). Similar results are reflected in Bangladesh, Nicaragua and Peru (ADB, 2010). The positive impacts of information access for women are also seen in education and gender awareness.

#### 4.4 Education

Education can affect outcomes directly and indirectly, impacting women's outside options and thus their bargaining power. "Both the level of a woman's education and her level of education relative to her husband's may be associated with her bargaining power" (Doss, 2013). Women account for two-thirds of the world's 774 million illiterate adults – this has remained unchanged over the past two decades (Rojas et al, 2012). Electricity enables access to educational information and information communication (Panjwani, 2005). The quality of schools can also be improved (Köhlin et al, 2011). Access to light can mean increased time for studying and ability to participate in adult evening classes, for example.

There have been mixed results in terms of energy provision's impact on women's literacy

and numeracy skills (Panjwani, 2005). However, there are some promising results. In Bangladesh, there was less gender disparity in adult literacy rates in electrified households and parents, in particular mothers and female family members, devote more time in assisting children's education compared to before electricity (Barkat et al 2002). Another study in Bangladesh on rural electrification found that "the overall literacy rates in electrified households is significantly higher (by 22%) and with much less gender inequity (female literacy rates being 31% higher in electrified than in non-electrified villages), than households in non-electrified villages" (Panjwani, 2005). The rises can be attributed to the availability of electricity as it had contributed to raising awareness about the value of education (Panjwani, 2005). Women in electrified households in Bhutan were also found to tend to be "better informed and more aware about education and health in general than their male counterparts, partly from increased social networking" (ADB, 2010).

To aid fuel collection, girls in particular may be taken out of school to help their mothers, "missing out on education perpetuates the cycle of female illiteracy and poverty" (Lambrou and Piana, 2006). The time saved from burdens such as firewood collection through clean cook-stoves

### Case Study: Sakhi Unique Rural Enterprise

Sakhi Unique Rural Enterprise (SURE) is a training and development organisation working across 13 districts in four states in India (Energia, 2014). It promotes the use of clean energy products and solutions through building the entrepreneurial capacity of a women's network that delivers and services such solutions for those people who are part of the poorest socioeconomic group. Rural women entrepreneurs are encouraged to undertake micro-businesses, and are provided with training, technical support and access to technology, finance and markets. Women are able to have more effective interactions with potential customers due to their place in the community as "one of their own". The initiative itself was born out of a previous project involving training and development in building and construction through women self-help groups..

SURE's mission is to enable social change and economic empowerment by developing and strengthening competencies of grassroots women as leaders and

entrepreneurs. The initiative tries to improve access to clean energy solutions such as smokeless cookstoves, biomass pellets, biogas, solar lamps and other socially relevant solutions which are provided at affordable prices through an effective network.

The organisation notes the challenge of working with women due to gender stereotypes and social constraints restricting social/economic mobility. However SURE claims women are able to overcome these barriers with the right support and emerge as successful entrepreneurs and community leaders. The entrepreneurs play a key role, not only in distribution, but also in improving the system, discussing community needs and giving feedback on product designs, quality and pricing. Entrepreneurs have received much appreciation within the family, and gained respect and a higher status in the community for their contribution to village life.

*Source: Energia news, 2014*

and electricity means girls as well as women can be released from some of their domestic burdens, enabling girls to attend primary school (UNIDO and UN Women, 2013).

A 2010 Asian Development Bank study in Bhutan found that "Children in electrified households completed more years of schooling compared to those in un-electrified households, with a more pronounced impact on girls than on boys. This is due to time saving on fuelwood collection and access to electricity" (ADB, 2010). Following a multifunctional platform project in Mali which enabled women to save time on tasks like milling cereals and also generate greater revenue from

the sale of agricultural goods, it was found that the "total proportion of girls completing primary school increased as did the girl-to-boy ratio in primary schools" (Cabraal et al, 2005).

Not only can electricity be a catalyst for improved standard schooling, but also energy entrepreneurship can have a role in young girls' social education and the norms they grow up with. Women acting as energy entrepreneurs and income generators can serve as role models for young girls and indeed, educators, passing on their skills and training so as to facilitate the next generation of entrepreneurs and more empowered women.

## 4.5 Gender Mobility

Constrained daily mobility, i.e. the element of physical access to different facilities bears upon the issue of women's empowerment. The daily mobility of women in developing countries is guided by a set of complex hierarchies. Uteng (2011) argues that the following elements are highly influential in the gendering of mobility: "prevalent social/cultural norms, transport infrastructure, physical/area planning, effects of globalization, governance (women's presence and participation in informal sector and micro-credit schemes), pre and post disaster/conflict rehabilitation process and access to information and communication technologies (ICTs)".

Safety issues hit women more intensely than men: safety concerns include poor physical infrastructure such as the absence of street lighting, concern of sexual harassment on public transport services or walking down poorly lit streets (Uteng, 2011). In the case of Bangladeshi garment workers, movement-related fear is pervasive and one of the biggest quoted concerns (Uteng, 2011). In rural areas, such as in a 2005-5006 study in rural South Africa found that safety was the biggest concern for almost the entirety of the group – 94% of respondents (Uteng, 2011). Public lighting improves women's safety and encourages evening community and commercial activities (Cabral et al 2005). Lighting could potentially increase women's political power, allowing them greater participation in communal activities and ability to attend evening classes (although this does not necessarily apply across the board) (Pachuri and Rao, 2013).

Electricity can therefore have a profound impact on women's mobility and participation in society (Barkat et al, 2002). A study in rural India showed women from homes with electricity had more time for leisure activities than women without (Cabral et al, 2005). Electricity may enable women to attend village meetings etc.

but in some cases women may still need permission from males to visit friends/attend markets (ADB, 2010). "Involvement in cultural activities can go a long way to liberate women from their traditional roles": women gathering together and participating in groups can give them the opportunity to express concerns and aspirations for change and see what is happening outside the house (Torri and Martinez, 2011). When women talk to other women about personal experiences "they validate it and construct a new reality" and when women "describe their own experiences, they discover their role as agents in their own world and also start establishing connections between their realities" (Torri and Martinez, 2011).

## 4.6 Gender Awareness and Women's Empowerment (through TV)

Communication and access to information's role in women's empowerment does not stop at schooling. It can heighten gender awareness through media such as television.

Social benefits of electricity can be enhanced in situations where mass media presents an image of empowered women and gender equality (Köhlin et al 2011). Technology improves access to information and the ability of women to communicate outside their households and communities. This is particularly relevant for women as they may be restricted in their ability to leave the home or participate in public affairs and may rely more heavily than men on radios (or televisions, if available) for news, information, and entertainment (UNDP, 2004). Women in electrified households watch more TV and listen to the radio, improving access to information, increasing knowledge and in some studies it resulted in the empowerment of women (Panjwani, 2005).

One study in Bangladesh showed that "women in households with electricity were much more aware about gender equality issues than women in households without electricity. Furthermore,

these women cited the television as their chief source of information for gender-equality related knowledge” (Cabraal et al, 2005). In addition, Chong and La Ferrara (2009) found that in Brazil the share of women who were separated or divorced increased significantly after access to television networks that carry telenovelas. It was found that “exposure to modern lifestyles as portrayed on TV, to emancipated women roles, and to a critique of traditional values was associated with increases in the share of separated and divorced women across Brazil’s municipal areas” (Chong and La Ferrara, 2009).

Energy through television can then play an important role in gender equality knowledge. Rather than being only for leisure, it can contribute productively towards gender equality (Cabraal et al, 2005). Access to information through media such as the TV or internet is especially important as it is the women themselves changing norms and making choices, as a result of greater access and ability to make informed choices, rather than an initiative attempting to impose a concept of empowerment and certain ways of doing things.

It is worth noting that TV can be an expensive way to provide basic information, so new ways of providing access to energy information need to be devised (UNDP, 2004). For both skills training and broader communication and awareness we can enable the use of online learning platforms and smart phones as another access point. Over time, internet and computers could bring large amounts of technical information into rural areas. Markets can also be useful contact points with women for disseminating information about and demonstrating new technologies (UNDP, 2004).

The last impact area, examined in the next sub-section, is safety and violence against women. This is an issue closely related to the gender awareness issues just outlined. For example, a study in rural India found that access

to cable television resulted in lower acceptance of spousal abuse (Pachuri and Rao, 2013). Influencing social norms through access to information is just one of the ways energy can impact violence against women.

#### 4.7 Safety and Violence against Women

In terms of physical/sexual intimate partner violence alone, the share of women who have experienced it in Sub-Saharan Africa is 40%, with 43% in South Asia and 40% in the Middle East and North Africa being victims (Solotaroff and Prabha-Panda, 2014). Violence against women can also occur during daylight hours in situations where resources are scarce and women are obligated to collect fuel from remote and isolated areas (UNIDO and UN Women, 2013).

Security and safety is often highlighted as a key benefit of electrification. In Sri Lanka more women than men appreciated the increased security and health benefits that come with village electrification (Massé and Samaranayake 2002). Firewood collection is a possible area of impact for improved energy services and by extension an area of impact for violence against women. Furthermore, where firewood is scarce and collection is restricted women are also more vulnerable to sexual harassment (Panjwani, 2005). Therefore, by reducing the need to collect firewood we may restrict their area of vulnerability. However, it should be borne in mind that reducing the need to collect firewood does not mean perpetrators will not find other opportunities to commit their atrocities.

Street lighting can also help to restrict the area of women’s vulnerability from sexual violence and assault. With World Bank rural electrification projects in Indonesia “women tended to appreciate increased security in the street at night thanks to lighting, and freedom from fear of fire from kerosene lamps” (Lambrou and Piana, 2006). Street lighting, by increasing safety, can also facilitate women “to attend night



Maasai women trained as solar installers carry their wares on donkeys in Kajiado County, Kenya. (TRF/Leopold Obi)

schools and participate in community activities. Women are less likely than men to have access to information and be included in political and community life”; increasing safety can be key to enabling women’s participation in communities (Panjwani, 2005).

Research has indicated that “education is one of the most effective ways of combating gender based violence [and] understanding discriminatory attitudes and prejudices which condone violence against women and girls is essential if this behaviour is to change” (Soroptimist, 2012). Energy provision can facilitate communication and information sharing on gender issues, heightening gender awareness through TV etc. In India, Jensen and Oster (2009) found that “the introduction of cable television is associated with significant decreases in the reported acceptability of domestic violence toward women and son preference, as well as increases in women’s autonomy and decreases in fertility”.

In addition, providing internet access and greater connectivity with the wider world can also help diminish some of the problems women face in dealing with the aftermath of sexual violence. Information can help alleviate feelings of isolation and helplessness, increase access to support networks (e.g. legal aid or women’s

groups), improve healthcare services to victims and facilitate the participation of rural women in dialogues around these issues.

Women’s bargaining power can affect their well-being directly, including by reducing the violence that they face (Doss, 2013). Therefore areas such as entrepreneurship (through resource control or increasing agency) and capacity building, which we have seen can increase women’s bargaining power and their ability to negotiate, could make a positive difference to women’s risk of violence. For example, resource control can act as a form of protection for instance, against child marriage for girls and intimate partner and domestic violence for women, as can the ability to negotiate. Empowering women through energy entrepreneurship schemes can help not only to bring women out of poverty but also increase their resource ownership and ability to negotiate and strategise in the household and the community increasing their bargaining power within the household, and therefore potentially reducing the violence they face (Solotaroff and Prabha Panda, 2014).

## 5. REFLECTIONS FOR SMART VILLAGES

As we have seen throughout this report, “energy by allowing progress to be made in terms of health, education and poverty” as well as in time and labour saving, women’s safety and gender awareness, can give “women more chance of having the opportunities traditionally reserved for men. In this way, it allows the living conditions of women to be improved” (Panjwani, 2005). In addition to this smart villages, by enabling entrepreneurship, add another realm of opportunity for women, and can potentially increase their bargaining power in the household so that they can empower themselves and make real choices.

These positive impacts for women also have an extended positive impact on society in general. “Expansion of women’s capabilities in terms of education, income, access to resources and participation in community and group activities has an impact not only on women’s own freedom and well-being but also on the well-being of the society” (Vepa, 2007). By enabling and improving the lives of women through energy provision we are not just benefitting women themselves but the wider community.

While “basic electricity services remain essential for sustainable development, no technology, regardless of its cost, climate resilience, or mode of dissemination can ensure that the electricity generated and used will in fact improve gender equality” (UN Women, 2014). Gender analysis needs to be incorporated into planning and implementation of smart villages in the future to ensure that the benefits of electricity reach the whole community, and the impact of such changes is maximised.

Before projects that make a real impact on women’s lives can be realised, energy provision equipment and technology also

needs to be considered through a gendered lens. The energy sector needs to change in terms of supply, with “responsiveness [...] in the provision of equipment using modern energy forms that reduce the drudgery of women’s labour, and at affordable prices. The challenge to the energy profession is evident” (Clancy and Skutsch, 2002). Not only this, but energy suppliers need to formulate their technology to meet the needs of women in different cultural contexts in order for it to be truly effective. This may sound like a tall order but some organisations such as, Greenway Grameen infra mentioned earlier are doing just this (Energiya, 2014). Smart villages, by harnessing the power and value of young entrepreneurs and drawing focus and sponsorship to projects like these, can help contribute to modern energy solutions meeting both women’s and men’s needs and lifting the burdens of poverty.

Lambrou and Piana (2006) note that, “energy initiatives should be part of a framework where technology and social programmes have the same objective: promoting people’s welfare”. This is something the Smart Villages Initiative’s integrated and holistic approach can take into account, expanding the focus from technology dissemination. The key is being needs focused rather than technology focused. Lambrou and Piana (2006) have also highlighted the need for decentralised schemes for energy that can provide possibilities for greater local decision-making and greater likelihood of participation by women in rural areas. The bottom-up, decentralised approach inherent in the Smart Villages Initiative enables gender concerns to be incorporated into all levels of project planning as well as providing opportunities for women and men as energy entrepreneurs.

Whilst energy provision alone may not necessarily lead to more equality in gender roles, “it can at least relieve some of the most burdensome and unhealthy aspects of their daily lives and expand the development options available to women, their families and their communities” (Energia, 2015). Additionally, the Smart Villages Initiative by taking a more integrated approach, and by drawing attention to the role of entrepreneurship can hope to make a real impact on gender equity in the longer term as part of a broader collaborative development programme not only restricted to the field of energy. For example, in terms of entrepreneurship, while women’s economic empowerment may not eliminate social or political discrimination, it can build up women’s self-reliance, expertise and confidence through managing business enterprises. Such skills can help them gain greater control of their lives in other ways as well, this in turn allowing them to empower themselves within their community (Energia, 2006a).

At a higher project planning level we need to consider a gender sensitive approach to energy financing, for example, placing more investment into cooking energy needs (NORAD, 2011). “Much more can be done to understand gender as it relates to the financing of energy access, particularly at the decentralised level.” (IIED, 2014). As we have seen, the “different roles, responsibilities and voices of women and men (girls and boys) within households, markets and communities drives differences in their access and use of energy, and the impact of energy services on their lives” (IIED, 2014). Gender-sensitive energy financing can help expand women’s access to energy for work and in turn act as an additional route to gender equality.

Ultimately we are left with the need for choice, it is the women and men in those communities

who best understand their needs. Smart villages as a concept need to be adaptive so that it can fit into specific socio-cultural contexts and not impose constraints on what the village should look like. Conceiving of a smart village can be a participatory process integrating not only international experts but also the community themselves. Women and men “have to be responsible for designing and building institutions which appear appropriate and useful to them” (Wong 2009). “The challenge is to develop sustainable multi-dimensional energy strategies that integrate gender variables, with women treated alongside men as strategic partners rather than passive beneficiaries” (Lambrou and Piana, 2006). It is through increasing women’s choices that they can empower themselves within their households and communities.

The Smart Villages Initiative has a key role to play in advocating gender concerns in energy projects not only with policy makers and project organisers but with technology developers, academics and young entrepreneurs – starting at the root of energy development initiatives. We look forward to collaborating and interacting in this regard with organisations like ENERGIA who have much experience in incorporating gender-sensitive energy perspective to project planning cycles and we urge others to do likewise.

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