WORLD DEVELOPMENT REPORT 2012

GENDER EQUALITY AND DEVELOPMENT

BACKGROUND PAPER

SOCIAL INFLUENCES ON GENDER EQUITY IN ACCESS TO AND BENEFITS FROM ENERGY

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1 INTRODUCTION – BACKGROUND TO STUDY, SCOPE

This background paper has been commissioned as a contribution to the preparation of the World Development Report 2012 which will focus on development and gender equality. It is a companion paper to two other papers which examine gender issues in relation to common property resources and economic dimensions of gender and energy. Gender, as a concept, refers to the socially determined ideas and practices of what it is to be female or male. It contrasts with the concept of sex which uses biological attributes to categorise someone as male or female (Reeves and Baden, 2000). This paper focuses on the socio-cultural dimensions that influence and shape gender equity in terms of access to and benefits from access to modern energy[1] and improved energy technologies[2]. Gender equity recognises that women and men have different needs and interests, and that to achieve equality in life outcomes, a redistribution of power and resources is required (Reeves and Baden, 2000).

At the macro-level it has long been accepted that there is a strong relationship between energy and economic growth (IDS, 2003). In the 1990s, the development discourse began to focus on the effects that economic growth has had on poverty. However, an interest in the links between energy and poverty took more time to emerge.[3] The focus on a broader interpretation of poverty as more than a lack of income has, for those involved with energy and poverty, led to attempts to demonstrate associations between energy and human development indicators such as those used in the UN's Human Development Index (HDI). A strong correlation has been shown between per capita commercial energy consumption and indicators used in the UN's HDI, such as life expectancy, literacy and school enrolment (White, 2002). Such aggregated figures need to be interpreted with caution. Whether these improvements in human development are caused by improved access to commercial energy[4] alone has not been demonstrated[5]. The correlation cannot be taken to mean that increasing energy consumption necessarily causes increases in wellbeing[6], although, as will be shown below, a lack of access to modern energy is a factor in people not achieving their desired level of wellbeing. There could be re-enforcing effects in its operation that explain the correlation between commercial energy consumption and the HDI. As people's income increases they may choose to buy (more) energy, while the use of more energy can contribute to increased income, which translates into the purchase of more and better quality goods and services leading to improved wellbeing. The focus on commercial energy neglects the benefits that more efficient technologies, such as improved cook stoves using non-commercial biomass, can bring to wellbeing. While it can be assumed that access to increased quantities of modern energy can have significant impacts on human activities and wellbeing, it cannot be assumed that energy alone is a sufficient condition for transformations in people's wellbeing[7].

[1] Modern energy is defined in this paper as energy carriers, such as LPG, electricity and natural gas, which are clean both in terms of handling and use. Modern energy can also include some types of biomass, such as biogas.
[2] Improved energy technologies are defined in the context of this paper to mean technologies which have an improved energy conversion efficiency which should be accompanied by reduced pollution levels. The emphasis here is on cook stoves and lighting since these are the most wide spread technologies used in households, small enterprises and community services (such as schools and clinics). For stoves this paper has reviewed not only improved biomass stoves but also stoves using new energy sources such as solar energy.
[3] For example, the World Development Report 2000 took poverty as its theme, but made no mention of energy.
[4] Commercial energy is generally interpreted to mean energy carriers, the form in which energy is delivered to the end-user, that are bought such as LPG, kerosene and electricity. However, in some circumstances, e.g. harvest time, and in some locations, including urban areas, biomass fuels can also be bought.
[5] Kooijman points out that such data have come to be used as proof that energy leads to (rather than follows from, or is part of) improvements in the factors measured in the HDI. Citing Shiu and Lam (2004) whose analysis of 21 separate studies show correlations in the Asian region that can lead to all possible conclusions: in some cases causal relationships were found to be bidirectional; in others, relationships were non-existent; while some found causal relationships from increased modern energy or electricity consumption use with Gross Domestic Product (GDP); and others found the reverse (Kooijman, 2009: p18).
[6] There is no universally agreed definition of wellbeing. Here we assume a broad definition in which a range of conditions, such as freedom from violence, and assets, such as education, contribute to good health and quality of life.
[7] Indeed, the need for complementary inputs in energy service delivery is recognised by the World Bank. The bundling of services such as water, sanitation and education with electricity has been shown to have disproportionate positive welfare benefits for the target group than if these services were delivered as separate projects (Perskin and others, 2000, cited in IDS, 2003).

At the micro-level, there has been a growing recognition of the role that energy can play in combating poverty through: (i) improved health; (ii) increased productivity and new opportunities for additional income; (iii) reduced labour and time spent on household activities (see for example World Bank, 1996; World Bank, 2000; UNDP, 2006). These categories are linked; for example, the reduced time spent on backbreaking physical labour allows the body time to recuperate. In the first category, the use of biomass for cooking contributes significantly to indoor air pollution, and the shortage of biomass can lead to a reduction in boiled water which has implications for the spread of water-borne diseases as well as general hygiene. Here, energy interventions could include the promotion of cleaner combustion through access to modern energy such as electricity or LPG, and improved cook stoves. In rural areas, increases in household income could be reached through improved agricultural production through mechanisation using diesel engines and electricity. Mechanisation can also bring additional benefits: it can reduce drudgery which has positive health benefits and it can save time which can be used for income generation or rest and recuperation. Despite these assertions, it is difficult empirically to attribute measureable poverty impacts solely to energy interventions since there are many other contributing factors operating simultaneously (IDS, 2003).

In the context of this paper, there appear to be two important assumptions underlying these assertions about energy and poverty: firstly, that the rural poor form a homogeneous group; and secondly, that they will benefit equally from energy interventions. However, work on poverty has increasingly recognised that the poor are not homogeneous, not only in terms of the extent of their poverty but also their reasons for being poor. The processes through which people become poor have a distinct gender dimension (Naryan, 1999). For men, unemployment and illness (which can be linked) are common reasons; and for women, divorce, widowhood, and desertion are cited reasons. The routes out of poverty for women and men are different due to their different assets. Women tend to be more disadvantaged than men in similar circumstances; for example, women's access and control over assets such as land, cash and credit is more limited than men's. Women's technical skills are often less than men's; for example, compared to men, women's reading levels are lower and they have less experience with hardware. Women in general are 'time poor' (see below). This means that energy interventions aimed to help the poor are likely to benefit men differently from women, in part due to their different capacities to respond, and partly because they have different needs linked to the gender division of labour (see section 2.2 for a more detailed discussion of gender). The process and equitable outcomes are made more complex because women have in general less influence over decisions and exercise less control over their own lives and resources –both at the household and community levels– than men (Moser, 1993);this includes the acquisition of energy technologies. These differences between women and men pose challenges for ensuring equity in access to and benefit from energy.

This paper examines the evidence as to whether or not access to modern energy and energy efficient technologies is meeting the challenges, referred to above, related to tackling poverty in a gender equitable way. In doing so it seeks to answer the following six questions: 1) What changes are taking place in terms of women's role within the household compared to that of men? 2) How are economic opportunities for women and men influenced by access to modern energy? 3) Are gender relations affected by access to modern energy? 4) How does access to modern energy influence household members' allocation of time? 5) How do the energy services[8] of lighting, information and cooking provided through modern energy influence gender roles and relations? 6) What are the factors that influence access to modern energy?

The focus is primarily on rural areas in the group of countries collectively known as 'the South'. This is due to the literature being mainly focused on rural areas in these parts of the world. The small body of work on gender and energy shows that household energy issues primarily fall

[8] Energy services can be defined as the desired and useful products, processes or services that result from the use of energy; for example, illumination, comfortable indoor climate, refrigerated storage, transportation, cooking (Annecke, 1999). End-users are more likely to express the requirement for an energy service than a particular energy form such as LPG.

under the responsibility of women. Urban women face similar inequalities to their rural sisters: low capabilities, low rewards in the labour market, exclusion through social stigma and discrimination, a lack of productive assets and resources relative to men (Amis, 2002). In addition, studies from the countries which emerged after the demise of the USSR indicate that there are some similarities there as well in relation to gender and household energy.

The paper is organised as follows. Section 2 explains the methodology, including the conceptual and analytical frameworks, used in writing the paper. Section 3 looks at the transformations taking place in women's and men's lives as a result of modern energy and its associated technology (questions 1 to 4). This is followed by an analysis in section 4 of three drivers of transformation: electric light, TV and radio, and improved cook stoves (question 5). Section 5 looks at how and to what extent informal and formal institutions promote the uptake of modern energy technologies and their fuels (question 6). Section 6 summarises the answers to the questions posed above, identifies gaps in the literature, and gives some pointers on how energy interventions can be aided by ethnographic and social science research.

2 METHODOLOGY

2.1 Approach and scope

This paper is based on a desk study of the existing literature on gender and energy primarily from the last twenty years[9], as well as two detailed case studies using ethnographic approaches. There are distinct gaps in the literature. For example, there appear to be no empirical studies on the impacts of modern energy, or lack of it, on HIV/AIDS infected populations; and none specifically on the connections between gender, energy and major diseases such as malaria.[10] This is despite these illnesses being highlighted in Millennium Development Goal (MDG) 6.[11]

Energy as an enabling factor in social transformations at the micro-level has not played a major role in the development discourse. It is only since the Beijing Conference that gender and energy has emerged as a discourse in development. Energy, unlike other infrastructure-related sectors such as water, transport and ICT, has also not been a central topic within the social sciences, including anthropology. There is therefore no extensive empirical literature available with a social science perspective on gender and energy. Unfortunately much of the evaluation literature related to energy projects, including the stoves literature, does not take a gendered perspective, often referring instead to actors as 'people' or 'consumers'.[12] There is also another part of the literature which uses 'women' and 'gender' interchangeably. These are distinctly different concepts. While the second includes the first, the first does not necessarily include the second. (See section 2.2 for a discussion on the concept of gender.)

To neglect the distinction between 'gender' and 'women' can lead to incorrect interpretation of data. Women and men often use, are affected by, or benefit from energy services differently; but more importantly, because the activities of one may affect the opportunities of the other, the experiences of women and men should not be considered in isolation. The same energy service may indeed affect men and women differently, with different social or economic outcomes. For example, electricity at home in the evening hours may improve the quality of life for some members of the family, including illumination for reading, and entertainment, education and enlightenment from radios and televisions; while for other members of the family it may simply extend the working day. If equity is a goal of an intervention, then it is important to ask who is experiencing what impact and why, and then to identify negative outcomes for which

[9] This period was chosen to allow for the opportunity to make the impacts of gender mainstreaming in the energy sector visible.
[10] Further gaps are identified in Section 6.
[11] The Millennium Development Goals form a global action plan for the United Nations and other members of the development community to achieve the eight anti-poverty goals by the year 2015. MDG 6 aims to combat HIV/AIDS, malaria and other diseases (see http://www.un.org/millenniumgoals).
[12] The benchmark paper by Barnes (1994) on stoves is a good example.

timely adjustments can be made. The importance of gender is now recognised by international development agencies who consider the promotion of gender equality and the empowerment of women as an integral and necessary dimension of efforts to reduce poverty and enhance economic growth.[13]

In this paper, we draw on empirically based research that focuses on *gender* (rather than women) and energy in the academic literature, reports from research institutes and international development agencies, as well as the body of sociological literature on the historical shaping of electricity systems in the North. Emphasis is placed on the use of findings based on research carried out using recognised scientific methods by independent observers. The data sets are mainly qualitative. Two specially commissioned case studies based on PhD ethnographic research (one in South Africa and one in Zanzibar, the United Republic of Tanzania) related to gender and energy have been used to support the findings and to shape the recommendations. Ethnographic approaches require the researchers to embed themselves into a community for extended periods of time, allowing for more detailed interaction with community members, for observations and opportunities to explore and explain. Such approaches offer different insights from standard questionnaire surveys, as will be seen from the findings presented in the case studies and in the main text. In section 6 we discuss the value of such approaches, and the challenges in generating and using such data, for energy policy formulation.

Despite the work of many multi- and bilateral development agencies in relation to gender, there is a lack of gender disaggregated statistics related to energy at all levels. For example, there is an extensive literature on indoor air pollution (IAP)[14] exposures linked with child and adult morbidity and mortality; however, these figures do not disaggregate the effects on girls and boys, while most impacts on adults are assumed to be on women in their role as cooks (ENERGIA News 4.4, 2001). The lack of gender disaggregation in statistical studies limits the usefulness of these correlations in determining differential impacts on women and men, or girls and boys; and particularly in assessing their relationship with gender equity and empowerment. The failure to disaggregate data also hides other differences for example between rich and poor, urban and rural, and between generations.

The analysis focuses primarily on the modern energy sources of electricity and LPG as providing high quality and clean combustion, and offering the potential of health improvements and time savings over biomass fuels traditionally used in most poor households. However, electricity and LPG are commercial fuels that are not always readily available in rural areas, which can act as a barrier to access for poor households. For this reason, improved biomass stoves, potentially a low-cost option, are also included in the analysis since they too can offer time savings in biomass collection and health improvements from reduced indoor air pollution.

2.2 Conceptual framework

Gender is a concept which refers to a system of socially defined roles, privileges, attributes and relationships between men and women, which are learned and not biologically determined. Gender roles shape identity, determining how women and men are expected to think and act as women and men – and how they are perceived by others. Gender roles are often determined and prescribed by strongly held cultural and religious traditions. Gender roles are not universal; they vary in degree from society to society, which reinforces the point that gender roles are not determined by nature but by the social environment in which a person is raised. Gender cuts across social identity, intersecting with a variety of other identities, including class, race and

[13] See for example: Gender-Responsive Social Analysis: A Guidance Note. Incorporating Social Dimensions into Bank-Supported Projects, Social Development Department, The World Bank, June 2005 (page 28).

[14] Indoor air pollution (IAP) is the smoke emitted when burning solid fuels, such as coal and biomass, which is considered to contain many health-damaging pollutants, including particulate matter (PM), carbon monoxide (CO), sulphur oxides, nitrogen oxides, aldehydes, benzene, and polyaromatic compounds (Smith, 1987 cited in Bruce *et al*., 2003). IAP is associated with a number of respiratory illnesses including chronic obstructive pulmonary disease (COPD), cancer, tuberculosis, as well as influencing perinatal outcomes including low birth weight, and eye diseases (http://www.hedon.info/health: accessed 5 March, 2011).

ethnicity, age, religion and family structures, among others. For example, in low-income households, it is usually the wife who does the cooking, while in wealthy households, the task may be allocated to someone else – either another female relative or a paid servant. Because gender roles are socially constructed, they are subject to change in response to changes in socio-economic circumstances, natural and man-made disasters such as droughts and war, technological development, education and so on. In other words, gender roles are generally dynamic and they change with time. Not only do different communities define gender roles differently, but people within the same community can also view gender roles in different ways.

These tasks and responsibilities are allocated on the basis of what a particular society considers appropriate roles for women and men. In many societies, the tasks and responsibilities that constitute women's roles are assigned to the private sphere (for example, homemaking, child-rearing, maintenance of family and kin relations, paid work that can be conducted within the home), while men's tasks and responsibilities are assigned to the public sphere (for example, earning money outside the home, performing work duties that involve travel or marketing, participation in public structures, political action) (Social Development Department, 2005). These roles are not universal, but vary in degree from society to society and within a society. It would be erroneous to assume that tasks and responsibilities are immutable; for example, household fuelwood collection being a task assigned to women only – societies exist where fuelwood collection is considered to be part of men's traditional role (see below).

In general, women tend to have a greater range of tasks and responsibilities than men. This situation can result in women having to carry out many tasks simultaneously while men can generally carry out tasks sequentially. Women can also be more time-poor than men. These differences have implications for capacity to participate in activities such as meetings and to take up opportunities which arise as additional tasks e.g. income generating projects. However, energy interventions can help reduce women's burdens and free up their time for other opportunities.

Feminists see gender as a concept which focuses on the relational position of women and men whilst accepting the mediation of other socio-economic characteristics. The concept of 'gender' explains who does/experiences what and why. The answer to the question 'why' is explained in terms of power relations and an additional dimension of 'experiences' in terms of body politics, in particular women's right to control their bodies in relation to sexual activity and reproductive rights.

Amartya Sen summarises what occurs in households as follows: social arrangements regarding who does what, who gets to consume what, and who takes what decisions – which can be seen as responses to a combination of cooperation and conflict (Sen, 1990: 129).These social arrangements are the nexus in which women's and men's identities are shaped in everyday life, influencing how they are perceived as women and men and how they are expected to think and act as women and men. The manner in which women and men behave within their gender roles is to a large extent shaped by societal norms, the accepted standards of behaviour shared by a particular society. Along with these roles come certain rights and obligations for women and men based on cooperation and support. Within a household, men and women are able to negotiate to some extent (depending on the society) their rights, benefits and obligations as regards carrying out certain duties or tasks. We stress, however, that in any society several norms and standards for behaviour and judgment may exist in parallel, being more or less articulated – although some norms tend to be hegemonic, in other words there may exist a dominating gender ideology in a society, which may be resisted. This is an important premise for understanding intra-household negotiation processes and why women and men may hold several identities which are played out in distinct contexts (cf. Moore, 1994).

Intra-household negotiations do not usually take place between equals. In most societies, men have more power than women to make decisions about, and exercise control over, not only

their own bodies, lives and resources, but also that of other family members. This balance of power between men and women defines the relationship between them. The effects of differences in power operate at all levels in society: household, community, organisational, national and international. Hence, gender is considered to operate at all levels in the analytical framework presented in the next section.

Gender relations, like gender roles, are socially determined and are influenced by the same social, cultural, political and economic expectations. Gender relations exist both within the private (household) and public (workplace and community) spheres. Gender roles and relations are shaped by a range of social, political and economic institutions – both informal, such as in the family, and formal, such as in the legal system. Changing gender roles and relations requires both informal and formal institutions to change as well.

Gender and development discourses aim to transform gender roles and gender relations, giving women greater equality with men in terms of the division of labour, creating more and better life chances for women and giving them greater control over their bodies. These transformations are in part brought about by empowering women. There is no standard definition of empowerment nor is there consensus on the best way to empower women (Khamati-Njenga and Clancy, 2002). It has been suggested that this lack of clarity in defining empowerment leads to projects that incorporate women's empowerment goals not being able to reach their objectives (Skutsch *et al*., 1999). Practioners are probably consciously or unconsciously using empowerment to mean 'power to make decisions and solve problems' and/or 'power to organise with a common purpose or common understanding to achieve collective goals'. The feminist movement, when advocating women's empowerment, has used both the 'power with' and the 'power within' meanings. 'Power with' is taken to mean organising with others who share a common purpose. 'Power within' is interpreted as the creation of self-confidence, self-awareness and assertiveness. By analysing their experiences, individuals come to see how power operates in their lives, and so gain the confidence to act to influence and to change this situation. In other words, they are able to exercise their agency. For groups to gain power and take control over their own development, access to different types of power (social, political and psychological) is required (Friedmann, 1992, cited in Standal, 2008: 23). Social power is contingent on the possession of a range of assets (such as information, knowledge, skills, and finance as well as participation in social organisations), increasing and enhancing capacity to decide upon and meet objectives. Political power is seen as the individuals' access to participation in decision-making processes in informal and formal institutions, to voicing opinions and to taking collective action especially in decisions affecting the individual's life and future. Psychological power is gained through self-confidence and awareness of one's possibilities and is akin to 'power within'. These three dimensions of power are considered to be contingent upon each other and are mutually reinforcing.

However, given that gender is a relational concept, it is not only women's capacity to act which needs to change; men also have to accept the need for that change (that is, a shift in power relations) and to change their behaviour to accommodate a more equal balance of power at all levels in society. Women's empowerment can be assisted by formal institutions such as the law (for example, equal rights enshrined in the constitution). However, women must first want to challenge their subordinate position; then they must have the capacity to be able to challenge the inequality as experienced in their daily lives, in particular the informal institutions which shape gender roles and relations. In other words, women must be able to exercise their agency, their capacity for autonomous action.

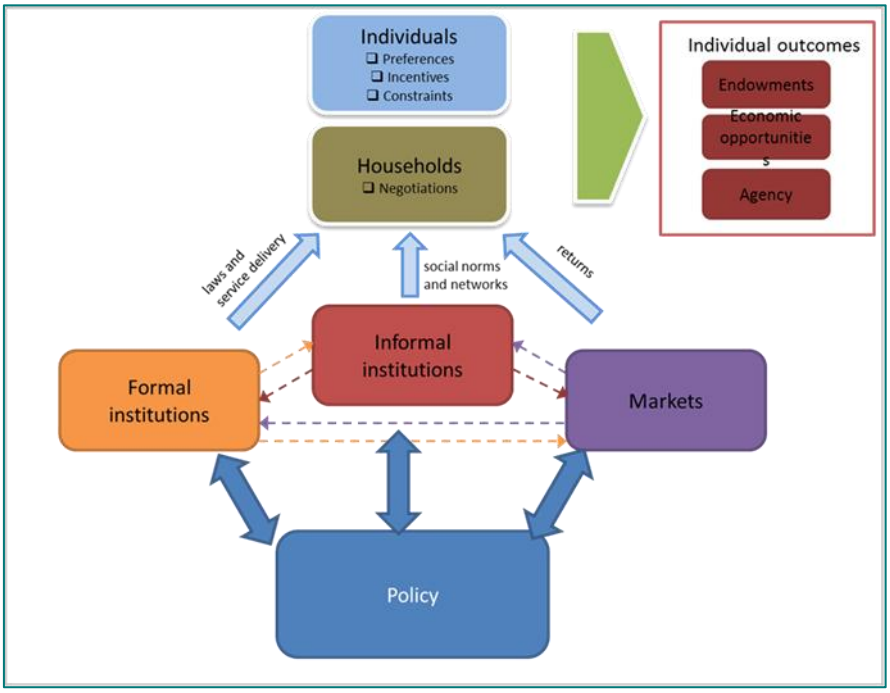
There is some concern that when women's empowerment is presented as a redistribution of power and social transformation that change the rules, norms and practices in the institutions which govern their lives (such as the family, kinship and community as well as the state and markets), it can lead to tensions and conflict (Kabeer, 2002). Men will challenge their loss of power and its associated social status. However, men can also benefit from women's

empowerment. While their 'power over' women's lives might be reduced, they can benefit from women's increased 'power within' when working together with women.

2.3 Analytical framework

Figure 1 presents the analytical framework used in this study. While many impact evaluations of energy interventions at the micro-level would take the basic unit of analysis as the household, social analysts, while recognising the existence of the 'household' take individuals within the household and the relationships between them as the unit of analysis. This framework considers that individual outcomes are shaped by a number of factors which are internal and external to the household. Individuals have preferences about the nature of the outcomes and what should take priority in terms of using household resources and which outcomes to prioritise. In reaching their outcomes, individuals are influenced by the incentives and constraints they face.

Figure 1: Analytical framework of this study



The external influences on intra-household decision-making, as well as household resources and individual capacity (endowments) to take up incentives or overcome constraints, include: informal institutions, such as social norms; and formal institutions such as laws, and services delivery. Behaviour and attitudes are shaped by and are embedded in informal institutions which mediate and modify the relationship between theory and practice (Social Development Department, 2005). In this paper we analyse the influence of the formal and informal institutions only, on the preferences, incentives and constraints of women and men and their individual outcomes. The third influence (markets) is the subject of a companion paper. A premise of this paper is that, since projects do not operate in a vacuum, a more responsive policy can be developed through a better understanding of intra-household decision-making and the way informal and formal institutions influence it.

While the analytical framework includes the 'household' as a unit of analysis, from a social science perspective this is a contested term (hence our initial use of the concept in inverted commas). There is no accepted standard definition of a household. In many cultural settings households can be seen to share common features (such as co-residence, joint production, shared consumption, and kinship links); however, anthropologists would caution that even

within cultures there are possibilities for diversity. Households are also dynamic. The composition changes over time, through natural life processes of birth, marriage and death – but also temporary relocation for a range of reasons such as schooling or employment. Blackden (2009) points out that the development literature has a tendency to use the shorthand term 'household' to cover whatever exists between the community and the individual.[15] This point should be kept in mind when comparing multiple sources of literature which either do not define the concept of a household, or differ in their definition.

In this paper, we recognise this problem of lack of clarity in the definition of the household as a unit of analysis. We consider that this methodological problem can be overcome through the recognition of the household as: a social construction in which two groups of people who would identify themselves as 'women' and 'men' position themselves and undertake specific tasks and assume responsibilities that are defined by their gender roles in furtherance of common goals and individual interests. This approach also allows for the influence of other socio-economic characteristics, such as age, ethnicity, status (i.e. child/adult; single/married/divorced/widowed) and income levels, to form part of the analysis. Differences in power operate at all levels of society: household, community, organisational, national and international. Hence, gender is also considered to operate at all levels in the analytical framework.

This analytical approach rejects the notion of the household as a unified entity pooling resources and whose preferences can be expressed in terms of a single utility function. From a feminist perspective, the household is a place of negotiation, in which women and men define their roles and relations (mediated by informal and formal institutions), in a context where there is both conflict and cooperation over labour allocation and the distribution of resources, with important implications for individual outcomes. Such an assertion challenges consensual models of development, pointing out that conflicts of interests and differences in priorities can exist between female and male members of the same household (Social Development Department, 2005). Therefore, assuming that when aggregate household income rises, the notion that all household members' wellbeing improves equally can lead to erroneous conclusions.

In this paper, we use gender both as an analytical tool and as a concept. Gender analysis asks questions in relation to men and women about: who is doing what, who owns what, who makes decisions about what and how, and who gains and looses by a planned intervention. Gender as a concept explains the responses of households to energy interventions, such as improved stoves and electrification, as well as identifying within the household where the benefits accrue.

3 THE EFFECTS OF MODERN ENERGY AND MORE ENERGY-EFFICIENT TECHNOLOGIES: TRANSFORMING GENDER ROLES AND RELATIONS

Table 1, taken from a World Bank publication, gives an indication of typical end-uses or energy services in rural households. Such a table is not unusual in evaluations of energy access (although a strong point of this table is that it is at least differentiated by income group. However, the table perceives the household as a socially undifferentiated unit varying only in technology. It does not identify who in the household would benefit, and in what ways, from access to modern energy forms (such as electricity or LPG) or more energy-efficient technologies. It also omits a number of important community organisations, such as schools and clinics, which also have energy needs and benefit household members in different ways. Gender equality in access to modern energy and its associated services remains hidden from view.

[15] Blackden (2009) cites the World Bank/FAO/IFAD *Gender in Agriculture Sourcebook* (World Bank 2009), as an example, which he states has more than 1,000 references to households without ever specifying what exactly it is intended to mean.

The energy services listed in Table 1 are used to fulfil the tasks and responsibilities of gender roles, which can be classified into practical and productive needs of women and men in the household.

Table 1: Typical End-Uses and their Energy Carriers, as differentiated per income group in Developing Countries (Source: World Bank, 1996: 25)

	Income level		
Household	**Low**	**Medium**	**High**
Cooking	Wood, residues and dung	Wood, charcoal, residues, dung, kerosene, biogas	Wood, charcoal, kerosene, LPG, coal
Lighting	Candles, kerosene, none	Candles, kerosene	Kerosene, electricity
Space heating	Wood, residues, dung, none	Wood, residues, dung	Wood, residues, dung, coal
Other appliances: radio[16] /television	None	Grid electricity and batteries	Grid electricity and batteries[17]
Space cooling and refrigeration	None	Electricity (fans)	Electricity, kerosene, LPG
Agriculture			
Tilling	Human labour	Draft animals	Animal, gasoline, diesel
Irrigation	Human labour	Draft animals	Diesel, grid electricity
Processing	Human labour	Draft animals	Diesel, grid electricity
Industry			
Milling/mechanical	Human labour	Human labour, draft animals	Grid electricity, diesel, gasoline
Process heat	Wood, residues	Coal, charcoal, wood and residues	Coal, charcoal, wood, kerosene, residues
Cooling/refrigeration	None	None	Grid electricity LPG, kerosene
Services			
Transport	Human labour	Draft animals	Diesel, gasoline
Telephone	None	Batteries	Grid electricity

Practical needs (which in Table 1 would equate with household end-uses) can be met by energy services such as lighting, cooking and space heating/cooling. These energy services make tasks easier and can help save time and reduce drudgery. Access to these services has primarily a welfare function and does not challenge gender relations. Productive needs can also be met with lighting and space heating/cooling, as well as other services which save time and reduce drudgery (such as with transport, storage and processing). These energy services can increase production and the quality of products. Access to energy services based on modern energy and energy efficient technologies can open up new business opportunities (e.g.

[16] Another energy carrier purchased by households is dry cell batteries to power radios. Barnett (2000) quotes survey data from Uganda in 1996, which showed that 94% of rural households not connected to the electricity grid used dry cell batteries and these households were estimated to be spending about US$6 per household per month on batteries. Barnett comments that although such batteries are convenient, they are a very expensive way of buying electricity. In terms of energy supplied, the cost of electricity at the time of his analysis was more than US$400 per kWh.

[17] The original table does not mention solar home systems. However, it is probably this category of households that would gain access through the market to electricity with this technology.

providing a mobile phone recharging service). Increased business opportunities or more efficient production can lead to increased income. It is argued that women who bring (extra) money into the household can change their status and bring a shift in gender relations.

Gender analysis recognises a third category of needs: strategic interests. These can be defined as the interests which relate to women changing their position in society, which help them gain more equality with men, and help them towards empowerment in all its senses. In other words, meeting strategic interests can change gender relations through enhancing women's agency. It is not clear how energy interventions can directly address women's strategic interests. The literature has many references to the assertion that street lighting improves the safety of women and girls at night, for example allowing them to attend night schools and participate in community activities, such as political meetings (see for example Havet, 2003). On the other hand, Skutsch (2005) has questioned whether energy technologies are able to empower women.

This section examines the evidence for gender differences in the way energy services based on modern energy and improved technologies influence two specific aspects of women's and men's lives: time use, with its links to reduction in drudgery and improvements in wellbeing, and economic opportunities. These two issues are linked. Time poverty has been increasingly recognised as a dimension of poverty (see Social Development Department, 2005; Blackden and Wodon, 2006). Women are particularly time poor and the associated drudgery of their tasks mainly fulfilled through their own physical labour has implications for their health. It also may have implications for their children's health if they do not have time to take children to clinics for vaccinations (Blackden and Wodon, 2006). Time poverty also reduces opportunities for income generation that access to modern energy can bring. Women are more likely than men to be affected by this constraint which would have implications for shifts in gender relations if the assertion is correct that women's status in the household improves through their increased contribution to household finances. Most of the evidence in the independent evaluation literature on gender and energy relates to electricity with limited in data on LPG and improved cook stoves. The literature provides considerable amounts of evidence which demonstrates correlation between energy and transformations in women's and men's lives but causality is more difficult to prove (see for example, Cecelski, 2005; ENERGIA, 2006). Often multiple factors are involved, for example, it has long been recognised that the availability of electricity alone is not sufficient to stimulate enterprise development or start-up (Kooijman-van Dijk, 2009).

The sub-sections below on time (3.1) and economic opportunities (3.2) are followed by the identification of some negative and unexpected effects of energy interventions. This section concludes by exploring whether or not there are transformatory changes in gender roles and relations linked to access to energy services.

3.1 Time, drudgery and wellbeing

In this sub-section, we look first at the evidence of how energy interventions are leading to time saving and then how this 'saved' time is used in the household. Most of the available evidence focuses on women, rather than on both women and men, presumably because of the greater length of women's day.

As stated above, the development interest in time saving through access to modern energy and its related services is linked firstly to improvements in wellbeing, due to increased time for rest and reduced physical effort; and secondly to increased opportunities that can accrue for income generation. In addition, women's daily workload –due to the gender division of labour– is generally considered a limitation on women's and girls' ability to empower themselves economically and politically, by attending adult education classes or school and engaging in productive and civic activities (United Nations Millennium Development Project, 2005). Access

to leisure is considered a good indicator for women having time to devote to empowerment activities (ENERGIA, 2006). Thus the focus on time saving primarily looks at women due to their long working day[18] –with between 11 and 14 hours being common, compared with around 10 for men (ENERGIA, 2006)– as well as their responsibility for the household's wellbeing. For example, the EnPoGen study in Sri Lanka (Masse and Samaranayake, 2002) revealed that women get up earlier and are awake for 16 hours or more, of which 13 hours are for work, compared with 10 for men. Village transport surveys in Ghana, Tanzania, and Zambia showed that women spend nearly triple the amount of time transporting goods compared with men. Women carry about four times as much in volume as men, primarily water, firewood, and crops for grinding, on their heads (Blackden and Wodon, 2006). The rise in migration by men leading to an increase in the number of female-headed households, adds to women's burden and time constraint.[19]

The availability of electric lighting logically can allow people to choose if, when and how they extend their waking hours. However, the evidence from the literature about time saving and reduction of drudgery is mixed. Households using solar lanterns in Afghanistan reported that they stayed up longer in the evenings because they were no longer paying for expensive diesel to power the generator (Standal, 2008). However, a study in rural Bolivia found that electric lighting had no effect on the diurnal rhythm of men's and women's lives since the tasks that were part of their agricultural livelihoods could not be adapted for electric light (Sologuren, 2006). For women, a longer working day appears to be primarily linked to taking up income generation opportunities (see below). Good quality light allows women greater flexibility for managing their time, as tasks can be carried out when it best fits within the day. Women do value this flexibility (Barkat *et al.*, 2002; Annecke, undated; Winther, 2008). Women in urban South Africa were able to use morning hours to combine chores and see their children off to school. In some electrified households, men were also prepared to help with the chores (Annecke, 1999). A less well recognised aspect of electric lighting is the contribution it makes to time saving. Being able to flick a switch saves time previously used for purchasing kerosene, and cleaning and maintaining lamps (Mahat, 2004; Standal, 2008).

One of the main areas of intervention to improve time saving is to address the issue of fuelwood collection. It is generally assumed that women bear more of the labour costs of fuelwood scarcity than men. The amount of time spent varies, being site-specific, according to environmental conditions, social set-up and distance to forest/wasteland resources, but reported estimates of time allocation range from one to as high as five (in parts of Nepal) or six (in parts of India) hours per household per day (ENERGIA, 2006). However, there is some evidence to indicate that fuelwood collection is not necessarily always a female task. Studies from Ethiopia, Madagascar, India, Nepal, Vietnam and Indonesia find that both men and women collect, and on some occasions men and children are the primary collectors (Cooke *et al.*, 2008). Men tend to take over responsibility when the fuelwood supply close to the household decreases (Cooke *et al.*, 2008) or in urban areas, such as in Benin and Ghana (Blackden and Wodon, 2006). Children can be allocated fuelwood collection duties during labour intensive periods of the agricultural cycle, such as harvest time. Cooke and her co-researchers concluded that the household decides "*who will collect and at what time in a manner that minimizes the cost to the household*" (Cooke *et al.*, 2008: 113).

Time is made available through interventions to reduce fuelwood collection using improved cook stoves or alternative fuels such as LPG or alternative devices such as solar cookers (see below for a more detailed discussion of these interventions).Time savings in the use of improved stoves is frequently reported but rarely quantified (ENERGIA, 2006). Figures are usually based on estimates of respondents' recall which is notoriously unreliable; however, time saving is reported to be as much as half of the time spent in fuel collection, or up to 100% when

[18] For a review of gender, time and labour studies, see Cecelski, 2005.

[19] There are an increasing number of women migrating for work, leaving their husbands responsible for meeting practical household needs for which they may lack appropriate skills (e.g. cooking), which may influence household wellbeing (e.g. insufficient or inadequately cooked food). This appears to be an unexplored area.

biogas[20] is used. Since most households continue to use multiple fuels and do not abandon fuelwood entirely, times stated by respondents may be considerably over-estimated. The available evidence from observation shows that the *use* of improved stoves or modern fuels, such as LPG, does not produce significant time savings. Saptyani (2010), reports 15 minutes are saved when LPG replaces kerosene, while Barnes and Sen (2004) report 8 minutes. However, interestingly in the Sunderbans, India, women reported time saving during cooking if there was electric light in the kitchen. This brighter light enables women to combine other tasks with cooking since they were able to see across the kitchen and monitor the pots on the stove (Chakrabarti and Chakrabarti, 2002; Winther, forthcoming). Previously, the women were only able to use one hand for doing chores since one hand was occupied with holding a kerosene lamp. Electric light enables tasks to be performed with two hands (and more safely since the danger of fire from dropping the lamp is removed). Women estimated that this new way of working saved them around one and half hours per day (Chakrabarti and Chakrabarti, 2002).

Significant saving of women's time appears to have come from the provision of labour-saving devices to meet practical needs of water-pumping and grain-grinding through mechanised community services. Based on a review of studies in sub-Saharan Africa, it was estimated that average households spent 134 minutes per day on water collection (Rosen and Vincent, 1999). Electrified water-pumping to central places in villages in Zanzibar has led to women saving three hours a day (Winther, 2009). In Mali, women reported saving two and a half hours a day on processing grains when traditional hand-milling was replaced by a diesel-driven mill (Porcaro and Takada, 2005). A study in Northern Tanzania found that the time saved by women queuing for grain-milling when the mills switched from using diesel to electricity, although not quantified, was considered sufficient for the women to now be able to set up their own small enterprises (Maleko, 2006). However, in China, it was men who benefited in terms of productive needs from electrification of grinding and milling since this was their main responsibility – and which was prioritised over pig food preparation, which was women's responsibility. However, when this task was eventually mechanised, women's workloads were not substantially reduced since this newly available time had to be used for agricultural work, in part because men saw it as an opportunity to migrate to urban areas for better paid work and women consequently had to add the men's tasks to their own (IDS, 2003). Water collection is a task often allocated to girls and boys, for example, in Benin, Ghana and Madagascar (Blackden and Wodon, 2006). Interestingly, this task can continue to be their responsibility even when they attend school which can limit their options for after-school study (see below for impact of electric light on this need).

Fuelwood collection might not always be the most onerous task for women. Tinker (cited in Celski, 2005) claims that even in supposedly degraded areas, other household tasks may be more time consuming than fuelwood collection, and energy efficient stoves might not be women's priority. A study in the resource-deficit Chiduku Communal Area in eastern Zimbabwe in the early 1990s (where there was no electricity and kerosene was expensive) showed that women spent 4.1 hours a week on fuelwood collection and 10.3 hours on water collection. Women provide 91% of the household's total effort in providing both of these household needs (Mehretu and Mutambira, 1992). This is not to say that fuel-saving stove programmes are misguided (see below for the benefits of such programmes); however, they should be appropriately targeted and be in line with women's priorities.

Most of the literature on the gender-energy-wellbeing nexus relates to women's and children's exposure to indoor air pollution from biomass stoves (see section 4). Literature on improved nutrition resulting from access to energy technologies is more limited, which is somewhat surprising since the Millennium Development Goals 4 and 5 (which shape much international development assistance) focus on improvements in infant and maternal health. A portable solar dryer introduced in rural Tanzania was able to improve food quality in terms of reduced

[20] This is surprising since biogas digesters need approximately one litre of water for each kilogram of dung. This can result in fuelwood collection being substituted by water collection which is a task allocated to women. Overall there is no reduction in physical effort, since the water usually has to be carried from the source to the digester, with little or no time saving.

contamination and increased nutritional content of vegetables compared to conventional open-air drying. The dryer was designed according to women's criteria of: flexibility, portability, time saving and individual use. Children's consumption of vitamin A-rich foods was reported to be higher in the families of women who had adopted the dryer, than in those of women who had not adopted it (Mulokozi *et al.*, 2000, cited in Blackden and Wodon, 2006: 24).

While the time demands of fuelwood collection are well recognised, there is very little literature on the physical impact of carrying 20kg of wood every day throughout a major part of a woman's life, beyond anecdotal evidence that it results in musculoskeletal damage and/or back pain (Matinga, 2010). This is surprising since occupational health standards limit the loadsthat can be carried, particularly for pregnant women;[21] also, WHO and UNICEF in their child-health training manuals recommend reduced fuelwood collection during pregnancy (Matinga, 2010). Women are reported to suffer sexual harassment while out collecting fuel but this is not well documented in the literature either (Haile, 1989). Reports have come out about attacks (including rape) on women living in refugee camps from Kenya, Northern Uganda, Sudan and Ethiopia, while they search for fuelwood in surrounding areas (Matinga, 2010). A study in Northern Uganda revealed that the situation was regarded to be so serious that men and boys started collecting fuelwood instead; they in turn were subject to physical assaults from rebels (Kasirye *et al.*, 2009). While supplying LPG might reduce these attacks, there are concerns that women may be asked to 'pay' camp officials for cylinders with sexual favours.

Considering that MDG 6 focuses on combating HIV/AIDS, malaria and other major diseases such as tuberculosis (TB), it is also surprising –given that these diseases can reduce the capacity to undertake physical labour, such as wood collection– that there appear to be no studies specifically related to their linkages with gender and energy (ENERGIA, 2006). Healthy household members also suffer additional stress when having to care for the sick, who may require more warmth, more nutritious meals and more boiled water. Matinga (2010) found that when women in her South African study villages were diagnosed with HIV/AIDs, the effect of wood smoke on TB was a source of concern. The women felt that their household responsibilities left them with no choice but to stay in smoky kitchens whereas men were able to choose to spend less time in the kitchen. GTZ's Program for Biomass Energy Conservation (ProBEC) in Southern Africa has included within its fuel-savings programme a component intended to help alleviate the impact of HIV/AIDS on households and women in particular, although at the time of writing there were no results available.[22]

Most of the evidence on time saving tends to relate to women, with only a few insights into men's activities. This may be related to the way energy interventions are reported. Given the identified benefits to women and their families of saving women's time and labour this is an understandable focus of interest. Electricity tends to be evaluated mainly in terms of benefits to the household, which –given this is the centre of women's tasks–brings a focus on meeting the family's practical needs. Electric lighting is the main end-use of interest for evaluation of impact on productive needs which again links to small-scale activities that centre on the household. Men's productive needs in rural areas are often best served by mechanisation rather than electricity, with the exception of irrigation. Such interventions may not be reported as energy interventions but as agricultural modernisation with an emphasis on agricultural output, rather than time and effort saved.

There are three ways in which women and men use their saved time:

- Income-generating activities (see section 3.2);
- Catching up on household chores and more time for child care; and/or
- Leisure and rest.

[21] in relation to forestry work, the International Labour Organisation recommends maximum loads of 20 to 25 kg for carrying and less for lifting (cited in Magtinga, 2010: 32 (footnote 37)).
[22] http://www.probec.org (accessed 31 January, 2011)

In general, it appears that when more efficient energy sources do save time, men are more likely than women to use these savings for recreation and leisure. In a study in Zanzibar, for example, the way men spent their leisure time changed with the advent of electricity: before electricity, men spent their evening hours outside the home with their male friends; after households had access to electricity, the men were more inclined to spend their evenings watching TV at home (or in each other's homes) (Winther, 2008).

Socio-cultural analyses of the effects of electricity's coming to a community have also found that people's perception of time changes. The new range of choices provided by the introduction of artificial light (instead of the cycles of the sun and the moon) as to what to do and when, has contributed to the perception that time is speeding up. This can make predictions of re-allocation of time difficult.

It is not unusual in project documents related to energy interventions to read that women use time saved for income-generating activities. This might be a desired outcome but the reality is sometimes different. In South Africa, Green (2003) found that women were not interested in using time saved for new activities; they were tired and harassed and wanted to rest. In Sri Lanka, women gave income-generating activities a low priority, preferring to use the two extra hours of useful time electricity gave them for better housework and child care, but also for resting, socialising and watching TV (Matly, 2003). In Tanzania, on the other hand, the need for cash in many low-income households made income generation a priority over other activities such as education (Meikel, 2004). This shows that energy interventions take place in a complex context, with many dynamics at work which may be difficult to deconstruct through standard questionnaire techniques.

We would conclude this sub-section with three important findings related to women's time saving which are causes for concern. Firstly, women's time might be saved by an energy intervention, but it can be increased in other ways. Secondly, leisure and rest which have been identified as vital for women's wellbeing and that of their families, seem to have the lowest priority for many women. A third significant finding is that it should not be assumed that women will automatically use any 'saved time' for income-generating activities.

3.2 Economic opportunities

This sub-section identifies the ways in which the introduction of modern energy affects economic opportunities for women and men. Women's use of modern energy sources for income generation is probably more extensively reported in the literature than that for men. Again, this may reflect the way in which the introduction of an energy technology is reported or evaluated.

Most of the available evidence related to energy and economic opportunities has focused on access to electricity. Women's entrepreneurial activities generally use process heat and they are located in the informal sector. For example, selling prepared food is a common activity and is seldom found at a fixed location or structure (thereby making electricity inappropriate), although electric street lighting can extend the hours for trading. There is clearly a gap in knowledge about the role of process heat in small and informal sector enterprises (Clancy *et al.*, 2003). However, there are many examples of women using a range of modern energy and its associated technology: LPG for preparing food for sale in Indonesia (Saptyani, 2010), gas refrigerators for making ice to sell at a nearby school in urban South Africa (Annecke, undated), solar dryers to export quality dried fruits in Uganda (UNDP, 2000), a diesel generator providing multiple services in Mali (UNDP, 2004), electric light for chicken breeding in women's cooperatives in Zanzibar (Winther, 2008), as well as becoming producers of energy equipment (for example, in rural Bangladesh where women assemble and sell fluorescent lights - ESMAP, 2004).

In China, men are able to benefit from the introduction of improved technologies powered by electricity which have enabled women to take over many of their agricultural tasks (IDS, 2003). Since men in China generally enjoy greater mobility than women, they were found to make use of this advantage and to move to urban areas for better paid employment (Ramani and Heijndermans, 2003).

Electricity primarily supports income generation by both women and men through the extension of the working day; this is linked with the household often being the centre of small-scale enterprises. Men report that the level of power available is often not sufficient to operate the type of equipment they would use in enterprises, such as welding gear and motors (Annecke, 1998). A study in Tanzania, Bolivia and Vietnam found that locating the enterprise in the household allows women in particular to combine income-generating tasks with household duties (Kooijman-van Dijk and Clancy, 2010). Annecke (1998) reported that the types of activities women in South Africa were involved in were based on their current skills primarily related to household tasks, such as cooking and sewing, which can provide low-levels of remuneration. Similar findings are reported in Bangladesh (Asaduzzaman *et al.*, 2009).

The stimulus improved lighting (or any other energy service) provides for starting up a new business or expanding an old one is limited, and complementary inputs are needed (Kooijman-van Dijk, 2010). The literature has a number of examples of the sort of complementary inputs that can promote women's use of modern energy for income generation. In countries where women have limited opportunities for income-generating activities, creating an enabling environment which strengthens women's legal position, improves their educational status and good health care –as happened in Tunisia– can play a role (Cecelski *et al.,* 2005). Targeting women in appropriate ways that help overcome their specific constraints can support them to take up the opportunities modern energy offers. Annecke (1998) reported that seven of the twenty households in her study on rural South Africa had commercial activities within nine months of electrification. There was a high level of awareness that modern energy can help with business development, which could be linked to demonstrations by an engineer from the project showing possibilities with electricity. This approach addresses women's lack of knowledge about new technology. For example, the UNDP sponsored multifunctional platform programme in Mali took the culture of rural areas into account, to overcome potential male resistance to projects interpreted to benefit women. The villages were not treated as a homogenous group. Instead, participatory approaches were used in each village to determine social, economic and environmental conditions, and to identify villages where the platform would be sustainable. The entry point for project development was through the village chiefs; the programme staff ensured that the chiefs saw the benefits of the project to the whole community, and convinced them of the need to accept that women should be the owners of the platform. While working to make women's income generation as the main objective, men were also able to benefit directly from the project, through being employed as technicians to maintain the diesel engine and its equipment (Burn and Coche, 2001).

The Zanzibar case study found that the lack of attention to services which could save women's time –such as a village mill and a kindergarten– proved a barrier to women's income generating activities when electricity became available (Winther, 2008). These barriers would have been identified if women had been consulted.

Location plays a role in women being able to generate income. For example, in northern Tanzania, women were able to use grid electricity to set up an office centre providing services such as photocopying in a village where there was a ready-made market in the form of a residential college (Maleko, 2006). Women from remote villages in China, interviewed as part of the EnPoGen study, identified their location and the lack of transport as key constraints in their income generating opportunities (IDS, 2003).

The evidence tends to support the supposition that women are capable of seizing opportunities when they have the resources. However, access to modern energy alone may not be enough –

other than to keep women employed in producing vital, but nevertheless low remuneration, goods and services.[23] It may be more important to strengthen their position, as was done in South Africa and Mali, to enable them to participate in the planning, management and operation of interventions and in markets. Winther's case study clearly shows the consequences of the failure to do so: a lack of gender equity in energy access. It is not only a question of ensuring that women have an appropriate set of skills, but also ensuring that women's capacity to participate is not being undermined by male resistance. This aspect is discussed further in the next section.

3.3 Negative and unexpected effects

Energy interventions take place in a complex context, with other dynamics at work. This means that while there are many positive effects of access to modern energy, there are also negative and unexpected effects.

Unfortunately, women are not always the beneficiaries of energy interventions which can either increase their workload or put them out of work. The situation of women in China described in the EnPoGen report showed that while they may save time in one task with an energy efficient device, this time can be re-allocated to other tasks. If a device substitutes for men's labour, this can allow men the opportunity to migrate to urban areas. Women are left behind to take over their husband's tasks. These women-headed households lack labour and other resources. It cannot be assumed that remittances will flow to the households of absent husbands (IDS, 2003).

Women can also lose vital sources of income by interventions designed to reduce effort and drudgery. In Bangladesh, steel rice hullers were introduced to replace manual rice-hulling resulting in many rural women losing jobs that contributed vital household income. In particular, women wage-labourers from landless families were hardest hit since rice-hulling was estimated to provide 55% of their annual income (Cecelski, 2004).

In rural Zanzibar, the amount of time spent on firewood collection remained the same after the arrival of electricity (12 hours per week per household). On the one hand, electricity indirectly reduced the consumption of firewood since women wanted to watch TV, and they were able to reduce the number of cooked meals from three to two per day using leftovers for the third meal, without any apparent objection from the men. This reduction was also coupled with women's participation in a new income generating opportunity, farming seaweed, which was not driven by access to modern energy but by demands from the global market. The reason that the time spent on fuelwood collection remained the same was that women had to walk further in search of bush wood due to an increasing scarcity of trees caused in part by a tree-growing project, which had the effect of privatising land close to the village (Winther, 2008).

Households can come under particular strain upon gaining access to electricity and it brings a shift in responsibilities. In Zanzibar, fishermen were using five months of their income to pay for a connection and additional income for new appliances, reducing the amount available to buy basic necessities. Besides this, responsibility for the households' daily living expenses is shifting increasingly to women (Winther, 2008). Indeed, such is the cost of electricity in Zanzibar that it was found to be raising the cost of assets that men have to accumulate prior to marriage, hence delaying the age at which men marry. The cost of electricity is also acting as a barrier for some men to marrying several wives, which is a cultural practice in Zanzibar. The barrier is linked to the cultural value of treating all wives equally, something that men are finding difficult to achieve (Winther, 2008). In the past, a man's success (and hence status) was said to have been measured in the number of children he had, as well as his capacity to provide for several wives living in their own households. The expectations of what a 'good husband' should provide have risen, as has the cost of meeting these expectations. These expectations include

[23] Women's income-generating activities are often in the informal sector selling to low-income groups.

an electricity connection. Nowadays, men who choose to marry several wives without offering all of them electricity, risk being ridiculed.

Not all interventions are welcomed and some are greeted with suspicion and uncertainty. Reductions in women's drudgery and time saving can for instance open up tensions in gender relations. In Zimbabwe, men are reported to have rejected the use of solar cookers by their wives, since technology and its development are seen traditionally as a male preserve (Nyoni, 1993). They expressed reservations about what their wives would do with the time saved In fuelwood collection by the introduction of solar cookers (Green, 2001).This situation has been called a 'gender tug-of-war' which can arise when a new technology (the responsibility for which is culturally considered to be the men's arena) is introduced into what is culturally considered the women's arena (for example, cooking and food preparation) (Rodgers, 1994). Projects that aim to benefit women and which bypass men in their dissemination mechanisms, can leave men uncertain about their new position with respect to women. They are no longer the providers of technology for the household. For women, uncertainty comes when they feel their identity being threatened when men take over what are traditionally seen as women's roles in their society (see Matinga's case study).

There are occasions when project evaluations reveal unexpected findings which cannot be explained through standard survey techniques. A study about fuel switching in rural Mexico, found that some high-income households stopped using LPG. No specific factor could be identified to explain this phenomenon, but the most plausible explanation was that family size had declined due to migration, leading to a change in the pattern of cooking; for example, no need to cook large quantities of food quickly (Masera *et al.*, 2005). However, other families adopted LGP even though the price had increased. These findings illustrate the assertion with which we opened this sub-section: energy interventions take place in a complex context, with other dynamics at work. To reveal the dynamic that will enable more effective interventions requires the researcher to become much more embedded in the community.

3.4 Transformatory changes in gender roles and relations

This sub-section begins by looking at the ways in which access to modern energy meets practical needs, and how this affects gender roles. It then examines the evidence supporting whether or not there are changes in gender relations.

There is evidence that shows that all household members benefit from access to services delivered by modern energy sources or improved energy technologies (Cecelski, 2004; Cecelski, 2005; Energia, 2006). The distribution of benefits varies with gender and age. Women particularly benefit from help with household chores (either from reduced drudgery and/or allowing better time management of their chores). Men seem to benefit most from increased rest and entertainment. Children particularly benefit from access to TV, as well as better lighting in the home for reading, and in the streets for safety.

In households with adult men and women, the gendered division of labour generally allocates to women the responsibility of collecting household energy related to their spheres of influence in the household – in particular, activities centred on the kitchen. Evidence suggests that even in commercial fuel markets, women remain responsible for ensuring that the household has access to energy; for example, by organising the purchase of kerosene, charging of batteries, topping-up of electricity meter pre-payment cards. So while they do not necessarily make the decision to purchase or pay for the energy, women often remain as the managers of household energy and appliance use (Annecke, undated; Clancy *et al.*, 2007; Winther, 2008). However, men become involved when fuel has to be collected over long distances, where fuel is purchased, or when there are social restrictions on women leaving their homes (Cecelski, 2004; Cooke *et al.*, 2008).

Men are also found to do more domestic chores once a household acquires electricity. Men in China (e.g. the Naxi villages around Lashi Lake) and Laos will cook food for themselves when their wives are busy (Kelkar and Nathan, 2005). There are similar findings in urban South Africa and Zanzibar although men will only use electricity and not LPG or kerosene (Anneke, undated; Winther, unpublished[24]). In Sri Lanka, men were found to share in chores such as ironing after household electrification (Massé, 2003). However, similar transitions are not reported in relation to LPG or kerosene.

In a study of electrification in Bangladesh, no changes in the gender division of labour were found (Barak, 2003). In the US, with the acquisition of new household appliances, men have actually reduced the time they spend on housework, and certain tasks that were shared before have become solely the responsibility of women (Hawthorne, 1996).

Access to modern energy appears to enable women to fulfil their traditional roles (to their satisfaction and wellbeing) rather than bringing significant transformation in gender roles. Electricity in the kitchen makes women's lives easier and reduces the stress of providing meals to meet other household members' (particularly men's) time schedules (Anneke, undated). Kelkar and Nathan (2005) comment that –while energy services based on modern energy reduce the labour intensity in many household chores, which may make it easier for working couples to share domestic duties– such energy uses do not *inevitably* lead to changes in gender roles. They cite the case of Japan as an example in which all the available energy uses have not led to any sharing of housework between men and women.

The available evidence shows that it is still mostly men who make the decision about acquiring modern energy technologies and fuels, even though women tend to hold on to the cash (Anneke, undated; ADB, 2010). However, there are studies in which some respondents say that decisions are jointly made (e.g. Matinga, 2010; Saptyani, 2010). Even where women make household decisions on spending cash –as observed in matrilineal societies in Eastern Bhutan and Meghalaya, India– women themselves tend not to invest in equipment that saves domestic labour, unless its cost can be compensated for by the income from the labour saved (Kelkar and Nathan, undated). However, there is evidence from communities from which men migrate as labourers and in which women heads of households receive social funds (such as in South Africa),where women have a considerable say in decisions on the acquisition of modern technologies compared to other contexts.

There is however mixed evidence about more fundamental transformations in gender relations. None of the three studies on energy, poverty and gender carried out for the World Bank, in China, Sri Lanka and Indonesia, were able to show that electrification resulted in a greater voice or empowerment of women in community affairs (IDS, 2003; Madon, 2003; Masse, 2003). It is also possible that access to television can contribute to reducing gender violence (see below). A possible explanation for the lack of significant transformation in gender relations is that this may require more time than changes in gender roles. A second explanation, in line with Skutsch's proposition, is that energy access alone is not sufficient, and other contextual factors such as legal and policy frameworks are needed to support such a change.[25]

[24] Gender roles shape identity and behaviour by which women and men are perceived, and judged, by others. Ironing was a new activity which came with electrification. It was found to be acceptable for men, mainly teachers, to iron because it did not contravene the community's perceptions of how a man should aesthetically look when performing their tasks within their gender roles. The man still appeared attractive (*hapendezi*), in the way a man should, when ironing.

[25] See paper by Clancy and Feenstra (2006) which suggests an energy policy-enabling framework.

4 ENERGY TECHNOLOGIES AS DRIVERS OF TRANSFORMATION

This section focuses on identifying how three specific energy technologies (electric light, TV and modern stoves) drive transformations in women's and men's lives.

4.1 Electric light

Some indications were given in section 3.2 about how electric light impacts on time poverty, particularly for women. In this sub-section, we focus on other aspects of the transformations brought on by access to electric lighting, in terms of social relations, feelings of safety, improvements in literacy and education, and women's health.

Within households, access to electric lighting has transformed relationships between husbands and wives. For example, a study in rural Afghanistan found that using a solar lantern allowed for cooking outside, after which the prepared food was brought inside, allowing the family to eat together in a smoke-free atmosphere. Men also considered that the food tasted better without the smell of kerosene lamps. These changes were felt to have improved family relations (Standal, 2008). The same study found that men and women when discussing household issues at night were able to see each other's faces which was felt to bring a better understanding about what was being said, and to reduce tensions (Standal, 2008). Having more than one room lit, also gave parents in Afghanistan opportunities to spend more intimate moments away from their children. This is in contrast to changing sexual patterns in Zanzibar where the husband and wife have less time for intimacy in electrified homes. There, men either stay up late at night to entertain guests while watching TV; or if they do not have a TV at home, they go to a friend's place to watch, coming home after their wives have gone to bed (Winther, 2008).

Electric light also changes people's world views. In comparison with homes lit by kerosene – which are marked by an 'aesthetic of darkness' linked to the spirit world– the social aesthetics in the new electric light –freed from the fear of the spirit world– allows for laughter and a more relaxed atmosphere, resembling that of the daytime (Winther, 2008). "*The light literally became a symbol of protection against any kind of evil*", according to Standal (2008; 78). Street lighting and portable solar lanterns are perceived to provide safety against visible (e.g. wolves) and invisible (e.g. evil spirits) threats of the night (Anneke, undated; Winther 2005; Standal, 2008). Social relations and the building of social capital have been improved by enabling visits after dark.

It is often stated that street lighting increases women's mobility after dark, allowing them to participate in community and political events, leading to their empowerment. However, social norms and values do not always change as quickly as technology. In their work with hill tribes in Northern India, Kelkar and Nathan (2007) found that perceptions about women that existed before the advent of street lighting continued to act as a barrier to women leaving their home after dark. This has implications for one of the often stated (intended) outcomes of rural electrification projects: that electric lights enable women to improve their literacy levels because of the possibility of attending evening classes (see for example Davis, 1998). Firstly, electric light allows for classes to be held at a time when it is assumed that women are available (i.e. in the evening). Secondly, it enables them to feel safe when walking at night. There is evidence to show a correlation but not causality between women's literacy and electric light. Women's literacy was found to be significantly higher (by 22 per cent) in electrified households in Bangladesh (Barkat *et al*., 2002) while an ESMAP survey found electricity to be a factor in women reading in India (Barnes and Sen, 2003). While there are references to women reading, there is little information about what they read. Literacy classes in a solar project in rural Afghanistan, which focused on 'mothering skills' and hygiene, were linked to improvements in

family health (Standal, 2008). Women from low-income households in urban South Africa were found to read the Bible, magazines and newspapers but not books – only children read books. No mention in the study is made as to what men read, if they read at all (Anneck, undated). In South Africa, although there had been much talk about the possibility of women improving themselves through night classes, as well as women being interested in participation, the classes did not materialise (Annecke, 1999).

Another of the often stated claims for electric lighting is that it will lead to improved school performance and allow women opportunities to improve their literacy and other educational skills. Girls' life opportunities are restricted compared to boys because they are burdened with a much higher level of household chores. Most studies on the impacts of lighting in schools do not provide disaggregated information for boys and girls, however, but treat children as a homogeneous group (ENERGIA, 2006). It can be difficult to demonstrate causality, due to the existence of other confounding factors, such as access to schools (ADB, 2010). In Bangladesh, somewhat higher school attendance of girls in electrified villages was associated with the availability of electricity in schools and with the provision of fans to increase comfort (Barkat *et al.*, 2002). Dropout rates were also lower in electrified villages. In Tunisia, families felt that girls could walk more safely to school in the early morning due to street lighting, and school administrators felt that this was an important factor in increased school attendance by girls (Cecelski *et al.*, 2005).

Studies in South Africa challenged the claim that children do their homework by electric light (Anneke, undated; Matinga, 2010). Researchers felt that statements made in response to questions about this issue did not always match with findings through participant observation. In Zanzibar, only a few children were reported to do homework after sunset even if they had electric light at home; although some children, both girls and boys, were sent to private tutors who had electric light at home (Winther, 2008). In comparison, in the Sunderban in India, people in electrified households reported that their children spent as much as 4.5 hours per day doing homework while children in non-electrified households were said to spend 4.2 hours on homework (Winther, in progress).[26] Opportunities for children to go to school at night do open up due to electric light. However, girls often face more restricted access to night schools than boys, due to concerns about girls' safety in the dark (Ahmed, 2008). In contrast, there is evidence from the Zanzibar case study that access to electric light created local initiatives to enable girls and boys, equally, to attend night schools in the month before important exams. From midnight, they slept in gender-segregated rooms with teachers (male and female) supervising them.

Yet a different kind of energy intervention allowed for a significant improvement in girls' general school attendance: the installation of electrified water pumps and taps. When this happened in Zanzibari villages, girls were freed from their previous task of collecting water, and parents started sending their daughters to school to the same extent as sons (in 2001, 93% of girls between 7 and 17 and 95% of boys attended school in Uroa village, Winther 2008). In 2006, this practice appeared to have also spread to non-electrified villages. People in electrified villages explained this in terms of other villages "*wanting to copy them*", thus reflecting their perception that electricity gives status. Another contributing factor could be the generally strong emphasis on education in Zanzibar at the time of the survey (again linked to the MDGs).

In addition, women's wellbeing has been reported to benefit from access to better quality lighting. This can be the psychological empowerment which makes women feel that there is a better future for their children, since they have access to computers – although women in rural Afghanistan tempered their optimism with concerns about whether or not there would be jobs in which they could make use of these skills. Standal (2008) reports that women's mental health had suffered as a consequence of the years of conflict in Afghanistan; they were not able to carry out their role of constitutes a "*good mother*" in their society, by fulfilling practical needs.

[26] It should be noted that these numbers are based on people's statements and not on observation-based data.

However, electric lighting has enabled them to perform their household duties to a degree that gives them a sense of satisfaction that they are once again "*good mothers*" benefiting their families. Another significant contribution from electric lighting is its assistance to improving the safety of deliveries. Not only does this help medical staff in their work but it gives women more confidence and they are more relaxed (Standal, 2008). In Zanzibar, having light in the local clinic allows women to give birth in their village, allowing them to save money that would have been spent on transportation to a more distant clinic; it also saves them having to spend several weeks with relatives prior to the delivery (Winther, 2008). However, perceptions of what is 'modern' and 'better' can override time and financial savings. In her study in Tsilitwa, South Africa, Matinga (2010) found that despite having a local clinic that is well-lit and well-fitted with waiting rooms (complete with a bathtub, bed and four-plate electric cook stove), women refuse to give birth there preferring instead to travel 35 km away to a larger hospital. The women considered it risky to give birth in the clinic, and going to the hospital and having a private doctor also gave them social status.

The EnPoGen report issues a statement of caution about drawing correlations and causality for the claims of electric lighting. The authors consider that many of the activities that respondents claim to do when they acquire electric light are not possible with the level of lighting in their homes (Ramani and Heijndermans, 2003). Indeed, this sub-section has drawn attention to different gaps between assumption and practice, as well as highlighting contradictions between what people say they do and what people actually do in practice. We consider that this once again demonstrates the value of ethnographic approaches in not only identifying these contradictions but also enabling the opportunity to provide explanations.

4.2 Television and radio

While much attention has been given to the role of television in people's lives, it should not be forgotten that while there seems to be a strong demand to acquire a television,[27] the percentage of households in a community actually doing so can be low.[28] This makes it difficult to make generalisations across an entire community, particularly since many of the households that have access to TV are often the wealthier ones. What people are able to watch also depends on their location. Urban areas with better access to electricity will have options for TV networks (either aerial or satellite) whereas in rural areas, there may be no TV signal and an insufficient supply of electricity to power a satellite receiver. In this situation, households will be restricted to watching videos. Many more households do have access to radios, however, which do not require a firm electricity supply since they can be powered by batteries.[29] For this reason, this sub-section addresses the impacts of both of these technologies. It looks at what types of programmes women and men watch and in which ways the programmes influence their lives in terms of wellbeing, perceptions of the world and how this influences behaviour, in particular regarding women's empowerment.

There is some evidence that women in electrified households do spend time watching TV and listening to the radio, often together with men (Ramani and Heijndermans, 2003). The educational and entertainment aspects of the media are valued both by women and men. The EnPoGen study considered that in its three countries of focus, the time women and men spent together has strengthened women's position in the family (Ramani and Heijndermans, 2003). This finding is supported by Winther's study in Zanzibar (Winther, 2008).

Both men and women in different settings have reported watching the news as their first programme of preference (Ramani and Heijndermans, 2003; Annecke, undated; Winther, 2008). Men also like to watch sports while women enjoy a greater variety of programmes. Women like the information they obtain from programmes aimed at them. Women in

[27] In the poor urban communities of South Africa in Annecke's study, she found that 5 out of 20 households had acquired a TV within six months of connection to the grid (Annecke, 1999).
[28] Standal (2008) reports that 12% of households in her study villages had a TV.
[29] See footnote 13.

Afghanistan consider TV as a "*place of learning*" where they gain new knowledge about health care during pregnancy and for their children (Standal, 2008). This appears to be the most common theme of health programmes aimed at women. It is possible that the promotion of infant and maternal health is due to the focus this issue receives under MDGs 4 and 5, whereas addressing IAP (indoor air pollution) is not specifically mentioned as a target. In Zanzibar, TV campaigns promoting the importance of boiling water in the rainy season were watched and women said they considered the advice to be important, but the advice was not followed in practice (Winther 2008). There is a gap in the literature about health programmes on the TV or radio specifically related to the dangers of indoor air pollution and fuelwood stoves. However, from the limited information available and the lack of women's awareness about the dangers of IAP, these do not appear to be common topics within health programmes. It is also of significance that women are less likely than men to visit other people's homes where there is a TV (IEG, 2008), so women without access to any information media may be less likely to learn about the dangers of IAP or other health issues through this mechanism.

Another important issue regarding infant and maternal health is family size. It is possible for women to become more aware of contraception through television and so to improve their understanding of how to plan their families. However, whether access to TV or other information campaigns has any influence on family size is not clear. In general, evidence on people's sexual activity is difficult to obtain since these are highly private matters, particularly in rural societies. The ethnographic evidence here is mixed, such that in some places, it seems that more intimacy between the wife and husband (Afghanistan) result from electrification, and in other places less (Zanzibar). This observation is generally in line with the conclusion of the World Bank's evaluation of electrification projects (IEG, 2008). We would like to point out the value of identifying contextual factors when trying to understand electricity's effect on fertility rates. As the Zanzibari case shows, other factors than the amount of time and the content of what people watch on television (and the degree of intimacy this provides to husband and wife) may explain reductions in fertility rates, as caused by electricity. Women in South Africa like 'soap' series (Annecke, undated; Matinga, 2010) and religious programmes. The women see the 'soaps' as sources of tips about how to deal with many of the relational problems in their daily lives as well as possibilities for self-improvement, such as how to become an entrepreneur (Annecke, undated). Other women report that they found the stories seen on TV as inspirational, such that women could have careers and become independent of men's cash (Matinga, 2010). However, men still make the decisions about what to watch, so their preferences have priority (Ramani and Heijndermans, 2003; Annecke, undated). Having access to satellite TV or a short-wave radio increases the range of programmes that men and women are able to watch. Such opportunities open up intellectual freedom, although this can be stifled where the media is subject to ideological control by the state. In rural households, these programmes provide a view of urban lifestyles and create aspirations which can lead to tensions when trying to fulfil them (Matinga, 2010).

The radio also acts as an important public information system. In places where ownership of watches is not widespread, women use the radio to keep track of time (Winther 200). In South Africa, the radio is often the only way families find information about missing family members. Similarly, in Zanzibar, death announcements are, after news, the most preferred type of radio programme among women (Winther, 2008). In a context where funerals take place the day after somebody has died, timely information enables people to fulfil social obligations and maintain social capital.

There are reported gender differences in the impacts of TV and radio. A number of studies report that access to positive images and stories have changed women's (and to some extent men's) perceptions of gender roles and relations: women realise that they "*don't have to remain as second class citizens*" (Barnett, 2000) and they gain the confidence to challenge male authority (Standal, 2008). Women in Tunisia are reported to have gained a good understanding of their legal rights from the media (Chaieb and Ounalli, 2001). Men are also more aware of women's legal position and their rights, and that women are aware as well (Standal, 2008;

Annecke, undated). Not all men are happy about this situation and resent their status being undermined (Annecke, undated). TV has also provided men with insights into women's lives that they would not ordinarily have access to, shaping their perceptions of women's lives in a more positive way (Standal, 2008). Whether this greater awareness of women's rights has led to a decline in domestic violence is however difficult to assess since it is considered a private matter and therefore rather sensitive for discussion with outsiders. Standal (2008), in her study of remote Afghan villages, considered that there was anecdotal evidence of domestic violence decreasing, since the relationships between men and women had improved. One man was prepared to admit that he no longer hit his wife. However, such evidence should be treated with caution since, although welcome, it is normative and does not necessarily signal a significant shift in gender relations.

Children, like their parents, use TV both as a source of education and entertainment. Parents on the one hand view TV as a positive influence in urban areas, keeping the children at home away from the dangers of the street; on the other hand, they are worried about the new types of dangers their children get exposed to on TV (Ahmed, 2008; Annecke, undated). In rural areas, parents feel that TV provides young men with entertainment and helps prevent them from becoming involved with problems in the street (Matinga, 2010). There is a gap in the literature about whether girls and boys watch different programmes or the types of programmes they watch.[30]

Television is an example of how modern energy systems create tensions between new ways of doing things and traditional values. Households are altering their daily routine to catch favourite programmes on TV. In Zanzibar, having a TV in the house is encouraging men to "*come home*" in the evenings rather than sitting outside with other men socialising. Such actions are considered to increase family cohesion. Women in Zanzibar were cooking fewer meals to be able to watch TV, although they also combined this with other household chores, such as sewing. This combined activity was nevertheless regarded as providing the women with rest (Winther, 2009). In South Africa, households adjusted their meal and socialising times (Matinga, 2010). The place of socialisation had also changed in homes with a TV, from the kitchen (which could reduce exposure to IAP in some cases) to the room where the TV is located.

People's desire to relax and watch television, as well as to display their new status, poses a potential moral dilemma in some cultures if watching TV means having men and women guests occupying the same room. In Zanzibari people are able to balance these tensions by creating a microcosm in the living room, divided according to gender which, aided by the use of bright electric light, gives the perception of the room being transparent and pure (Winther, 2008). At the same time, new, desirable technologies provide potentials for transformation in gender relations. Having a radio or TV may change a woman's status in the community. In Zanzibar, while the female and male guests are still seated separately, the host and hostess sit together reflecting their status as a 'modern' couple (Winther, 2008). These changes in the social, gendered patterns have had the effect that women associated with appliances (which have been purchased by their husbands, see below) obtain an equal position vis-à-vis men and women external to the household. The modern, nuclear family becomes an ideal which challenges the traditional social principles for organisation that include strict gender segregation and the ideology of men's superiority over women. Although the ideal of the male provider and female housekeeper is maintained, both spouses perform their roles in a new way that signals that they have a more equal standing than before, thus a qualitative change in the gender relationship.

There is no doubt that access to modern communication media transforms men's and women's lives by providing a 'window' to another world – with different ways of doing things and different ways of behaving based on different values. The (desired) transformations can create further

[30] Annecke (undated) reports that children in South Africa used TV to improve their English accents.

'gender tugs of war' and do not always benefit women.[31] As in the closing paragraph of section 4.1, we caution against drawing hasty conclusions about correlation and causality for observed changes and access to television and radio. Both Annecke (undated) and Matinga (2010), based on observation, question to what extent people are listening to what is being said – that both TV and radio often merely provide background noise; although there may be practical functions such as providing company for women alone in the house (Matinga, 2010).

4.3 Modern stoves

At the household level, there are three main reasons for development agencies to promote modern stoves: improved health; reduction in drudgery and time saved; and for households which purchase fuels, financial savings. While these are also motivations for households to adopt stoves, another driving force is that of status. This section examines the evidence of interventions to promote modern stoves and their impact on these factors with the exception of financial savings since this is the focus of a companion paper. The term 'modern stoves' is taken here to mean fuel efficient wood or charcoal-burning stoves, or stoves using new energy sources such as LPG, electricity and solar energy. Environmental issues, such as natural resource degradation, are an additional reason at the regional or national level for promoting modern stoves, but are not part of the analysis presented here.

It is well-documented that indoor air pollution (IAP) from burning wood, animal dung and other biofuels is a major cause of acute respiratory infections (ARI), which constitute the most important cause of death for young children in developing countries (Murray and Lopez, 1996). Through its effect on respiratory infections, indoor air pollution is estimated to cause between 1.6 and 2 million deaths per year in developing countries (Smith, 2000). Most of the deaths occur in poor households, and approximately 1 million are children (Smith, 1993; Smith and Mehta, 2000). There is strong evidence that the household solid fuel (HSF) smoke is a significant risk factor for three important diseases: acute lower respiratory infections (ALRI) in young children, chronic obstructive pulmonary disease (COPD) in adult women, and lung cancer, but the evidence is only strong for coal smoke (Smith *et al.*, 2005). Despite this data, ARI linked to IAP is not a specific target in MDGs 4 and 5.

In a comprehensive review of research on IAP and interventions to reduce pollution levels, Bruce *et al.* (2006) conclude that communities most at risk exhibit low awareness of the dangers of IAP. In Matinga's detailed study of two South African villages she found that while women recognised the immediate effects of smoke, such as headaches, coughing and sore eyes, very few were aware of long-term health impacts and certainly not the links with morbidity. This lack of linking health impacts to IAP may be due to the long latency of clear adverse effects of the illness that occur in adults due to long-term exposure to IAP (Masera *et al.*, 2000). The women in her South African villages would often sit in smoke-filled kitchens, at levels which Matinga found intolerable for conducting her interviews. When challenged about their tolerance of such conditions, the women replied: "*we are used to it – we grow up in smoke*" (Matinga, 2010). Respondents said that reducing smoke levels could be done by opening windows, although in practice it was rare to see this happening.

What is of concern is the reaction of the clinic staff. Nurses and programme managers of health services are trained in western conceptualisations of illness, and prioritise health issues from this perspective. In her study in rural South Africa, Matinga (2010) found that none of the health programmes and activities in the region where her villages were located incorporated issues related to firewood collection and IAP. The programme managers and nurses reported that this was because it was not part of their training or in their professional discussions, since this is "*just women's work*". The narratives of the nurses generally framed smoke as a minor irritant that women are used to. This means that the serious health issues described above in relation

[31] For example, women's workloads have increased because the images they see on television have created new standards for cleanliness (Standal, 2008).

to women's collection and use of fuelwood go unrecognised, non-prioritised and untreated.

Most of the available evidence for assessing the effectiveness of interventions to address IAP deals primarily with the effect on IAP levels rather than impacts on health. There is limited evidence about the effects as a consequence of personal exposure, which tends not to be gender disaggregated (Bruce *et al.*, 2006). A failure to consider gender aspects risks missing possible differences in exposure levels. Depending on culture, boys or girls will spend more time in the kitchen and hence siblings will have different exposure levels (Matinga, 2010). The implicit assumption is that the cook is a woman. However, this might be an erroneous assumption and neglect men's exposure since families are reported to eat together in smoky kitchens. In areas where space heating is provided by the stove, all family members will suffer exposure, although probably to varying degrees. Matinga (2010) criticises these studies for their failure to address the gendered nature of the diseases arising from IAP; i.e. how the social, cultural and historical positions and roles of women and men affect these outcomes. There is no doubt that kerosene, LPG and electricity have lower IAP levels than biomass. However, both kerosene and LPG do produce levels of indoor air pollution and have a different chemical composition from biomass fuels. Again, there is less information about the health impacts of these fuels than for biomass fuels.

Electricity is used for cooking mainly by higher income households, although urbanisation may have an influence in lower income households. In rural South Africa a study of an electrified village in the North West province found that 3.6 years (on average) after connection to the grid, 44 percent of the electrified homes had never used an electric cooker (Rollin *et al.*, 2004). In a poor urban township in South Africa, 216 of the 250 households surveyed (or 86%) had an electric stove or hot plate. These were much appreciated by women since cooking with electricity was faster than with kerosene (Annecke, undated).

There are other less reported health risks of open fires and stoves, such as burns and scalds. Children are particularly prone to accidents in the kitchen (Bruce *et al*., 2006; Matinga, 2010). Indeed burns were found to be the leading external cause of death for children under the age of one in South Africa (Butchart, 2000 cited in Matinga, 2010). Children are also at risk from paraffin poisoning. Accidental ingestion of paraffin has been attributed to the fact that it is kept in containers previously used to store milk, cold drink bottles, cups, jam and condensed-milk tins, within easy reach of adventurous children (Kossick, 1961 cited in Matinga, 2010). The most extensive studies have taken place in South Africa, where an estimated 4,000 children died from paraffin poisoning in 2000 (Butchart, 2000 cited in Matinga, 2010). The evidence suggests that in the under-five age group, more boys suffer from burns and paraffin poisoning than girls, while in the 10-14 age group it is predominantly girls who suffer from burns. In adults, women account for approximately 88% of burns. Men suffer burns from stoves when they are drunk. This gender difference in burns has been attributed to the gender division of work coupled with poorly designed stoves.

As was mentioned above, collecting firewood under the gender division of labour is generally considered a woman's task, and this is usually done manually.[32] However, when men become involved in this task, animal or mechanised transport is more common. Women start collecting fuelwood when they are girls, sometimes as young as 6 (Wilson, 1961; Matinga, 2008), and this may continue until they are well over 70 years of age. Daily loads of 20kg or more are carried over several kilometres – and depending on the location, this can include hilly terrain. There is evidence of back pains, eye and chest problems and high rates of miscarriage, as well as frequent falls, bone fractures, headaches, rheumatism, anaemia, and internal disorders – all related to carrying fuelwood (Haile, 1989; Haile, 1991 cited in Matinga, 2010). In urban fuelwood markets, men also carry heavy loads and are at risk from injury. In an extensive

[32] In developing countries, people manually carry firewood in three main ways: the first is by carrying the wood on the head (often referred to as head-loading), the most common form; the second is to strap a *tumpline* (a band) across the forehead, which is then tied to a pile of firewood (e.g. in a basket), a method that is common in Asia and parts of West Africa; a third way of carrying firewood is by using a sling across the waist, tied at the back like a satchel (Matinga, 2010).

review of the literature, Matinga (2010) found that the health consequences of such strenuous work are a considerably under-researched field by medical science. There is therefore a need for a similar type of research as that applied to IAP to understand the nature of the health effects.

The reduction of drudgery on the acquisition of a new stove comes when fuelwood collection is reduced or abandoned. However, whether households completely abandon fuelwood or charcoal has been questioned. It is now more generally accepted that many households, at all income levels in both rural and urban areas, use multiple fuels for a variety of reasons (e.g. household energy, security and cooking styles) (Masera, *et al.*, 2000). As was pointed out above, within the cooking cycle –from fuel collection to clearing away pots and pans– time saving primarily comes from a reduction in time spent on collecting fuel. When switching to cleaner fuels, the time saved in the kitchen appears to come from less effort needed to cleaning pots and pans, since they are no longer caked in soot and ash, while there are doubts about the amount of time saved in cooking (see section 3.2). However, in rural areas, kerosene and LPG often need to be fetched from town, which can take from a day to several weeks for LPG (Masera *et al.*, 2000). The time saved on this chore is one of the benefits women in Sri Lanka cited for electricity (Ramani and Heijndermans, 2003).

Kitchens are considered cleaner after a switch to modern fuels. Cleanliness, reduction in drudgery plus the status of switching to a modern fuel (kerosene to LGP) are reported as giving women in poor areas of Yogyakarta the feeling of modernity (Saptyani, 2010). However, in Mexico it was found that improvements in household income do not necessarily lead to lower levels of pollution and increased cleanliness in the kitchen. In rural Mexico, low-income households have mud floors which, with increased affluence, are gradually cemented over which allows for easier cleaning; and to improve air circulation indoors, vents are added to the roof in all rooms of the house – except in the kitchen. As a consequence, the kitchen does not benefit from removal of any smoke and hence improved hygiene (Masera *et al.*, 2000).

Modern stoves can have an impact on family relations, in particular on the role of women. In rural Mexico, cooking on open fires usually means that women stay alone in the kitchen while the rest of the family eats elsewhere; however, this changes when a new smokeless stove is bought (Masera *et al.*, 2000). Similar effects are reported in Afghanistan (Standal, 2008). In many societies, the cooking fire is seen as the social hub of the family, allowing the women of the household to socialise with their families. This was seen as one of the reasons for the rejection of solar cookers in South Africa –since their use required a shift to cooking outdoors which can lead to a breakdown of the social web– thereby weakening women's influence within the family (Green, 2001).

Solar cookers have attracted a lot of interest since they use a free resource, the sun, which is particularly abundant in regions of the world where there is considerable poverty, such as in sub-Saharan Africa. There appears to be very little impact literature on solar cookers with any sort of gender analysis. Indeed, few solar cooker projects have been independently evaluated (GTZ, 1999). However, it appears that as soon as a project has ended, most people stop using their solar cookers regularly.

Although the economic benefits of household energy interventions –the third rationale for promoting improved stoves– is not the focus of this paper, we would like to briefly comment on this issue. There is substantial evidence to support the assumption that households in monetised fuel markets save on energy bills through adopting more fuel-efficient stoves or by switching to more efficient fuels.[33] The EnPoGen study reported that newly electrified households in Sri Lanka may halve their energy bills, and in Indonesia reduce them by up to 70 per cent (Ramani and Heijndermans, 2003). In Bangladesh, average monthly expenditure on

[33] The EnPoGen study report pointed out that in poor households, fuels or electricity for lighting are often the main cash expenditure on energy, and the proportion of this expenditure in the household budget can be significant (Ramani and Heijndermans, 2003).

kerosene in electrified households was only Tk. 28.3 compared with Tk. 65 in non-electrified household (Barkat *et al.*, 2002). However, in the medium- and long-term, these savings are offset by increased electricity consumption from greater appliance use.

We conclude this section by saying that modern cook stoves as a mechanism for transformation primarily address women's practical needs and have a welfare function. Modern stoves reduce drudgery linked to fuel collection and cleaning but time poverty is limited to collection. However, there is a danger that solar cook stoves, which require a switch from cooking indoors to cooking outdoors can undermine women's influence within the family. At the moment in time where many family decisions are taken, women are then removed from the decision-making arena. However, fuel efficient stoves that allow cooking in a smoke free kitchen might contribute to strengthening women's position in the household. Improved women's and children's health is a driving force behind many stove programmes. There is a substantial body of high quality scientific research on IAP. There are three aspects in relation to the use of modern cook stoves and biofuels that concern us: firstly, there is an assumption that health is improved as a consequence of reduced levels of pollution. We think that it is imperative that this assumption be verified; secondly, men's exposure to IAP is largely neglected; and thirdly, the focus on IAP is only one part of the gender-health-energy nexus. There is an urgent need to conduct research of the same quality on the health impacts of the other parts of the fuel chain (for example, spinal injuries and sexual violence).

5 INFLUENCING BEHAVIOUR TOWARDS THE UPTAKE OF MODERN ENERGY AND ITS TECHNOLOGIES

In the preceding sections, we have identified how energy interventions influence gender roles and relations, and the impacts that these can have on endowments, income generation and agency. In the next sub-section (5.1), we identify the determinants that influence these changes. We then analyse how informal and formal institutions influence these (see 5.2). In the final sub-section (5.3), we examine how modern energy and appliance acquisition and use are prioritised within the household.

5.1 Determinants of and constraints to the uptake of modern energy and its technologies

Although the focus of this paper is the influence of non-economic factors on equity in access to modern energy and its technologies, we agree that family finances are a key determinant in the uptake of modern energy fuels and technologies. However, it is how the use of those family finances is determined, who makes the decisions, whose preferences are prioritised and how those decisions are influenced –particularly in terms of intra-household negotiation– which is very much rooted in gender relations. Therefore, any attempts to make energy interventions at the household level cannot neglect gender issues. It has been a surprise in reviewing the literature, how little attention in the energy sector is in fact given to gender. Household evaluation data are still not gathered in a gender disaggregated way, which limits the analysis and leads to unexpected outcomes. These outcomes are not always positive for women even when they are the specified beneficiary. There is nevertheless a substantial and growing literature on women and energy. However, while assessing the extent to which many aspects of practical and productive needs are met, this type of analysis misses out on women's empowerment and changes in gender relations. It also misses men's priorities and their influence on household dynamics.

The value of women's labour can be the determining factor in the uptake of improved cook stoves or fuel switching. For example, there has been a much better uptake of improved stoves in China than in India. In rural China, there are income generating opportunities for women

which are considered more valuable to the household than using women's labour (and hence time) to collect firewood. Income generating opportunities of a comparable level (at least at the time of the reported research) were lacking in rural India (Nathan and Kelkar, 1997). Even in monetised fuel markets, the opportunity costs of women's time can promote fuel switching (Sathaye and Tyler, 1991 cited in Masera *et al.*, 2000). This argument about the value of women's time has also been used to explain why, even where there are modern fuels available, for example in Pakistan, these fuels have not been adopted even among higher income groups (Nathan and Kelkar, 1997). An alternative explanation for this is that in high-income households, cooking is not the responsibility of the senior woman in the household but the task of a relative or hired help. The cooking medium is then not a priority issue.

However, households do not always buy the energy technology themselves. Sometimes, stoves and small electrical appliances are gifts from family members (Annecke, 1999; Masera *et al.*, 2000). In Mexico, families use these items as a status symbol to show the family's progress. There are similar findings in Indonesia, South Africa and Zanzibar (Saptyani, 2010; Annecke, 1999; Winther, 2008). However, it is not clear to what extent status is actually a determinant of uptake.

Another way that households obtain energy technologies is through programmes that have either given the technology away for free or at a highly subsidised rate. This has proved to be damaging when there is a switch to a commercialised delivery mechanism, when households become reluctant to pay the full market price (Masera *et al.*, 2005). As was pointed out in Section 4, the introduction of new technologies in what is culturally construed as women's sphere of influence can lead to gender tugs-of-war and male resistance.

Not meeting expectations can be a deterrent against the uptake of modern energy technologies. Women in South Africa were disappointed that their solar home systems could not power their kettles or irons, which would represent time savings (Annecke, 1999). In grid-connected areas men felt that the power supply was unreliable and not of a sufficiently powerful supply to drive equipment such as grinders and drilling machines (Annecke, undated). Despite the extensive literature on stoves cataloguing women's preferences for features of a stove to match their cooking practices, there still seem to be problems in designing stoves to meet expectations.[34] Indeed, GTZ points out that there is only one thing all cooking traditions have in common: they are all different (GTZ, 1999). Masera *et al.* (2000) consider that culture is reflected in cooking practices and that this is a strong determinant in the uptake of technologies. While LPG has many benefits, the stoves are not suitable for cooking tortillas in the quantities required for a family meal, and their use considerably increasing women's time in the kitchen (the available LPG stoves cook two tortillas at a time compared to the traditional stove which cooks eight). The taste of food is not the same when cooked on LGP.

In urban South Africa, where low-income households do cook with electricity, there is a lack of an appropriate-sized, robust and affordable stove (Annecke, 1999). In Indonesia, there were concerns about the safety of LPG because of reports in the press about exploding stoves, which was deterring some women from using LPG (Saptyani, 2010).

5.2 Informal and formal institutions, and intra-household decision-making

The formal institution that appears to play a significant part in enabling transformations in women's lives is the legal system. Strong laws that promote and protect women's rights and gender equality have been shown to initiate transformations in gender roles and relations, for example, in South Africa and Tunisia. The most significant energy service in this respect is

[34] The problem of marginalising women in stove design is nothing new. The history of stoves in the UK showed that when R&D about stoves became centred on laboratories, the development of the technology went from being controlled/managed by women (the cooks) to men (the scientists) (Crewe, 1997).

information provided by TV and radio. Both women and men are more aware of the situation, and this is leading to changes in behaviour. However, the extent of change is not always clear and men are sometimes resentful of these changes, feeling that they undermine their status. The media need to reflect a range of perspectives since state-controlled media may be selective about the issues they promote. For example, in Zanzibar, women who rely only on the state-controlled media are not aware of their human rights since this issue is not promoted (Winther, 2008). In this case, the legal system regarding inheritance and divorce rules is partly what contributes to women not benefiting from electricity to the same extent as men, and hinders positive transformations in women's lives.

It would appear that electricity is certainly playing a part in making men more willing to help women with domestic chores, so it is influencing change in gender roles to some extent. Men also seem pleased that they can cook and make drinks for themselves at their own convenience. Nevertheless, women still bear the burden of most household chores. Annecke concludes that "*it is clear that gender equality is not only a matter of meeting material needs and offering equal opportunities, it is also necessary to meet emotional needs in an accepting cultural environment*" (Annecke, undated: 44).

The question that therefore arises is: why is there so little support in terms transformations in women's lives from formal institutions in the energy sector? The energy policy of most countries is gender-blind[35] and does not provide the supporting framework that is required to meet gender needs in energy (Clancy, 2009). A good example of this blindness leading to a lack of support for appropriate interventions is the lack of awareness amongst policy makers about the impacts of IAP (Bruce *et al.*, 2006); and as we have highlighted in this paper, the lack of knowledge or understanding about other health issues related to biomass collection. This translates into a lack of awareness raising programmes to promote the benefits of improved cook stoves or modern energy carriers. This is in marked contrast to the radio and TV programmes promoting infant and maternal health.

The macro- and micro-levels are mediated at the meso-level by public, civil society and private sector organisations. These organisations are involved in the collection and interpretation of micro-level data to be translated into policy. Policy in turn is implemented at the micro-level by these organisations. The world view of these organisations influences the translation and implementation of policy. Energy policy has tended to focus on serving macro-economic goals, with an emphasis on the supply side through large infrastructure projects. Success tends to be measured in quantitative terms, such as percentage of households with access, and rate of connection. Technologies are considered to be neutral in the sense that everyone can benefit equally from access to modern energy services. When the demand side is considered, consumers come into the analysis. At the household level, women's role is recognised in the provision and use of energy from which it is assumed that women will automatically benefit from energy interventions and newly available energy services. For example, the introduction to a volume on rural electrification states: "*[W]omen and children as a group benefit more from rural electrification than men*" (Barnes, 2007: 8). However, evaluations of energy interventions, including household stoves, rarely evaluate the veracity of the assumption that women benefit from access to modern energy; instead, such evaluations refer to 'consumers', 'people' or 'communities'. In other words, energy policy is formulated and implemented in a gender-neutral way: it is assumed that women and men benefit equally from energy policy interventions. This observation might be surprising in the light of the 1995 Beijing Platform for Action which called for governments to take gender perspectives into account in policy formulation and implementation processes. Why is energy policy gender-blind? An explanation lies in the organisations of both the energy sector and gender experts who would be involved in

[35] An approach/strategy/framework/programme/policy may be defined as gender-blind when the gender dimension is not considered, although there is clear scope for such consideration (UNEP, undated). Although gender-blindness might be seen as treating men and women in the same way since no group is given special consideration –because the world in which such an approach has to be implemented is a gendered world– such an approach will affect women and men equally and can lead to programme failure.

mainstreaming gender into energy policy and practices.

Energy policymakers tend to be men. Energy organisations both in the public and private sector, as well as civil society (such as NGOs dealing with energy) tend to be male dominated, particularly in the professional posts. This male dominated structure results in men talking to men about energy issues. As a consequence, the fora where the issues are identified, and any potential solutions proposed, tend to have an inadvertent male bias. Where women have held senior posts in ministries of energy, for example in South Africa and Uganda, gender issues have tended to have a higher profile (Feenstra, 2002).

There appears to be reluctance by professionals in the energy sector to engage with gender mainstreaming. An evaluation of experiences of gender mainstreaming in a number of multilateral development organisations found that although many economists and engineers would accept welfare and efficiency approaches to meeting women's energy needs, they found meeting equality or empowerment goals through energy policy more difficult to accept. While many are not against gender equity, these professionals often did not see the relevance of gender to their work (Christian Michelsen Institute, 1999). Some consider that "*equality of the sexes is a matter of local culture and political concern*" (Skutsch, 1998: 947) while others consider that equality objectives cannot be reached through individual projects but through education and social movements.

However, gender mainstreaming requires not only an awareness of gender issues in energy, but also knowledge of procedures and ways of working by which gender matters can be incorporated in the regular process of planned development. This is the role of gender experts. However, from their side, there appears to be a reluctance to engage with the energy sector, which is in contrast to other hardware dominated sectors such as water and ICT. This could be due to a lack of awareness of the gender issues related to energy. Firstly, there is a lack of gender disaggregated data related to energy. Secondly, gender experts tend to have a social science background and until recently –as was mentioned in section 2– there has been little interest in energy issues. As a consequence, ministries responsible for gender mainstreaming do not prioritise the energy sector.[36]

Gender relations are embedded in informal institutions. It is here that we can see that there is still very limited change. Men still make the decisions about the adoption of modern energy technologies; men's preferences therefore take precedence over women's choices. The literature reviewed here provides numerous examples, such as: a new radio will be bought before a fuel efficient stove (Meikle, 2004). While women in urban South Africa have gained more control over income, especially if they earned it themselves, they seldom spend the money on themselves, apart from a few trinkets. Although factors such as women having their own income, exposure to modernity and education might in some ways affect energy use, gender –including women's definitions of feminities and men's definitions of masculinities and how these are enacted and interact– may override other external factors (Matinga, 2010). For example, traditional property rights, rather than formal legal systems, can govern a family's ownership of property, which can influence which electrical items are bought. In Zanzibar, women did not generally own such items, due to inheritance rules which favour men; nor do women receive them as wedding gifts, since in the advent of divorce, these are the property of men (Winther, 2005).

Culturally, it is the perception of women (what it means to be a "*good woman*" or "*good mother*") by both women and men that acts as a constraint. While women may be respected for their knowledge about child care and other domestic matters, they can be seen to be "*without knowledge*" for participating in traditional decision making fora (Standal, 2008). Therefore, at one level, the lack of consultation with women in Zanzibar, as reported in Winther's case, about

[36] See Kealotswe (2006) for a detailed description of the lack of contact between the two sectors in the processing of gender mainstreaming in the energy policy of Botswana.

electrification becomes understandable. However, at the meso-level of energy professionals, in the context of international commitments on gender mainstreaming, that position becomes more difficult to defend.

While the acquisition of material assets can proceed relatively quickly, social attitudes towards gender relations can be slower to change; for example in rural Afghanistan, while there is growing understanding by men of women's lives through access to TV, new perceptions of women have not translated into an acceptance of girls being taught by male teachers (Standal, 2008). As can be seen in South Africa, challenges to men's balance of power in their gender relations meet with resistance (Annecke, undated).

Gender relations are about asymmetries of power between men and women. Power relations, and hence gender relations, change over time and under particular conditions – being subject to fluctuations of emotional and physical wellbeing, as well as in material conditions and the ability to negotiate or bargain. These negotiations take place in private spaces –the home– although they are shaped by the social context with its norms and values in which the home is embedded. The home is where women exercise their power, even though men make the decisions about many aspects of family life. In the EnPoGen study, it was reported that women in the study area had heard about new improved stoves from relatives in their mothers' villages. While men were generally said to make the decisions about such acquisitions, women persuaded their husbands to buy one of the same design (IDS, 2003). It is also an explanation about why women may initially be enthusiastic about solar cookers since they see immediate practical benefits of time saving and cleaner kitchens, but then abandon them when they realise that a move out of the kitchen physically removes them from their sphere of social influence. However, this is rather more a manifestation of women's agency to bring an important improvement to their daily lives rather than representing a transformation of gender relations. Achieving gender equality is a process and as the feminist literature shows, it is not achieved without negotiation and struggle (Cornwall and Edwards, 2010).

The home represents for many women a space of personal fulfilment and meaningful social relations as defined by the social context. Energy technology interventions in the literature appear to contribute to the personal fulfilment of the good wife and mother by providing a cleaner home. Some may be concerned that this in fact reinforces gender roles, albeit lightening the drudgery aspects, rather than challenging gender relations. However, this sense of personal fulfilment contributes to women's psychological empowerment which increases their self-confidence and assertiveness. Men in rural Afghanistan reported that women became more assertive (Standal, 2008). It is possible that changes is gender relations are taking place but at a pace slower than the time frame for post-intervention evaluation.

5.3 Understanding how users see issues related to energy provision and use

Energy interventions contribute to the development discourse. An appreciation of how people experience, perceive, prioritise and respond to the various aspects of modern energy acquisition and use is crucial in understanding their reactions to development. Development is not universally welcomed by poor households since development brings with it a number of conflicts. Firstly, development is not a neutral process introduced into a neutral space; it enters a social world where traditional practices –which exist because they serve a specific and culturally valued purpose, where this purpose is explicit or hidden in rituals– are displaced. As a result, some aspects of development may be accepted, while other parts are rejected. Masera *et al.* (2000) consider that this is why households in rural Mexico do not completely switch to LPG but continue to keep their traditional socialising spaces (e.g. the old kitchen) and their most important traditional cooking practices which use fuelwood. From a cultural perspective, this multiple use of fuel enables people to maintain their own cultural space but also to control the direction of development.

Development is conceptualised as modernity marking a departure from the traditional, but such a departure has different meanings for different people, and this may result in tensions between individuals played out in different social spaces. At the household level, there are tensions between women and men, which have been referred to as gender tugs-of-war. These tensions are not always articulated, but manifest themselves in other ways. Men resist or do not prioritise the acquisition of energy technologies used in tasks that are considered part of women's roles when they feel that their status and authority –legitimised as part of gender relations– is threatened. Women also fear a loss of cultural identity, for example by being judged lazy if they switch from traditional wood stoves to modern LPG (see Matinga's case study). The switch would require a transgression of women's gender roles. To do this requires considerable empowerment in the sense of power from within.

Tensions also exist between the increasing adoption of western values (of modern energy) and the maintenance of what has been described as 'the autonomous culture' of indigenous people; i.e. the material, symbolic, ideological, and organisational elements that indigenous groups consciously maintain to keep control over their own cultural spaces (Bonfil-Batalla, 1990 cited in Masera *et al*., 2000). In South Africa, tensions between the traditional values of the fireplace and the other (new) values of watching TV are resolved by watching it while sitting around the fireplace (Matinga, 2010). In the Zanzibar case, these tensions were resolved by re-organising the gender segregated seating arrangements to allow male and female guests to enjoy together the newly acquired status symbol: the television (Winther, 2008).

The tension between western values of understanding and traditional ways of understanding, in which the latter predominate, –and not always to women's advantage– can be seen in the two case studies presented here. The health professionals in Matinga's South African villages used their cultural narrative to explain women's coughs, sore eyes, etc. whereas their western narrative should have made the linkage with smoke from biomass combustion. The electricity project developers in the Zanzibar case did not challenge the cultural narrative that technology is a man's domain and women lack 'appropriate knowledge' to participate in planning the electrification process. As a consequence, women's needs were not prioritised in both cases.

6 CONCLUSIONS

We conclude the review by: firstly, identify gaps in the gender and energy literature; secondly, summarising the key findings from the questions posed in Section 1; and thirdly, evaluating the contribution that ethnographic research can make to inform decision makers in the energy sector about developing energy policy that contributes to gender equity in access to and benefit from modern energy and improved energy technologies.

The approach taken in this paper was to review only the literature that provided independent assessments of *gender* and energy projects. While this literature is not as extensive as the literature on women and energy projects, it is sufficient to draw conclusions about the outcomes of energy projects. It is not possible to fully evaluate women's empowerment or changes in gender relations without a gender analysis. We strongly recommend that project design, implementation, and monitoring and evaluation uses and produces gender disaggregated data as standard practice and avoids gender-neutral terms such as 'consumer'. This approach should even be adopted in domains such as cook stoves that are generally assumed to be women's sphere of influence. Gender disaggregated data help raise awareness and ensure gender equity goals are being met. This type of data (see below) can also offer explanations for why project outcomes appear as they do.

There are a number of gaps in the literature. Stove project evaluations in general miss gender analysis. This risks not identifying why stoves –which have obvious benefits of time saving and reduced indoor air pollution– are either not taken up or are abandoned shortly after a project finishes. There appears to be a tendency to neglect men's exposure to IAP due to assuming

their absence from women's space of the kitchen. It is a cause for concern since impacts on men's health may go unrecognised and untreated. Again related to health, there are no empirical studies on the impacts of modern energy or lack of it on the HIV/AIDS infected population; and none specifically on the connections between gender, energy and major diseases such as malaria. There are very little empirical data comparable with that for IAP about the impacts on women's health of daily carrying of heavy loads of biomass, which exceed ILO recommended safety standards, throughout their adult life. We consider that there is a need for epidemiological studies at a comparable level to that for IAP. Somewhat surprisingly, there is very little in the literature that evaluates the role of modern energy in income generation from a gender perspective. The focus has tended to be on women as entrepreneurs and the role of electricity in enterprise stimulation. The evaluation should be broadened to include men and other modern energy sources.

Access to energy provides benefits to women and men in terms of reducing the physical effort and the time taken to perform the tasks related to their practical and productive needs. In terms of gender roles, modern energy in general appears to be enabling women to fulfil their traditional roles in ways that give them satisfaction, judged according to the prevailing gender norms and values of what it means to be a "*good woman*". However, there are some tasks usually allocated to women which men are now prepared to assist with (such as ironing and preparing snacks and drinks), when they use electricity but not LPG. Men appear to take on the tasks which do not infringe on their ideas of masculinity (Winther, 2010), as well as those that serve their needs in a timely manner – without recourse to involving women in the household and reducing the possibility for creating, or further exacerbating, intra-household tensions (Annecke, undated). Reduced physical effort through mechanisation is not always to women's benefit since this enables women to take over men's productive tasks, which in turn creates an opportunity for men to migrate in search of better paid work. It should not be assumed that this will lead to increased remuneration to the household. Indeed, an unintended outcome can be that men's migration leads to women's increased time poverty because of the need to take on extra tasks. Our findings would agree with Kelkar and Nathan (undated) who considered that reduction in labour intensity does not inevitably lead to changes in gender roles.

Our assessment of the role of energy in income generation focused on whether or not women and men were responding to the opportunities that modern energy created for income generation. We did not look at the evidence about levels of income earned. However, it appears that women tend to remain in low-paid activities often based on domestic skills such as cooking and sewing. The reasons for this are well documented, for example, lack of access to finance, insufficient knowledge about technologies. Women need more than modern energy to participate in markets, they need their endowments built to help them participate. The multifunctional platform project in Mali is an example of best practice in this regard with its attention to gender incorporated into the project methodology (UNDP, 2004). While women's economic empowerment was the main objective, gender relations in the local context were taken into account in the project design. The village chiefs (men) were used as the entry point, highlighting the benefits for the whole community. Women owned and managed the platforms while men were employed for some of the tasks, such as engine maintenance.

In respect of the issue of time saving, men use this as an opportunity for relaxation and entertainment. For women, there is no discernible pattern: some women prefer to invest this extra time in income generating activities, some in household chores, and others prefer to spend time with their children or for relaxing (Ramani and Heijndermans, 2003). This variation in priorities should not come as a surprise since women's empowerment is intended to give them a greater opportunity to choose and to exercise more control over their lives. When identifying opportunities for energy interventions with women as the main beneficiaries, which task is indeed the most time consuming should be assessed. It is not always fuelwood collection (nor is fuelwood collection always women's responsibility) – depending on the context, water collection and manual grain-milling can be more onerous (Winther, 2010). On the other hand, women in Zanzibar wanted a kindergarden for child care so that they could take up

new income generating opportunities (Winther, 2008).

In terms of changes in gender relations, there are indications of changes particularly brought about by access to electric light, television and radio. These assets result in women and men spending more time together. Indeed in Zanzibar men were choosing to come home to watch TV rather than stay outside socialising with their friends (Winther, 2008). This increased contact time between men and women is reported to improve understanding between couples and to increase women's status. The content of programmes is important in shaping perspectives about gender relations. Television allows entry by one sex into places normally 'forbidden' to another because of societal norms and values. For example, men in Afghanistan reported having a better understanding about women's work load and supported acquisition of labour saving technology (Standal, 2008). At a deeper transformatory level, television and radio educate women and men about women's human rights. The exact contribution to reducing violence against women is difficult to correlate as are other issues related to highly personal matters such as contraception. However, research in South Africa revealed the resentment that some men have towards women's empowerment, seeing it as a threat to men's status; or in other words, to the balance of power relations (Annecke, undated). These tensions will probably not be resolved quickly, and transformations in gender relations should not be assumed as a short-term outcome of electrification, but rather that they may come about gradually and in the long term. Three points should be borne in mind for awareness raising strategies: firstly, access to radio is more widespread than television; secondly, televisions tend to be owned by wealthier households; and thirdly, men's preferences in programmes dominate.

It is men who continue to make the key decisions around major purchases, including energy technologies related to women's sphere of influence. Therefore, energy interventions aimed at women should also involve men in shaping messages in ways that men can relate to; for example, about benefits to the household's finances.

Formal institutions, such as the law, do play a major part in women's empowerment. However, women need to have the 'power within' in order to use their agency for obtaining their strategic needs. The role that energy can play in meeting women's strategic needs has been questioned (Skutsch, 2005). Indeed, empirical evidence is lacking to demonstrate correlation in the claim that energy helps meet women's strategic needs through lights in the streets and in evening classes, enabling them to build their social and political capital. This is an area which needs more exploratory research.

The support from the formal institutions of the energy sector for transforming gender roles and relations is weak. There is a lack of involvement of women in the design, production and marketing of energy technologies targeted at women. This is not a new finding, but the situation continues to be perpetuated. In several of the studies reviewed, people wanted to be consulted beforehand about interventions (Annecke, 1999; Winther, 2008). There are contrasting outcomes in the case studies from South Africa and Zanzibar, in relation to grid extension. While women in South Africa participated in the consultation process in their village and were able to argue for their house to be included in the connection plans, women in Zanzibar were not consulted and their needs were not met. In the latter case, two important spaces for women (the mill and the kindergarten) were not electrified. This missed the opportunity to reduce women's waiting time while their grain is milled, which was one of the opportunities that has been identified as creating significant time saving for women.

In part, the lack of attention to gender in the energy sector can be explained by a lack of awareness of the need for gender mainstreaming due to: firstly, the lack of gender disaggregated data; secondly, the lack of awareness on the benefits to be gained from incorporating gender analysis into energy project design; and thirdly, a lack of know-how on gender mainstreaming in the energy sector. There are a number of examples of best practice that can be used to overcome these gaps. Energia (the international network on gender and sustainable energy) has developed a methodology for engendering energy policy and

organisations, which has been used in a number of countries in Africa and Asia. The World Bank's AFREA Gender and Energy Programme and Norad's Oil for Development and Clean Energy Programmes are offering their partners 'Just in time' technical assistance at the project level, as well as the development of a portfolio of case studies to show the benefits of gender in energy projects.

There is still a lot we do not understand about the complex dynamics that are at play in the nexus between women, men, and energy services. We consider that there is a need for more in-depth studies to provide that understanding about what determines access to modern energy and energy efficient technologies – and how, once acquired, these promote more gender equitable outcomes. Moving away from the household as a unified model and examining intra-household decision making brings "*explanatory powers far beyond those of the current model*" (Bruce and Dwyer, 1988: 2-3).

We consider ethnographic approaches, in which the researcher is embedded for long periods in the community, and uses qualitative data gathering methods to understand the problems from the perspective of women and men in particular cultural settings, to be crucial. A long-term presence enhances the possibilities for gaining people's trust so that they are more prepared to share their concerns, desires and dilemmas, and in so doing, reveal issues that would otherwise not have been noted in questionnaire based surveys. The two ethnographic cases that have helped shape this paper have demonstrated the value of this approach. They have shown how unexpected and sometimes unwanted (from a project manager's perspective) phenomena emerge as a result of the acquisition of technologies using modern energy. For example, the acquisition of new stoves can threaten women's and men's cultural identities, leading to their abandonment (Winther, 2008; Matinga, 2010). Ethnographic approaches are revealing in terms of power relations and negotiations. While men still make decisions about the acquisition of household technologies –even those related to women's tasks– women are able to negotiate to obtain technologies which meet their needs, as with the women in China who acquired improved cook stoves (reported in the EnPoGen study) (IDS, 2003). Observation over extended periods creates opportunities to compare what people say they do and what people actually do; for example, as Matinga found discrepancy between claims that women would open windows to reduce smoke from cooking with smoky biomass, and never seeing this occur in practice. There are more opportunities to understand life and its contradictions, as well as the tensions between women and men from their perspective. This type of research is however not intended to displace quantitative surveys; both have their place in framing energy policy and its implementation.[37] We nevertheless appreciate that the complexities in terms of differences and diversity that are revealed by ethnographic research present important challenges for policy making. These challenges can be met by formulating energy policies on the basis of more widespread consultation with the communities that are intended to be the beneficiaries of policy outcomes, and by allowing women and men to prioritise their needs. This is in keeping with the wishes expressed by women and men in the studies in South Africa and Zanzibar who had not been consulted about energy interventions and as a consequence felt that their needs were neglected.

[37] For a detailed discussion of this perspective, see Chambers, R. and Mayoux, L. (2003) *Reversing the Paradigm: Quantification and Participatory Methods*. Paper presented at EDIAIS Conference on "New Directions in Impact Assessment for Development Methods and Practice", University of Manchester, 24-25 November 2003.

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