

**Title of the Study: GENDER MAP OF THE SOLAR ENERGY SECTOR  
IN NORTHERN PHILIPPINES**

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### **Abstract**

*In the face of increasing energy prices and the challenges presented by climate change, renewable energies have now become one of the most important topics on the political stage (German Energy Agency, 2010). Long before the Renewable Energy Bill was passed in 2008, the Philippines' Department of Energy (DOE), through its Rural Electrification Program, had already installed solar home systems (SHS) and solar battery charging stations (SBCS) in upland communities in the provinces of Abra and Ilocos Sur in Northern Philippines.*

*The operation and maintenance of solar technology lies on how the men and women in those communities handle this renewable energy, hence a gender map is deemed important.*

*Utilizing the Gender Analysis Framework of the Asian Development Bank (2002) and guided by the Actor-Based Model of Human Ecology by Orlove (1977) and the "Structure of Constraint" concept by Folbre (1997), the research involved 337 respondents to determine who, between the men and women, are more involved in the various activities affecting their lives as well as who can access and control the resources necessary for their survival.*

*Social factors, namely: demographic, economic, cultural, and institutional factors were considered in the study.*

*Reproductive activities such as housekeeping and taking care of children are done by the mothers while community and leisure activities involve both men and women. For the productive activities, men dominate in the pre-operation, operation and maintenance of the solar energy systems.*

*Resources, such as materials, and labor are mostly availed of and controlled by men while capital and credit are mostly controlled by women. There was no training conducted regarding solar technology.*

*Respondents find the materials available but unaffordable. Technical assistance is non-existent but the system is simple and its process is comprehensible.*

*Social factors are related to the men and women's involvement in reproductive, community, leisure, and productive activities as well in their access and control of resources namely capital, materials, labor, and credit.*

## **Background of the Study**

In 2007, the Department of Energy (DOE) predicted that Luzon's power requirement would increase from 8,302 MW in year 2006 to a critical level of 9,721 MW by year 2010 which requires additional power sources. This was seen as a key opportunity to develop other energy potentials which would translate into savings from imported fuel.

The following year, 2008, the Renewable Energy Bill was passed which provides incentives to renewable energy developers. It has been three years since the Philippine government mandated the harnessing and utilization of renewable energy (RE) which is evident in the power sector where increased generation from geothermal and hydro resources has lessened the country's dependency on imported and polluting fuels (<http://www.doe.gov.ph/ER/Renenergy.htm>). In the government's rural electrification efforts, on the other hand, renewable energy sources, such as solar, micro-hydro, wind, and biomass resources anticipated wide-scale use. For many Filipino families, RE has provided electricity and power for water pumps and continues to serve the needs of agriculture, small industry, homes, schools, and other communities.

In rural and low-income urban households, energy is 'women's business'; women are responsible for providing energy, and they use it for domestic chores and productive activities. However, the poor quality fuels many women use contribute to their poverty, ill health, and level of drudgery. Despite these negative impacts, energy policy remains gender-blind. This can be attributed to the invisibility of women's needs to energy planners, stemming from a lack of appropriate gender-analysis tools to meet the particular data requirements of the energy sector (Clancy et al, 2007). Women are also the ones most affected by the energy crisis (Batliwala & Reddy, 1996).

To address the needs of both women and men in the energy sector, this study looked into gender structures, through gender mapping and analysis, of communities utilizing RE, specifically solar energy. Gender analysis or mapping is a term applied to identifying what individual women and men experience and the strategies they choose in their daily lives: the choices and constraints they confront are mediated by gendered institutions, norms and policy contexts, and discontinuities in gender relations (Sengendo 2007, as cited by Aquino, 2010).

The National Electrification Administration (NEA) reports that all municipalities in the Philippines are energized. However, there are still unenergized communities, particularly in remote areas, such as islands, islets and mountainous areas which cannot be reached by the electric utility grids. In Northern Philippines, electric cooperatives specifically the Ilocos Norte Electric Cooperative (INEC), Ilocos Sur Electric Cooperative (ISECO), and Abra Electric Cooperative (ABRECO) manage the provision of electricity but for off-grid areas, there is a need for alternative energy sources, such as solar systems. In 2000, the Philippines had an installed solar photovoltaic capacity of 567 kilowatt (kw). While the technical potential exists, prohibitive costs and the grid extension of conventional electricity hinder the commercial potential of solar home systems, which the DOE places at 500,000 (Maghirang, 2006). Based on the 2001 inventory of solar technologies, a total of 5,120 solar systems have been installed in different parts of the country. The DOE, particularly its Renewable Energy Management Bureau, is mainly responsible for installation of solar systems. The research and extension arm of the bureau in Northern Luzon is the Mariano Marcos State University – Affiliated Renewable Energy Center (MMSU-AREC) which caters to the provinces of Ilocos Norte, Ilocos Sur, and Abra. In 2010, the MMSU-AREC was granted a 2 million-peso research fund by the DOE-Gender and Development Fund to conduct Gender Mapping of the Renewable Energy Sector in Northern Philippines, which involves biomass, wind, hydro and solar energy sectors, hence this study.

The installation of solar home systems (SHS) and solar battery charging stations (SBCS) provides rural residents with increased access to energy and to better sources of energy for lighting and productive activities. These can have dramatic effects on women's education, literacy, nutrition, health, economic opportunities, and involvement in community affairs, with significant benefits for their families and communities as well. As per UNDP (2001), global evidence shows that the availability of illumination in homes can increase attainment of education and literacy among women and extend their working day to provide time for income-generating opportunities related to cottage industry activities and other home-based enterprises. Lighting in public places can increase the safety of women and communities, and can allow women greater access to public gatherings (Batliwala & Nathan, 2012). Installing solar lights in homes enables children to study in the evenings and improve school performance.

### **Statement of the Problem**

The study generally aimed to map the gender structures in the solar energy sector in Northern Philippines particularly in the provinces of Abra and Ilocos Sur. Specifically, it sought to answer the following questions:

1. What is the composition of the solar energy sector in terms of social factors, specifically: demographic, economic, cultural, and institutional aspects?
2. What are the reproductive, community, leisure, and productive activities in which men and women in the solar energy sector participate?
3. Who, between men and women, have more access to and control of resources?
4. What are the social factors related to the men's and women's activities, access and control profile?
5. What are the issues and concerns in the social energy sector that need to be addressed?

## **Significance of the Study**

The results of the study highlighted the gender structures in solar energy-based communities that yielded information on the roles of men and women in the productive, household, leisure, and community spheres, as well as their access and control of resources, such as capital, credit, labour, and materials. Such information revealed gender disaggregated data which are necessary to address the needs of both men and women, such as improving the efficiency of their productive roles and improving their role performance in decision making and in household and community affairs.

Moreover, since renewable energy is an essential ingredient in sustainable rural development, the study provides information on how to improve solar energy systems through the insights and suggestions of the users.

For policy planners and implementers, particularly the DOE through the MMSU-AREC, the results of the study would be useful in assessing if the objectives and methods for the renewable project, specifically for solar energy systems, should be enhanced or modified to improve the chances that the project will succeed and to ensure that both men and women have equitable access to and control of the project. Also, the results of the study can be used as springboard for bringing consultations and energy literacy to the barangays with the assistance of the academe, private sector, and line agencies.

Data can help electric cooperatives in objectively assessing their roles in providing electricity to far-flung areas through solar energy. These include ABRECO and ISECO. Also, they can aid manufacturers and suppliers of solar cells in knowing the demands of their products and address the needs of their clients.

Lastly, the study can aid researchers, extension workers, and legislators in their efforts to mainstream gender in their respective fields, which can eventually translate to more gender-sensitive social, economic, and political endeavors.

### **Scope and Delimitations of the Study**

The study tried to establish the gender structures in solar-based communities in Northern Philippines. Only the provinces of Ilocos Sur and Abra were considered since Ilocos Norte is already fully energized. Ilocos Sur and Abra utilize SHS and SBCS. The study also covered other stakeholders, such as the MMSU-AREC, ABRECO, ISECO, and the Barangay Power Association (BAPA).

The study focused on mapping and analyzing the involvement of men and women in reproductive, community, leisure and productive activities, as well as their access to and control of resources on solar energy systems. The mapping framework is closely patterned after the Asian Development Bank (ADB) Framework but some parts were modified to fit the local culture.

The involvement of men and women in the solar energy communities was measured through an instrument constructed particularly for this study.

## **Theoretical Framework**

In the utilization of resources and in the decision to get involved in various activities, an individual is governed by his/her own decision-making process. The present study was guided by the Actor-Based Model of Human Ecology as posited by Orlove (1977) and the concept of Structures of Constraint by Nancy Folbre (1994), as cited in the 2009 World Survey on the Role of Women in Economic Development.

The Actor-Based Model of Human Ecology claims that environmental adaptation is seen as the result of the outcome of thousands of individual decisions about how best to interact with the environment. The term 'environment' refers to both the physical environment (rivers, mountains, soil) and social/ecumenic environment (human activities such as migration, communication patterns, formation of social groups, etc.). Individuals are assumed to be constantly making choices about how to exploit available resources while coping with environmental hazards. Those who make correct choices will survive and prosper, those who choose less wisely will be selected against. Over time, the more successful adaptive strategies will become institutionalized as cultural norms.

The actor-based model with its emphasis on the processes by which people make decisions about how to interact with their environment is a valuable approach for understanding of how change occurs in social systems in response of environmental perturbations.

In the study at hand, the utilization of solar energy is a product of many individuals' decision to harness such resources. The actor, in this case, the user-beneficiaries of solar energy systems, constantly make choices and decisions in the operation and maintenance of their solar panels and battery chargers. Those who made correct choices have maintained their solar energy systems while those who did not have disposed of the facility.



To suit the study at hand, it was assumed that an actor's gender greatly influences his/her decision-making process thus the study adopted an Actor/Gender Based Approach.

Meanwhile, Folbre's "Structures of Constraint" refers to the norms and rules defining social relationships among different groups in society, which place some in positions of dominance over others and differentiate the choices available to them—including access to and control over resources. Gender-specific structures of constraint refer to the social norms, values, and practices which define inequalities between women and men in societies, generally allocating different roles and responsibilities and assigning a lower value to those aptitudes, capabilities, and activities conventionally associated with women. Gender-specific norms typically include the assignment of responsibility for reproductive work within the family to women and the primary wage-earning responsibility to men (2009 World Survey on the Role of Women in Development).

Such constraints also include the restrictions on women's movement in the public domain that prevail in some parts of the world, and stereotypes relating to women or men doing certain kinds of work or using certain types of technology. Men are as likely to face cultural barriers in taking up activities and occupations deemed "feminine" as women face in taking up those defined as "masculine". These constraints are not uniform across the life cycle, but can vary by age, marital status, and position within the family, as well as other factors.

Gender-specific constraints create inequalities in the distribution of valued resources and capabilities between women and men on the basis of ascribed differences. More pervasive forms of inequality relate to property and inheritance rights, productive assets and access to education, skills and paid employment. They generally favour men, who are perceived as the primary producers and wage earners, over women, who are regarded as secondary earners (World Bank, 2001; Grown and others, 2005, as cited in the 2009 World Survey on the Role of Women in

Development). While both women and men from low-income households may be disadvantaged in their pursuit of livelihoods by their lack of education, skills, assets and networks, gender often intensifies the effects of other social inequalities in access to resources and opportunities.

It is important to highlight the institutional, as well as the individual, nature of these constraints (Kabeer, 2008, as cited in the 2009 World Survey on the Role of Women in Development). Constraints may be imposed by institutions in the public domain as a result of active discrimination, unconscious bias or lack of knowledge. Institutions are bearers of gender-specific constraints when their principal actors reflect and reinforce, consciously or unconsciously, discriminatory norms and values which impose restrictions on women's choices. There are many examples of institutionally imposed gender constraints. Employers, both women and men, may discriminate in favor of men, who are seen as "unencumbered" by reproductive responsibilities, or use women's assumed status as secondary earners to justify paying them less. Discriminatory laws, policies and programmes can reproduce gender inequalities through assumptions about men's primary wage-earning roles and women's domestic roles which often bear no resemblance to reality.

In the study at hand, it is assumed that while both men and women do participate in various reproductive, community, leisure, and productive activities, there are institutional and individual constraints that hinder their full involvement in these activities, as well as their equal access to and control over resources. In the use of solar technology, there are also structural constraints that hinder women's full involvement, access to and control of said renewable energy. Only when these constraints are minimized, or better yet, eliminated, will gender equality be achieved.

## Conceptual Framework

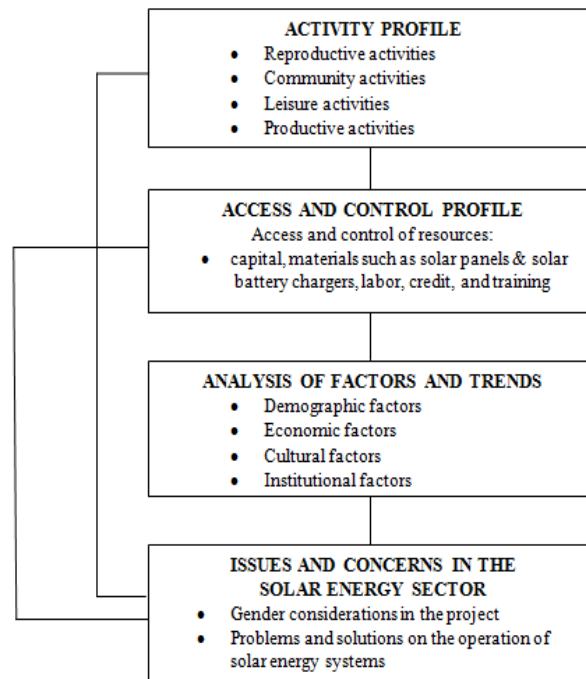
The study adapted the Gender Analysis Framework developed by the Asian Development Bank (2002) but with some revisions and modifications to suit the study's problems. Gender analysis implies recognizing that households and communities are not solitary units with undifferentiated labor resources, but in fact are made up of women, men, and children who may share, complement, differ or be in direct conflict in their need for or interest in improved technologies and social change. The ADB Framework has four parts and is carried out in two main steps. First, information is collected for the Activity Profile and the Access and Control Profile. Then this information is used in the analysis of factors and trends influencing activities and access and control, and in the analysis of issues and concerns in the solar energy sector.

The Activity Profile identifies what men and women do and where and when these activities take place. It seeks to answer the question, "Who does what, where, and when?" In seeking the answers to the question of *what*, mapping looks at the categories of activities in which men and women get involved.

The usual categories of activities include productive, reproductive, and community-related service. Reproductive activities pertain to child-bearing and rearing, and human resource maintenance activities in the household. Community work and affiliation to community organizations and attendant tasks comprise community-related service activities. For the study at hand, leisure activities are also included since engaging in recreation is part of one's life. Productive activities, in this study, include tasks in the utilization of the solar energy systems which include pre-operation, operation and maintenance of solar technology. Information on how much time (temporal) and how often these activities are being done were gathered. The question

of *where* attempts to know where the activities take place (spatial). Knowing the place indicates description and distance that suggests access and mobility.

The following figure shows the four main parts of the framework:



**Diagram of the conceptual framework in mapping the gender structure of the solar energy sector in Northern Philippines patterned after the ADB Framework (2002)**

(Source: [http://www2.adb.org/Documents/Manuals/Gender\\_Checklist/Agriculture/agri0400.asp](http://www2.adb.org/Documents/Manuals/Gender_Checklist/Agriculture/agri0400.asp))

The Access and Control Profile considers resources, such as land, equipment, labor, capital, credit, and training. It differentiates between access to a resource and control over decisions regarding its allocation and use. It enables planners to consider whether the proposed project could undermine access to productive resources, or if it could change the balance of power between men and women regarding control over resources.

The Analysis of Factors and Trends involves determining how activity, access, and control patterns are influenced by demographic, economic, cultural and institutional factors.

Demographic factors include household composition and household size, educational background, and other aspects. Economic factors include occupation, income, and assets. Cultural factors include attitude, knowledge, and aspirations in life. Institutional factors include involvement in organizations, and roles of service providers in the solar energy sector. These factors are correlated with the different activities and access and control profile to determine which among these variables are interrelated.

In the ADB Framework, the last box refers to the Program Cycle Analysis which indicates if and where the objectives and methods used by the project should be refined to improve the chances that the project will further succeed and to minimize the likelihood that women will be disadvantaged as a result of it. However, for the study at hand, Program Cycle Analysis was modified into Issues and Concerns which looks into the gender considerations in the project as well as problems and solutions in the utilization of solar technology.

Moreover, in the original ADB Framework, all the boxes are connected by arrows (↓) to specify that one part affects the other. However, in the study at hand, the arrows were modified into interconnecting lines ( | ) to show the interrelatedness of the different parts, not their effects on each other.

With the aid of the framework, gender disaggregated data among solar energy-based communities as to activities, access and control were generated. Moreover, the components of the SHS and SBCS projects determined male and female participation in the productive and community level.

Moreover, the “structure of constraint” concept by Folbre (1994) was also adopted to address the gender issues present in the ADB Framework. To illustrate, within the Activity Profile, there are gender-specific constraints that hamper either the men or women’s full involvement in these activities. In Access and Control Profile, there are also institutional

constraints that restrain women to have equal access and control over resources. Among demographic, economic, cultural, and institutional factors, there are also constraints that affect men and women's status in the community. Recommendations are forwarded to minimize or eliminate these constraints in the solar energy sector.

## **Presentation of Findings**

### **Social Profile**

**Demographic Factors.** Majority of the respondents belong to nuclear families with an average family size of 5 and average number of children of 3. Majority belongs to the Roman Catholic Church and almost all are *Tinguians* or *Itnegs* (the local ethnic community). The fathers and mothers have an average of 7 and 8 years of formal schooling, respectively which reveals that majority were only able to finish elementary level.

**Economic Factors.** The average total family monthly income of the respondents is PhP 6,564 (USD 147) where 96% earn between PhP 200 (USD 4.49) and PhP 28,467 (USD 639) monthly. Most of the fathers and mothers are employed with farming as their primary occupation. In terms of monthly income, the average income of the fathers from their primary occupation is PhP 2,319 while the mothers have PhP 1,907.

The solar-based households rely heavily on fuel wood since they are located in mountainous and forested areas.

Since the households are in off-grid communities, most of them do not have appliances. For those who can afford to buy appliances and gadgets, 30% have radios which are either connected to their 9-volt- batteries or are run by dry-cell batteries.

With regard to assets and properties, most of the respondents own their farmlands where they cultivate rice, vegetables, and root crops, with an average area of 6,000m<sup>2</sup>. Majority of the farmlands and residential lots are registered to the fathers. With regard to housing, almost half are considered semi-permanent, i.e. these houses are made of cogon, bamboo and wood which are mostly registered to the fathers. In terms of vehicles, very few respondents own one because most cannot afford it and the roads to their communities are mostly bumpy, dusty and rocky hence, vehicles are difficult to maintain. Lastly, the livestock owned by the respondents include cattle, carabaos, swine, horses, goats, and poultry (chicken, ducks and turkey).

**Cultural Factors.** The respondents are knowledgeable about solar energy systems. They are aware that solar energy system is non-pollutant, can be used in far-flung areas, and easy to maintain. They generally have favorable attitude towards solar energy system since they have been using them for quite some time and they have benefitted from them. In terms of aspirations, the respondents aspire for themselves to be healthy and to be rich, for their families to go to school and buy bigger house, appliances and vehicle and for their community to have better roads and bridges and to have more livelihood activities to further increase their income. For the benefits derived from solar energy system, all the respondents stated that through their SHS/SBCS, they have light at night which is very useful because children could study and parents could work longer hours. Also, the respondents do not have to buy kerosene gas for their lamps which consequently saves them some money.

**Institutional Factors.** Most of the fathers and mothers (both 84%) are active members of non-government organizations such as Farmers' Association and cooperatives for the fathers; and Rural Improvement Club or RIC, *Timpuyog ti Inna* and Women's Club for the mothers. The service providers for solar-based communities are the ABRECO, ISECO, and MMSU-ANEC,

which were tapped by the Department of Energy and by politicians to put up solar energy systems in Abra and Ilocos Sur.

### **Activity Profile**

For reproductive activities, women are more involved than the men in housekeeping, marketing, food preparation, cooking, washing clothes, ironing clothes, caring for the health of family members, teaching and guiding children, providing moral and emotional support to children and to spouses and paying bills and tuition fees.

For community activities, both fathers and mothers are involved in barangay fiesta, clean and green activities, barangay meetings, helping or assisting neighbors during occasions such as birthdays, weddings, baptism or wake/funeral, maintenance of peace and order, settling disputes or conflicts and maintenance for solar battery charging stations, except for maintaining charging stations, which only few mothers are involved with.

For leisure activities, most of the male and female respondents go to picnics, converse with friends and neighbors.

For productive activities, most men and women were not involved in all pre-operation activities which included planning/deciding to purchase solar panels or battery chargers, estimating cost, deciding to buy solar panels / battery chargers, choosing the location where solar panels/battery will be placed, preparing the location for the solar panels/battery chargers and the actual purchasing of solar panels / battery chargers. Meanwhile, for the activities under operation aspect, most of the men performed these activities such as wiping of solar panels, checking the battery's water level, bringing the battery to the charging station and bringing it home (activities which are for those with SBCS only), making sure that the solar panels are not shaded and are



exposed to the sun, making sure that the wires are properly connected to the appliances and contacting technicians when there are problems with the panels and batteries.

### **Access and Control Profile**

The study revealed that men have more access to and control of materials and labor while women are more involved in gaining access to and controlling credit. Men have greater access to capital but women control where this is spent. This shows that men still have more access to and control over the resources in the solar energy sector although women have still a vital role in deciding where and how to spend capital and credit, which are both financial resources. This indicates the important role of women in budgeting and allotting money for the different needs of the family.

### **Factors and Trends in the Solar Energy Sector**

The demographic and economic characteristics such as number of household members, age, civil status and highest educational attainment of the respondents and their number of appliances are related to their involvement in reproductive, community, leisure, and productive activities as well in their access and control of resources namely capital, materials, labor and credit. For cultural factors, only attitude and aspiration for the self and the family were found to be related to involvement in reproductive, community, leisure, and productive activities. On the other hand, knowledge and aspirations in life were found to be related to the men and women's access and control of resources. Moreover, the respondents' type of organization and type and degree of involvement affect their participation in reproductive, community, leisure, and productive activities as well as in their access and control of resources. Lastly, access and control of materials, labor and credit are related to the respondents' involvement in reproductive, community, leisure, and productive activities.

## **Issues and Concerns in the Social Energy Sector**

Men and women find that utilizing solar energy systems entail costly repair because technical experts are needed, and these are almost unavailable. Also, if their batteries bogged down, they would rather buy replacements if they have the financial resources, rather than have them repaired because that is more expensive. Some respondents have difficulty in installing and maintaining their systems. For instance, women find difficulty climbing the pole or the roof to clean and wipe the solar panels. Also, they need to make sure that little children cannot reach the solar panel and play with the battery. Some children would accidentally throw stones on the panel which can cause damage and breakage.

Those who have experienced these problems gave solutions to these. For those who found the solar energy systems difficult to install, they suggested that there should be an expert who would install the system and that the solar panel should come in handy packs so that they could ask a household member to assist them install it. For those who found the solar energy system difficult to maintain, their solutions were: to replace the destroyed battery and light bulb, and keep the panel inside the house. There were suggestions that trainings or seminars should be conducted to explain proper maintenance of the system.

As for gender concerns, the study revealed women have low involvement in the utilization and operation of solar technology. It was also noted that women have lesser access to and control over resources especially labor and materials. For women to have greater access to and control over solar technology and other important resources, they need to be empowered through orientation, trainings, and education. Women's equal access to and control over economic and financial resources is critical for the achievement of gender equality and the empowerment of women and for equitable and sustainable economic growth and development (2009 World Survey on the Role of Women in Development). This does not mean that men

should be ignored. Both men and women need to work hand-in-hand to fully utilize the solar energy system even as they perform their household and community obligations and responsibilities. Both genders are treated as partners in development hence, their contributions are equally important.

### **Conclusions**

Both the men and women in solar-based communities are involved in reproductive, community, leisure and productive activities. This implies that both genders participate actively, although in different degrees and frequencies, in all the activities, including matters which involve crucial planning and decision making at home; with the use, operation, and maintenance of the solar panel and battery, and charging station; in the farm; in the community; and even in leisure activities. Both the men and women in the solar energy sector see each other as partners in development.

The men have more access to and control over resources such as materials and labor, compared to the women. This implies that the fathers, even in communities in the mountains or in the hinterlands, and as practiced in the earlier times, are still looked up to in society as the overall influential persons and heads of their families who are given the power to access and control the resources of the family. However, women have more control over capital and more access to and control over credit, which are both financial resources. As for training, the respondents have no access over it. As for their non-access to trainings in solar energy systems, however, the result indicates that they had not been reached in the mountains or in the hinterlands because of the following reasons: the difficulty of reaching the place due to the rugged terrain; the scarcity/difficulty of transportation and communication facilities to be able to reach the place,

and to facilitate coordination with the residents; and that there is a lack of intervention efforts by the government to conduct trainings and other non-formal education strategies.

The different demographic, economic, cultural, and institutional factors as well as access and control over resources are related to the respondents' involvement in, reproductive, community, leisure, and productive activities. This implies that indeed, some personal, cultural, and institutional factors had been responsible in influencing the people in the communities, especially the women, with their involvement and/or non-participation to activities in the maintenance of the solar energy systems, activities in the house, farm, leisure, and in their respective communities. Therefore, the study was able to utilize the 2002 ADB Paradigm on determining the factors and trends that influence men and women's participation to activities as well as access and control of resources.

For the gender considerations in solar-based communities, the women, compared to the men, are a little less active in productive activities; and that they have lesser access to and control over resources. This implies that if the women were given enough opportunities and access to resources, these would no doubt bolster their strength in any aspect, especially in planning and decision making for the family and even for the community.

### **Recommendations**

Based on the findings and conclusions generated, the following are hereby recommended:

1. Since majority of the solar home systems and solar battery charging stations are not functional anymore, the ABRECO, ISECO, and MMSU-AREC technicians should conduct a follow-up and monitoring of these systems in order to be able to make sound recommendations for policy-making. For the communities in Ilocos Sur that

are already connected to the grid, thus the respondents do not use their SBCS anymore, the charging stations should be transferred to off-grid communities so the panels will still be useful. For the communities in Abra that do not use their SHS because of battery defects, ABRECO should conduct a follow-up about the status of their panels and batteries and if new batteries are needed, ABRECO and the concerned LGU must pool resources so that the SHS will still be relevant and useful in these communities.

2. The solar energy system must be revitalized, be made available to all the residents of the solar-based communities; and that government interventions, such as trainings and other non-formal education strategies, must be conducted so the residents would know the proper care and maintenance of the system, thereby ensuing for a longer lifespan of the solar panels, batteries, and other gadgets needed for the utilization of the solar energy.
3. Resources, such as capital, materials and credit, must be made more available to solar-based communities. Particularly, these should not only be made available to the males, specifically the fathers, but also to the females, or to the mothers, who are inherently the partners of the men, and who also do crucial decision making in the family. Since these solar-based communities are located in far-flung areas, the residents could not readily gain access to these resources which they need for their productive and livelihood activities. The LGUs, therefore, through the organizations present in the barangays, should provide funds and financial assistance to the residents. Women participation and leadership roles should also be enhanced to give women more power to assert their rights and grab opportunities.

4. A sustained and responsive monitoring system that engages the active participation of both men and women in the community should be developed.
5. Micro-finance and gender-sensitive livelihood opportunities should be provided to enable solar-based communities to generate income that will sustain the maintenance and even the expansion of the systems.
6. There should be recognition of the role women play in managing the environment in order to include gender analysis among the tools that experts should use for the project scoping, planning, implementation and monitoring and evaluation, and impact assessment.
7. To address the various structures of constraint in the solar energy sector, it is recommended that there should institutional reforms on land registration and granting of titles to give women equal entitlements to their family or clan's property; technicians in particular and development workers in general must undergo gender sensitivity training and orientation in order to realize and acknowledge the equal capacity and capability of the men and women in utilizing and maintaining solar technology; and there should be education and information dissemination, through the organizations in the community, about the resources that men and women can equally avail themselves of and control.

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