



Gender Equality in Renewable Energy in the Lower Mekong: Assessment and Opportunities

USAID CLEAN POWER ASIA

[July 21, 2017]

This publication was produced for review by the United States Agency for International Development
by Abt Associates Inc. and Stockholm Environment Institute

GENDER EQUALITY IN RENEWABLE ENERGY IN THE LOWER MEKONG: ASSESSMENT AND OPPORTUNITIES

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Contract No.: AID-486-C-16-00001

Prepared by: Stockholm Environment Institute (SEI)

Submitted to: Abt Associates Inc.

Submitted on: July 21, 2017

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ACRONYMS

ACE	ASEAN Centre for Energy
ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
CEO	Chief Executive Officer
CGEO	Chief Gender Equality Office
DEDE	Thailand Department of Alternative Energy Development and Efficiency
DEPP	Lao PDR Department of Energy Policy and Planning
EDC	Electricité du Cambodge
EGAT	Electricity Generating Authority of Thailand
ENERGIA	ENERGIA International Network on Gender and Sustainable Energy
FAO	Food and Agriculture Organization of the UN
FiT	Feed-in tariff
GERES	Groupe Energies Renouvelables, Environnement et Solidarités
GMS	Greater Mekong Sub-region
ICoProDAC	Improved Cookstove Producers and Distributor Association of Cambodia
ILO	International Labour Organization of the UN
IPU	Inter-Parliamentary Union
IRENA	International Renewable Energy Agency
JICA	Japan International Cooperation Agency
Lao PDR	Lao People's Democratic Republic
LEDs	Low Emission Development Strategies
LWU	Lao Women's Union
MEM	Lao PDR Ministry of Energy and Mines
MOIT	Vietnam Ministry of Industry and Trade
MW	Megawatt
n.d.	No date
NGO	Non-government organization
NESDP	Thailand National Economic and Social Development Plan
NSEDP	Lao PDR National Socio-economic Development Plan
OECD	Organisation for Economic Co-operation and Development
PCI	Project Concern International
REE	Refrigeration Electrical Engineering Corporation

RGC	Royal Government of Cambodia
SDGs	Sustainable Development Goals
SEI	Stockholm Environment Institute
SPCG	Solar Power Company Group
TIEB	Thailand Integrated Energy Blueprint 2015-2036
UN	United Nations
UN Women	United Nations Entity for Gender Equality and the Empowerment of Women
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
USAID LEAF	USAID Lowering Emissions in Asia's Forests
USD	United States dollars
V-LEEP	USAID Vietnam Low Emission Energy Program
WoWE	Women of Wind Energy

ACKNOWLEDGMENTS

The authors wish to thank the interview informants from Cambodia, Lao PDR, Thailand, and Vietnam, James Grall, Michael Wykoff, and other colleagues at Abt Associates for reviewing earlier drafts of this paper, and Dr. Kalpana Giri at SEI Asia for her suggestions and inputs. We also thank USAID for the funding under contract AID-486-C-16-00001 to conduct the important and innovative research that has led to the publication of this paper.

EXECUTIVE SUMMARY

The USAID Clean Power Asia program assists the four Lower Mekong countries of Cambodia, Lao PDR, Thailand, and Vietnam, as well as other Association of Southeast Asian Nations (ASEAN) member states, to encourage power sector investments in environmentally friendly, renewable energy sources. The program specifically focuses on scaling up investment in grid-connected renewable power. Gender is a crosscutting theme for all USAID programming. USAID Clean Power Asia has developed and is implementing a Gender Implementation Plan to ensure gender equality and inclusion is addressed across program activities. This white paper aims to illuminate women working in the energy sectors of the focus nations as part of a gender and renewable energy assessment informing the program's Gender Implementation Plan. This includes women working in utilities, power generation, distribution and transmission, and regulatory bodies, as well as women working in the private sector and in civil society and non-government organizations (NGO). The specific objectives of this white paper are to:

- Provide an overview of renewable energy sectors in Lower Mekong countries
- Assess gender issues and gender equality in the renewable energy sectors in Lower Mekong countries
- Make recommendations for promoting gender equality and gender-responsiveness in the renewable energy sector, and specifically for the USAID Clean Power Asia Gender Implementation Plan

The scope of this paper is the energy sectors of Cambodia, Lao PDR, Thailand, and Vietnam, with a focus on grid-connected (rather than off-grid and mini-grid) renewable energy. The paper reviews academic and grey literature as well as presents the results from key informant interviews of individuals strategically placed in the renewable energy sector of the four focus countries. Findings are organized according to the energy and renewable energy value chain: (i) policy environment: gender responsiveness in (renewable) energy planning that considers demand side issues such as benefits of sustainable energy to women and men in households and communities; (ii) leadership in employment in the private renewable energy sector; (iii) consultations for infrastructure development that consider the needs and interests of women and men stakeholders; and (iv) end-use issues that favor equal well-being for women and men, the poor, and other social groups.

As renewable energy options are increasing in the region, most governments still have unclear policies and incentives regarding their adoption, but nevertheless have set up long-term targets. Driven by the private sector, hydropower and solar energy development is increasing, whereas biomass and wind power sector growth is lagging and remaining relatively smaller in scale.

The policy environment for advancing gender equality and renewable energy is well placed in the region, yet these concerns remain separate. National gender equality plans and commitments have been made by national governments, but they do not go far enough into technical sectors like energy. Thus, it is unclear how governments will include women in their energy transition efforts,

which in the era of climate change mitigation and green growth schemes are pivotal in driving economic development.

The public energy sector in the Lower Mekong countries responsible for renewable energy policy and planning is dominated by men, who are mostly engineers by trade. This has not changed significantly for decades, although more women are being employed, and executive and management level positions are overwhelmingly occupied by men. Women are usually concentrated in the financial, administrative, human resources, and promotional aspects of energy organizations. Perceptions that ‘energy work’ involves heavy labor and is not ‘suitable’ for women remains persistent. This is in large part due to the field-based aspects of installation and repair of power grids that are commonly associated with masculine labor, and that traveling afar for this purpose pose risks to women and pull them away from their families.

A few notable renewable energy firms and enterprises are being led by women executives, who are largely highly educated and from wealthy families. These firms were originally construction and appliance firms, but who diversified into renewable energy such as solar energy and small hydropower. These women are known to drive the business side of these firms, and rely on male technical specialists for infrastructure development and maintenance. It is not clear whether these firms took the renewable energy path because they were run by women, thus we are unable to validate notions that women essentially pursue sustainable options. Other renewable energy firms are also led by male executives. Despite women’s leadership in these firms, they also subscribe to gender norms that their first responsibility is to take care of the home, thus running a business allows them the flexibility of time and mobility to juggle work and domestic obligations more easily. There is also evidence that female entrepreneurship in community improved cookstoves using clean biomass energy (charcoal) is also on the rise, and may potentially economically empower women. However, despite some progress at economically empowering themselves, women still face prevalent gender norms that constrain their access to longer term finance beyond microcredit, education for finance and business management skills, and to networks that could lift their self-confidence and expand their opportunities. Women leading businesses, by itself, is not the only route for their empowerment, but the transformation of unequal norms that may disadvantage them in the first place, especially on some stages of the value chain.

Overall, renewable energy planning continues to be supply side-driven, focusing more on technology requirements and getting prices right, rather than demand driven with a focus on end-users, specifically women and men’s specific energy needs in communities, focusing on issues of energy poverty and access. As the Lower Mekong region prepares for energy transitions, it is important to ensure that this process is gender and socially inclusive. Women – on equal footing with men – have the potential to realize a clean energy future. This opportunity must be optimized, not only for men.

KEY FINDINGS AND RECOMMENDATIONS

Key findings on gender issues and equality in the renewable energy sector and recommendations to address the current scenarios follow.

Finding 1: The policy environment on renewable energy and gender equality is in place in the Lower Mekong Region countries, but remains separate and siloed.

Recommendations

- a. Create a baseline on gender-specific data on employment and entrepreneurship potential in renewable energy.
- b. Enhance the capacity of gender specialists, women/gender organizations, and multilateral gender focal points on the gender dimensions of renewable energy and climate change mitigation.
- c. Create a network of gender champions in both the public and private sectors who will strategically initiate an enabling policy environment to ensure that gender equality in energy transitions and can begin to develop examples of gender-responsive national renewable energy policy and budgets using the value chain approach as a starting point.
- d. Develop gender-responsive low emission development strategies (LEDS) by collaborating with national women's ministries and non-governmental organizations (NGO) to embark on a gender analysis of the proposed strategies, and to make specific recommendations to ensure that these strategies will lead to gender-equal and inclusive results and benefits.

Finding 2: Women in the public energy sector and planning agencies are typically confined to the accounting/finance, administrative, human resources, and promotional aspects of energy efficiency and utilization. Men occupy the top positions of decision-making.

Recommendations

- a. Develop training modules on gender and large-scale clean energy for policy makers/planners, regulators, modelers and technicians. A useful tool is SEI's *Guidance Materials for Mainstreaming Gender Perspectives into Model-based Policy Analysis* (<https://www.sei-international.org/mediamanager/documents/Publications/SEI-2017-Gender-guidance-for-modelling-studies.pdf>) that could build capacities for incorporating gender issues into energy modeling for policy and planning.
- b. Enable engineering universities and programs to initiate affirmative action for gender-equal enrollment.
- c. Initiate dialogue with school and university leaders and networks to create an enabling climate for girls to excel and specialize in science and technology.

Finding 3: Most energy planning, including renewable energy, focus on supply-side issues of capital build-up, infrastructure development, and price. Demand-side issues such as gender-specific access and energy poverty do not figure prominently in energy planning and targets.

Recommendations

- a. Develop and explore 'community energy' models that address women and men's access needs for electric power, as well as explore how energy production equipment (solar panels, mini hydro turbines) can be managed and owned by women's community associations.
- b. Document case studies of women and men's involvement in the (renewable) energy value chain and resulting benefits and constraints.

- c. Engage end-users to articulate their energy needs, the business opportunities they seek out for (renewable) energy production, and possible innovations that they could be part of.

Finding 4: A number of women lead renewable energy businesses (e.g., solar energy, biomass, and clean energy cookstoves), and are socially accepted for being business leaders. Most successful female business leaders originate from wealthy families, whereas low-income women who lead small businesses like improved cookstoves have limited resources for expanding their enterprises. Together, their opportunities for expansion are also circumscribed by persistent gender norms that require them to observe their domestic obligations.

Recommendations

- a. Develop a network of stakeholders on gender equality in the renewable energy sector and women's leadership in energy transitions.
- b. Apply a gender analysis to renewable energy investment tools such as FITs and competitive bidding, power purchase agreements, private sector subsidies, and other credit facilities for women business leaders.
- c. Engage women entrepreneurs and explore capital resources that can expand their medium-sized renewable energy businesses by linking them with innovation specialists and financial advisory services.

I. INTRODUCTION

I.1 USAID CLEAN POWER ASIA BACKGROUND

The USAID Clean Power Asia program assists the four Lower Mekong countries of Cambodia, Lao People's Democratic Republic (Lao PDR), Thailand, and Vietnam, as well as other Association of Southeast Asian Nations (ASEAN) member states, to encourage power sector investments in environmentally friendly, renewable energy sources. The program specifically focuses on scaling up investment in grid-connected renewable power.

A major challenge for implementing renewable energy at scale is to integrate climate targets and renewable energy planning into power sector planning. USAID Clean Power Asia supports the establishment and updating of national renewable energy targets and the integration of these targets into power development plans and integrated resource plans for the power sector. The program also works to rationalize the planning and development of renewable energy by linking it to the transmission planning process.

USAID supports financial institutions, developers, and other relevant stakeholders to secure and reduce the cost of finance for renewable energy projects by helping to develop innovative business models; promoting standardized documentation and evaluation practices and approval processes for financing renewable energy projects; and providing other advisory services.

I.2 USAID CLEAN POWER ASIA GENDER-RELATED OBJECTIVES

Gender is a crosscutting theme for all USAID programming. USAID Clean Power Asia has developed a Gender Implementation Plan to ensure gender equality and inclusion is addressed across program activities. USAID Clean Power Asia seeks to collaborate with existing networks and organizations for greater impact with limited resources. The Lower Mekong nations, and the broader ASEAN region, are home to associations and organizations targeting both women and energy (though rarely both) and donor funding has allowed for significant inroads to be made in the promotion of gender equality in the energy sector. USAID Clean Power Asia engages programs and organizations that remain active in these areas. A key lesson learned from the highly successful **Gender Champions** network developed under the USAID Lowering Emissions in Asia's Forests (LEAF) program was that a program does not require pre-packaged tools or expensive inputs, but that real impact can be delivered and traction gained in promoting gender in any sector by identifying leaders and organically developing their capacity.

Specifically, USAID Clean Power Asia has the following gender-related objectives:

- To contribute to a reduction in gender disparities in access to, control over, and benefits from reliable and affordable grid-connected power sources, while increasing the capability of women to realize their rights and influence over energy sources for power

generation

- To increase the understanding of impacts on women/gender issues within the renewable energy value chain and the incremental impacts of accelerated grid renewable energy investment on women/gender issues
- To develop capacity and awareness of gender issues in renewable energy while increasing access and creating opportunities for women to influence decision-making.

1.3 AIM, OBJECTIVES, AND SCOPE OF THE WHITE PAPER

This white paper aims to illuminate women working in the renewable energy sectors of the focus nations as part of a gender and renewable energy assessment informing the program's Gender Implementation Plan. This includes women working in utilities, power generation, distribution and transmission, and regulatory bodies, as well as women working in the private sector, in civil society organizations, and in NGOs. The specific objectives of this white paper are to:

- Provide an overview of renewable energy sectors in Lower Mekong countries
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The scope of this paper is the energy sectors of Cambodia, Lao PDR, Thailand, and Vietnam, with a focus on grid-connected (rather than off-grid and mini-grid) renewable energy. The paper reviews academic and grey literature as well as presenting the results from key informant interviews of individuals strategically placed in the renewable energy sector of the four Lower Mekong countries. The structure of the paper is as follows: a brief review of the literature on gender and renewable energy to identify key issues and gaps; summaries of the status of energy sectors in the focus nations; an assessment of the pertinent gender issues and extent of gender integration in renewable energy in the Lower Mekong, including a profiling of women professionals in RE leadership roles, and finally; conclusions and recommendations for moving towards gender equality in RE sectors, specifically for USAID Clean Power Asia and the program's Gender Implementation Plan.

2. GENDER AND RENEWABLE ENERGY: KEY ISSUES AND GAPS

2.1 ENERGY SECTOR AS TRADITIONAL MEN'S PROFESSIONAL FIELD

Before focusing on the Lower Mekong, we first review the key gender dimensions of the global renewable energy sector, based on literature and studies from a range of contexts.

Gender-blindness in the energy sector is in large part due to two inter-linked factors: women's social position and the attitude of energy institutions to gender issues. Women's control over their own lives is generally weaker than that of men; men tend to dominate decision-making within households, in communities and institutions. Policymakers tend to be largely men and energy institutions and organizations 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 professional posts. Similarly, large-scale industries and agriculture, which are important energy customers for utilities, are also dominated by men in senior positions. This male-dominated structure results in men talking to men about energy issues. Consequently, the forums where the issues are identified, agendas are set, and any potential solutions proposed, tend to have an inadvertent male bias.

The energy sector overall is largely controlled by men aged 50 and above, with economists and engineers being the dominant professions. Although many economists and engineers would accept welfare and efficiency approaches to meeting women's energy needs, they find meeting equality or empowerment goals through energy policy more difficult to accept or address. While many are not against gender equity, these professions often do not see the relevance of gender to their work. Some consider that equality of the sexes is a matter of local culture and political concern, while others consider that equality objectives cannot be reached through individual projects but through education and social movements.

2.2 EMPLOYMENT AND LEADERSHIP GENDER GAP IN ENERGY AND RENEWABLE ENERGY SECTORS

In 2011, global renewable energy investments rose by USD 40 billion compared with figures in 2004, indicating that there are advances towards clean and more sustainable energy options (Pearl-Martinez, 2014). Data on employment in renewable energy, however, is generally quite sparse and gender-disaggregated data even more so. Information is restricted to several isolated studies; presenting an acute challenge to significant trend analysis. However, from the available data, a broad picture of gender imbalances emerges in renewable energy employment in both developed and developing market contexts.

It is also well established that women are already poorly represented globally in sectors like construction, renewable energy, manufacturing, and public transportation that are critical to the creation of a green economy. Women account for 9% of the global workforce in construction, 12% in engineering, 15% in financial and business services, and 24% in manufacturing. Women have also long been marginalized in the energy sector work force. They rarely hold ministerial positions in the fields of science, technology, natural resources, and energy, and are seldom considered key stakeholders for energy initiatives. Women make up less than 6% of technical staff and below 1% of top managers (UN Women, 2012). In Europe, women are significantly underrepresented in the electricity sector making up approximately 15% of the workforce (across countries this varies from 8-22%). In 2016, 16% of board members of the global top (by revenue) 200 utilities were women. In the Global South, a survey of the 10 finalists for the 2014 Ashden Awards found that the average rate of direct female employment (not including entrepreneurs or sales agents) was 23%. The same survey found that women's participation along the energy chain is generally low unless women are specially targeted for inclusion (Clancy, 2016).

A series of studies conducted in developed countries with modern energy markets show women holding a minority of jobs both in the renewable energy industry in general, a smaller minority in technical and managerial positions, and a lower share compared to the national economy (IRENA, 2013). One or all of these trends are found in the United States (WoWE, 2011; Hegewish et al., 2013), the European Union (Blanco and Rodrigues 2009), in Spain (Arregui et al., 2010) and in Germany (Lehr et al., 2008). Stevens et al. (2009) assess women and green jobs (including, but not limited to, renewable energy) and suggest that the green economy may unintentionally exclude women because most green jobs are expected to be in manufacturing, construction, and engineering – fields where women are significantly under-represented. Particularly with the advancement and uptake of automated technologies in the secondary sector (e.g., manufacturing and construction), the perception that most of these green jobs involve heavy labor, therefore limiting female participation, is at best over-emphasized and at worst false. Women only hold anything close to approaching an equal share of jobs in sales and administrative positions (30-60%), and in managerial roles as low as 15% (Stevens et al., 2009; Arregui et al., 2010). The overall estimated share of female employees in the energy industry as a whole, and in the modern (i.e., developed countries) renewable energy sector, is 20% (ILO, 2008; IRENA, 2013).

In developing countries, characterized by 'traditional' energy markets, data on employment are even harder to come by. There are no comprehensive global data sets, but some regional estimates and national case studies that document women in renewable energy, primarily through the lens of energy access, do exist (IRENA, 2013). For instance, World Bank studies have shown the disproportionate time spent by working women collecting and preparing fuelwood (e.g., Ilahi, 2000), the relationship between time allocation and "unpaid" household work and poverty (Blackden and Wodon, 2006), and the uneven share of financial gains along the charcoal value chain (World Bank, 2009). Women are primarily employed in retail marketing: the value chain stage that sees the smallest share of profits (e.g., in Tanzania, see Beukering et al., 2007). Improvements in cookstove adoption (as a means to reduce the unsustainable use of biomass) (Lewis and Pattanayak, 2012) and the production of crops for biofuels (Kammen, 2011) are creating increasing numbers of formal and informal energy jobs in developing countries, for example as shown in Cambodia (ENERGIA, 2009).

As described above, the available information on women in renewable energy sectors consistently show a wide gender gap in employment. However, the gender issues go far beyond numerical equal representation for women and men; many studies do not look beyond gender-disaggregated data to analyze, for example, women's participation in decision-making roles (IRENA, 2013). The economic and social rationale for gender equality in employment extends to gender equality in decision-making roles and processes, too.

A study of Fortune 500 companies by Joy et al. (2007) finds those companies with the highest proportion of women board directors outperformed those with the lowest proportions, in terms of returns on equity, invested capital, and sales. The analysis of such a variety of companies means these results stand across different industries and suggest an important lesson for the development of the renewable energy sector. As of 2017, women hold just 10.6% of a total of 6,000 board seats of Fortune 500 companies. Another assessment of over 1,500 companies' performances across many sectors found that those with more women on their board of directors are more likely to invest in renewable power generation; take steps to improve operational energy efficiency; have integrated climate change; measure and actively reduce carbon emissions and environmental impacts; have programs to reduce the carbon footprint of their supply chain; and address environmental risks in their financial decisions (McElhaney and Mobasser, 2012; IRENA, 2013).

In emerging market and developing country contexts, where women are important users and consumers of electricity from renewable energy sources, integrating a gender perspective into the design of policies, products, and services relevant to energy access is vital. Various studies have linked the failure of technology adoption, such as clean cookstoves, to failures to consult with women in the stove design process (Foley and Moss, 1983; Manibog, 1984). In the energy access context, decentralized systems offer more opportunities for women as energy users to participate in decision-making processes (Smith, 2000). Conventional energy models, by comparison, often see decisions made at the generation, transmission, and distribution stages by higher-level professionals (IRENA, 2013). Although not discussed here, the self-employment and entrepreneurship values associated with the growth of women-owned businesses also represents an important opportunity for women in the renewable energy sector of developing countries.

Women may also have formal or informal (intermittent or contract) employment along the energy value chain (e.g., power generation and trading, transmission, distribution, energy services, and appliances). To help women enter these jobs, a number of countries are providing training, as well as supportive working environments (Pearl-Martinez, 2014). Women may also find indirect employment in allied industries and those that provide services for the energy sector, such as the construction of large-scale renewable energy infrastructure, and services such as restaurants, catering for workers, health and social services, and temporary housing).

Constraints to women's involvement in renewable energy are tied to cultural norms and societal values that are context-specific. However, as traditional norms, including women's roles and responsibilities, change and women increasingly participate in the labor market (Boudet et al., 2013), there is an opportunity to assess and learn from common constraints. IRENA (2013) identifies three major constraints; skills, mobility, and self-perception.

As highlighted, a lack of key skills necessary for employment is a major challenge in renewable energy markets, especially for women. Girls' and women's relative (to boys' and men's) lack of access to basic education and specific training has created a barrier to acquiring the skills thus limiting women's ability to participate (Danielsen, 2012). Furthermore, the low percentage of women pursuing higher education, particularly in science, technology, and engineering fields, also constrains involvement. Once in the workplace, the constraints are not over. The "glass ceiling", where discriminatory barriers prevent women and ethnic minorities from developing their careers to high positions, restricts progress towards gender equality and equal representation in the workplace. There are also industry-specific risks that affect women more than men and can act to discourage entering into the sector in the first place, such as difficulty to maintain work/life balance, a lack of childcare facilities, harassment in the workplace, and gender discrimination in hiring procedures and in wage determination (IRENA, 2013; OECD, 2013).

The renewable energy sector tends to demand a high geographic mobility of its workforce. Although this affects all, women are likely to be at a significant disadvantage. For example, renewable energy construction projects can be in isolated areas, require purpose-build accommodation for workers, and impose long absences from families – women are less likely to be able and willing to be away from home for long periods (Eddy and Reed, 2013). Women in developing countries often face mobility constraints due to social responsibilities and traditional norms, which limits their participation in activities that require relocating or traveling. However, trends are that suggest an increase in women's mobility in the renewable energy sector (IRENA, 2013).

Some studies in renewable energy contexts, as well as in the construction industry, suggest self-perception is an important constraint for women's employment. For example, a study in India revealed that both men and women felt the reason women could not acquire skills for higher-paid masonry work was that women construction workers are unfit to be trained despite possessing the necessary capacities and desire (Barnabas et al., 2013). Women may also perceive that technical jobs are "only for men" or that they may be subject to discrimination or harassment if they entered such workplaces. In developing countries, self-perception relating to the traditional roles women hold limiting their participation in renewable energy development is still a key constraint.

2.3 BUSINESS AND EMPOWERMENT CASE FOR GENDER DIVERSITY IN RENEWABLE ENERGY SECTOR

Meaningful consideration, together with effective integration, of the gender dimensions of the renewable energy sector is a means to address two broad, yet significant, challenges: i) the current and projected shortages in skilled labor that may lead to the subsequent deceleration of the deployment of renewable energy technologies, and ii) the undoing of many of the social, economic and environment co-benefits associated with the growth of renewables. The "business case" rationale for integration revolves around striving for equal employment opportunities in order to expand the size and capacity of the labor pool to meet the demand for skills at all stages of the value chain and to improve business returns. Targeting women – half the population – is no longer just a pleasant bonus or a principle of good management, but is an essential ingredient of sound business practice, which could offer economic and other benefits to the renewable energy industry. This is

the case of ensuring talent is not wasted and this is evident in the agricultural sector, for instance, which has long argued that increasing women's access to financial capital, knowledge, and other productive resources such as land and water, enhances the productivity of the sector (Farnworth, et al., 2013; FAO, 2011).

The "social or empowerment case" rationale speaks to the empowerment of women in energy decision-making leading to the expansion and equal sharing of co-benefits, particularly around access to energy, household consumption, and women-led enterprises. Overall, mainstream energy planning continues to be supply side-driven, focusing more on the technology requirements and getting prices right (Clancy, 2009). Gender and energy studies in the past concentrated on the access issues of energy. There is therefore the need to benefit women who have been historically excluded from reliable access to energy. Both empowerment and business participation challenges are in large part due to prevailing gender biases that translate into forms of discrimination of women in most societies, including the energy sector. In short, there is an opportunity to democratize renewable and clean energy initiatives as they are currently on the upswing.

These two rationales need not be mutually exclusive, and there are three reasons that support this.

In the modern energy markets of developed countries, women have been shown to favor clean energy solutions, but are largely under-represented in the energy industry's workforces, particularly in both technical and managerial positions, thus limiting women's decision-making influence (Eddy and Reed, 2013). This trend has been attributed to gender issues of unequal opportunities, required educational backgrounds that are generally skewed towards men, weaker self-perception, and mobility (IRENA, 2013). In developing countries, where markets are emerging and energy access is limited, the major gender issue is the fact that energy poverty consistently has a more damaging impact on the lives of women than of men. It is on the women that the burden falls for meeting gaps in energy supply, for instance by collecting fuelwood, and this limits women's, and girls', ability to engage in education and expand their employment opportunities. Thus, this is the first compelling reason why women's participation in the use and development of renewable energy technologies is a necessity for tackling energy access and poverty in emerging economies and to ensure that energy needs of marginalized groups are adequately met (Clancy et al., 2002).

Although it is widely accepted that application of end-use energy technologies can improve productivity and contribute significantly to women's welfare, it does not guarantee that technological innovations can by themselves promote gender equality and women's empowerment. This is exemplified by the failure of innumerable projects promoting solar and biomass technologies to address social justice and equity concerns. This has led several researchers (see, e.g., Skutch, 2005; Kelkar and Nathan, n.d.) to emphasize that the process by which the energy service is planned, implemented, and maintained, if done in a gender-sensitive manner, may be more empowering than the energy technology itself. This is the second reason why women should be well-placed in the energy sector.

Finally, the third compelling reason is that achieving gender equality is also a core component of eradicating poverty: women and girls constitute 70% of the global population in extreme poverty (PCI, n.d.). Thus, employment generated through the deployment of renewable energy technologies

can contribute to poverty alleviation and realizing women's human development potential. It is also important that as women's employment opportunities are explored in developing countries, lessons are learned from developed countries to not replicate inequalities and instead ensure equal opportunities and representation in renewable energy employment, particularly in positions of power.

3. RENEWABLE ENERGY AND GENDER IN THE LOWER MEKONG

Energy and electrical power development is a particularly topical issue that is at the heart of the future of the Lower Mekong sub-region. The Mekong River has great potential hydropower capacity, and the large-scale development of that energy source is considered by governments as a central pillar to the socioeconomic development of the region. However, the Mekong has equally important uses for irrigation, agricultural production, aquaculture, and fisheries livelihoods for millions of households. The future development of hydropower is largely inevitable, but governments and the energy sector in general should seek to do so sustainably and must effectively assess and address the environmental and social impacts of that development, integrate the future effects of climate change on the river basin in those assessments and measures, and ensure that the economic benefits are felt equitably from the national to the household level, across different social groups.

Aside from large hydropower along the Mekong, other renewable energy sources are increasingly important for providing household energy access, rural electrification, and the host of socioeconomic co-benefits that arise from having access to electricity. Before considering the gender aspects of renewable energy in the context of the Mekong, this section briefly describes the renewable energy policies of the four focus nations – Cambodia, Lao PDR, Thailand, and Vietnam – and key information related to targets, actors and investments. The information presented pertains to four sources: solar, wind, biomass, and small-scale hydropower. Table 1 below summarizes the information by country.

Table 1: Summary of renewable energy policies, targets, policy environment, and sector gender issues in the Lower Mekong

	Cambodia	Lao PDR			Thailand		Vietnam			
Renewable energy-related policies	<ul style="list-style-type: none"> Electricity Law (2001) Rural Electrification Master Plan (2006) National Policy on Rural Electrification by Renewable Energy (2007) Power Development Plan 2008-2020 National Climate Change Strategic Plan 2014-2023 National Policy and Strategic Plan for Green Growth 2013-2030 National Strategic Development Plan 2014-2018 	<ul style="list-style-type: none"> Electricity Law (1997) National Policy Environmental and Social Sustainability of the Hydro Sector (2006) Investment Promotion Law (2009) Renewable Energy Development Strategy (2011) Policy on Sustainable Hydro Development (2013) [applies to projects >15 MW] 			<ul style="list-style-type: none"> National Energy Policy Act (1992) Energy Conservation Promotion Act (1992) Thailand Adder Scheme (2007) Thailand Integrated Energy Blueprint 2015-2036: Alternative Energy Development Plan Thailand Power Development Plan Energy Efficiency Plan Oil Plan Gas Plan Thailand Smart Grid Roadmap 2015-2036 National Social and Economic Development Plan 2015-2036 		<ul style="list-style-type: none"> Electricity Law (2004) National Energy Development Strategy 2007-2020 National Power Development Plan 2011-2020 Corporate Income Tax for Renewable Energy power projects (2013) Renewable Energy Development Strategy 2015-2030 Revised National Power Development Master Plan (2016) 			
Renewable energy target(s)	No specific target.	Type (MW)	2020	2025	Type (MW)	2036	Type (MW)	2020	2025	2030
(installed power capacity; for electricity)	However, by 2020 all villages should have access to electricity and by 2030 70% of households should have access to grid electricity. Target of 2,241 MW supply	Small hydro	134	400	Small hydro	376	S. hydro	-	-	-
		Solar	36	91	Solar	6000	Solar	850	4000	12000
		Wind	12	73	Wind	3000	Wind	800	2000	6000
		Biomass	24	58	Biomass	5570	Biomass	-	-	-

	Cambodia	Lao PDR			Thailand		Vietnam			
generation, MW)	from hydro to meet expected electricity demand of 2,770 MW in 2020 (81%).									
Selling feed-in tariffs (FIT)	No feed-in tariff (FIT) for grid-connected RE systems to sell to grid.	No FIT for grid-connected RE systems to sell to grid. Policy on tariffs in preparation (under DEPP).			Yes - FIT has two types: 1. Natural energy (i.e. hydro, wind, solar) and 2. Bio-energy (e.g., biomass, biogas). FIT is for 20 years for hydro, wind and biomass, and 25 years for solar.		Yes – FIT for small hydro, wind (on- and off-shore) and biomass (co-generation and pure-power). Tariffs adjustable to VND/USD currency fluctuations.			
Incentives	Some fiscal and investment incentives exist, but what and how benefits can be availed is not known.	Various – import duty free for machinery and materials; tax exemptions and rates depending on investment promotion zone; small hydro: free land access, land conversion fee waiver, tax and duty waivers, and others.			Various – import duty free for equipment; income tax exemption for 8 years; 50% reduction of corporate income tax on profits; costs deductions for infrastructure installation, transportation, electricity and water supply for 10 years.		Various – corporate income tax exemption for first four years, import tax exemption, reduced land rental fees.			
Financing support	USD 100/system subsidy from government. Electricité du Cambodge (EDC) provided USD 6M for operation of Renewable Energy Fund and implementation of three programs (Power to the Poor; Solar Home System; Assistance to Develop	Domestic and foreign investors have access to loans from commercial banks and other institutions in Lao PDR and overseas in accordance with Law on Investment Promotion and other relevant laws and regulations.			Energy Conservation Fund established by Energy Conservation Act in 1992 provides financial support for RE technologies. Energy Service Company Revolving Fund established in 2008 and managed by the Energy for Environment Foundation encourages investment and can be used		State investment credits with favourable interest rates.			

	Cambodia	Lao PDR	Thailand	Vietnam
	Electricity Infrastructure in Rural Areas. Grant assistance of USD 400/kWh for hydro and of USD 300/kWh for other renewables.		for: equity investment, equipment leasing, venture capital, credit guarantee and technical assistance.	
Policy environment on gender and renewable energy	No explicit policy. Other related gender-responsive instruments exist: National Climate Change Strategic Plan, National Strategic Development Plan on women's economic empowerment	No explicit policy. Other related gender-responsive instruments exist: Law on Women's Development and Protection, Vision 2030 and 10-Year National Strategy on Gender Equality (2016–2025) and Vision 2030 on Women Development, 10-year Women's Development Strategy (2016–2025).	No explicit policy. Other related gender-responsive instruments exist: Gender Equality Act (2015), National Economic and Social Development Plans	No explicit policy. Other related gender-responsive instruments exist: Gender Equality Law (2006), The National Strategy on Gender Equality 2011-2020.
Gender issues in employment and leadership in the RE sector	Producers and entrepreneurs in improved clean energy cookstoves and charcoal production are mostly women. Public sector on energy is male-dominated.	Limited data available on women's engagement in renewable energy enterprises. Public sector on energy is male-dominated.	Several female-run renewable energy enterprises, particularly solar, have flourished since the policy shift in 2008. Have benefited from FIT. Public sector on energy is male-dominated.	Some indication of female heads of business for large and medium-sized renewable energy firms. Public sector on energy is male-dominated.

Source: Data from ACE (2016), IRENA (2017), and interviews.

The discussions for each country in the sub-sections that follow present the renewable energy and gender policy environment, as well as some indicative gender employment information of the sector, which to date, remains largely undocumented and aggregated in the Lower Mekong. Data from interviews of industry actors conducted for this paper highlight their experiences with and awareness of gender issues and the level of engagement of women in the sector.

3.1 CAMBODIA

Cambodia's formal renewable energy sector began with the adoption of the Rural Electrification Master Plan in 2006, and subsequent National Policy on Rural Electrification by Renewable Energy in 2007. The primary objective of this policy is to provide clean, reliable, safe and reasonably-priced electricity (i.e., energy security) in rural areas, primarily based on renewable energy in a fair and equitable way. Currently there is no specific target set within the dedicated policy; however, by 2020 all villages should have access to electricity and by 2030 70% of households should have access to grid electricity.

In 2013, Cambodia enacted the National Policy and Strategic Plan for Green Growth 2013-2030, which aims to develop a green economy by the effective use of natural resources, environmental sustainability, green jobs, green technologies, green finance, green credit, and green investment. The National Climate Change Strategic Plan 2014-2023 promotes the use of renewable energy technologies for climate change mitigation. Additionally, the Plan recognizes the role of women in promoting green growth especially through human resources development and improved education that supports future green jobs.

Since 2011, the renewable energy sector has seen an acceleration of growth in terms of installed capacity, almost exclusively due to large hydropower. Due to the commencement of operation of the Kamchay dam in Kampot, the total national installed renewable energy capacity jumped from 23 MW in 2010 to 220 MW in 2011. Subsequent operation of large dams (six are connected to the national grid) has seen the total reach 1,205 MW in 2015, of which 1,174 is sourced from large hydropower. The remaining capacity is from biomass (23 MW), solar (6 MW), and small-scale hydropower (1 MW) (IRENA, 2017). To meet the expected electricity demand of 2,770 MW in 2020, the government, under the Power Development Plan 2008-2021, is targeting 81% (2,241 MW) to be supplied from hydropower. No other specific targets are set at present (ACE, 2016). There are currently no feed-in tariffs (FIT) for renewable energy systems in Cambodia. The goal of FITs is to offer cost-based compensation to renewable energy producers, providing price certainty and long-term contracts that help finance renewable energy investments, in short incentivizing the renewable energy production sector to grow. Elsewhere, FITs are being considered as an opportunity to bundle gender equality provisions to mitigate the possible negative impacts of large renewable energy projects, but this has yet to take place in Cambodia (Pearl-Martinez, 2014).

Through its National Strategic Development Plan (2014-2018), the Royal Government of Cambodia (RGC) mandates the development of renewable energy especially in its rural electrification plan. However there is no mention of gender-responsiveness in renewable energy development in the

Plan. Nevertheless, the plan places central importance on women's economic empowerment and is committed to advancing women's leadership in business and entrepreneurship.

In Cambodia, women own 65% of all businesses and this ownership provides a source of income for more than 329,000 women. However, the majority of women's businesses are microenterprises: 51% engage only one person, and 96% engage four or fewer persons. While women are more likely than men to own a business, women's businesses are concentrated in a smaller number of industry sectors than men's. Four sectors account for 97.1% of all businesses: wholesale and retail trade and services (66.4%), accommodation and food (16.7%), manufacturing (9.8%), and other services (4.2%). All other sectors account for less than 1% each (ADB, 2015). In wage employment, women's average monthly income from the electricity and gas industry is USD 223, whereas men's average monthly salary is USD 164 (ibid)¹. These are noteworthy indications of women's business predilections and that they are employed in the energy sector, receiving 134% more than men's salaries in the same sector. However, according to the Cambodia Socioeconomic Survey 2013, only 0.7% of technicians and associate professionals are women, whereas 1.1% are men.

Interviews with key informants confirm that renewable energy businesses – notably solar power – are managed and led by Cambodian women. “They make better business managers,” said Sov Leang, Chief Executive Officer (CEO) of Sun-eee Corporation, a solar energy developer. He added that daughters of prominent Khmer families manage the family businesses usually owned by their fathers and husbands. Being the chief managers also allows women time flexibility since they can juggle their time between their offices and homes, whereas men prefer 9-5 jobs, which possibly may also require some travel. “The face of the company is always a woman's,” Mr. Leang said, “and the women are the most skillful in dealing with investors and clients, as well as the mundane details of monitoring the licensed area for electrical transmission. Women are managers because they tend to be more diligent and educated than men. However, women do not work as electricians because of the hard labor involved and safety issues. Women's representation in the government energy organizations is poorer, as one must dedicate oneself to a full-time career, and well-off Cambodian women tend to prefer staying at home with their kids, once they start a family. If they are owners of businesses, they can continue running their business, because their time is flexible.” He also observes that it is the men who generate investments for solar power enterprises, although he admits that this industry has not yet peaked in Cambodia, being only on a very slow rise due to lackluster policy support by the government. Hydropower, meanwhile, is comparatively more promoted. Biomass energy development, on the other hand, remains small-scale and led by NGOs, which generally rely on small capital streams. Civil servants in the energy ministry, however, are predominantly men as the sector has been traditionally populated by men with engineering backgrounds. Women civil servants are concentrated in the finance and accounting departments.

In another interview, United Nations Development Programme (UNDP) Cambodia's climate change policy analyst Phearanich Hing said that to address climate change mitigation needs, UNDP works with the RGC and the Cambodian National Council for Sustainable Development to develop business

¹ The ADB (2015) analysis on the gender wage gap in Cambodia however points out that women's businesses account for only 40% of total business revenue and 51% of total business profits. Women's businesses therefore are on average smaller and less profitable than male-run businesses.

models for solar energy that could attract private investors. They began by establishing a solar battery charging station for solar-powered water pumps in 2015. To enhance the initiative, UNDP Cambodia also formed an informal technical working group on solar energy that combined NGOs, USAID Clean Power Asia, private sector representatives, and academics to further share information on the development of solar energy in the country. Phearnich informed that there are equal representations from women and men in this working group. She also confirmed that women were concentrated in management, sales, and marketing roles, whereas the men were academics and technical consultants. According to Phearnich, there are 11 solar companies in Cambodia, and they are led by men. They are still small companies, with weak administration and financial management systems, are unable to access credit or attract additional investments, lack technical capacities, and some are selling fake solar panels, which does not boost consumer trust. As a corrective, within the 40-member Solar Energy Association of Cambodia, there is a move to certify standards of solar energy panels and batteries. Phearnich added that for gender and energy policy action, the MME has a readiness plan, but which to date has no project or activities. “So far over the years, the link between gender and renewable energy has been forged through the development of improved cookstoves that not only targets women as users, but has emerged as a platform for increasing the number of female entrepreneurs,” she concluded.

The Groupe Energies Renouvelables, Environnement et Solidarités (GERES), in Cambodia since 1996, has been facilitating community access to biomass energy and improved cookstoves. Through proper harvesting methods and new production techniques in charcoal production for better quality fuel, GERES practitioners use less firewood and they developed a business model allowing the charcoal producers to improve their livelihood and sustain existing forests. Support for the development of the improved cookstove sector primarily came from carbon funds. Additionally, GERES develops improved cooking devices, following the traditional cooking practices but less fuel consuming. To produce and disseminate the improved cookstoves products, GERES empowers traditional pottery producers and distributors. The improved cookstove industry has produced 3,000 jobs as producers, distributors, and retail sellers, 52% of which went to women, mostly involved in the value chain. Vann Tola from Kampong Chhnang province, the vice president of the Improved Cookstove Producers and Distributor Association of Cambodia (ICoProDAC), launched by GERES, says that she started producing improved cookstoves in 2006, at 24 years old. “Then, in 2008, I received financial support from ICoProDAC’s economic pillar which encouraged me to expand. Right away I decided to invest in a bigger production center, to double my capacity and staff. Today, we produce about 6,000 improved cookstoves a month and work with 16 different distributors throughout the region, all the way to Phnom Penh.” Among Tola’s 37 employees, 28 are women (GERES, 2014).

The Cambodian case demonstrates that renewable energy can be a woman’s business, as it builds around existing gender norms that gives women positive social valuation as business developers and managers. However, there is room to further explore whether and how they are adequately able to access and generate investments to enlarge their enterprises, and whether scaling up and out is more of a man’s domain. The policy environment for advancing gender equality is strong in Cambodia, but this must deliberately pervade technical sectors like renewable energy.

3.2 LAO PDR

Like Cambodia, Lao PDR's rapidly growing renewable energy sector is dominated by hydropower. Beginning with the National Policy on Environmental and Social Sustainability of the Hydro Sector in 2006, and then subsequently the Renewable Energy Development Strategy (2011) and National Policy on Sustainable Hydro Development (2013), the government of Lao PDR is paving the way to capitalize on a theoretical hydropower capacity potential of 26.5 GW. As of 2015, Lao PDR had reached an installed large hydropower capacity of 3,879 MW (just 672 MW as recently as 2008), with small and medium hydropower at 38 MW and biomass at 30 MW installed capacities (IRENA, 2017).

Lao PDR's Renewable Energy Development Strategy (2011) sets a target of achieving 30% renewable share of total energy consumption by 2025. On the electricity side, this is expected to be achieved through significant capacity expansion of small hydropower (400 MW in 2025), solar (91 MW), wind (73 MW) and biomass (58 MW). Lao PDR is targeting 90% national electrification by 2020. Currently there are no FITs in Lao PDR, although the Department of Energy Policy and Planning (DEPP) is preparing a policy to introduce grid-connected selling tariffs for renewable energy systems. As noted already, the development of FITs could provide Lao PDR with an opportunity to consider gender equality as part of the mitigation of negative impacts of the development of large-scale renewable energy initiatives on local communities, as well as ensuring women's empowerment (Pearl-Martinez, 2014).

Lao PDR's 8th Five-Year National Socio-economic Development Plan (NSED) 2016-2020 was developed by the Ministry of Planning and Investment and officially approved by the National Assembly in April 2016. It is the nation's guiding strategic document and lays the foundation for the achievement of the National Strategy on Socio-Economic Development 2025 and the Vision 2030, as well as the Sustainable Development Goals (SDG). The 8th NSED targets the sustainable development of national energy systems with a view to ensuring domestic power stability, increasing regional competitiveness, creating basic rights, and a variety of energy business types, and increasing the expansion renewable energy and other alternative energy sources. By the completion of the 8th cycle of the NSED, in 2020, Lao PDR is targeting at least 90% of households to have access to electricity. Plans for developing energy policies and legal instruments include applying policies to facilitate the improvement of the peoples' participation mechanism in management, to reduce government subsidies while moving toward privatization of the energy sector, on investment in developing renewable energy sources, and to conduct a study and develop a master plan for rural electricity and construction of small hydropower plants in areas where it is possible, and solar power or diesel power generation in remote areas where hydropower is not possible.

The 8th NSED does not give mention to gender equality or women's empowerment in the context of national energy development, but rather it is identified as a cross-cutting priority. In a country where 60% of the population is below the age of 25, education is seen as critical to national development in Lao PDR, and subsequently to achieving gender equality in employment in key economic sectors, including energy. The ratio of boys to girls enrolled in education worsens as children move through the education system; in 2013 the ratio was 0.95 at primary school level, 0.84 at upper secondary school but only 0.6 for higher education. Despite high labor force participation rates for both men and women, the majority are accounted for in the agriculture sector and the gender disparity in education translates into a workforce capacity issue where 45% of males and only 33% of females in

employment have education of secondary school and above, according to the 2010 Labor Survey. The Plan targets improved public and private labor force capacity (Outcome 1, Output 5) but does not set gender-disaggregated targets for any performance indicator. Other indicators for gender equality and the advancement of women included are the share of women in wage employment in the non-agriculture sectors, which was recorded as being 34% in 2012, and the share of seats held by women in the National Assembly, which was 28% in 2016, according to the Inter-Parliamentary Union (IPU). The global average for women in parliament is 23% and the regional average for Asia is 19% (IPU, 2017).

Established in 1955 and closely tied to the country's history and development, the Lao Women's Union (LWU) is an important organization of women at all levels of government; central, provincial, district, and village, with a total membership of over one million. Among various functions, the LWU is mandated to promote the implementation of the national policy on gender equality and the advancement of women in the implementation of national socioeconomic development. Other important policies and mechanisms relating to gender equality include the national Law on Women's Development and Protection, Vision 2030 and 10-Year National Strategy on Gender Equality (2016–2025) and Vision 2030 on Women Development, 10-Year Women's Development Strategy (2016–2025). These policies and strategies present viable entry points for promoting gender equality in the renewable energy sector. Specifically, the following women's development targets outlined in the 8th NSEDP should be considered, even adopted, by the energy sector:

- Expand a LWU committee network to cover 20 percent of all business units in the private sector
- Promote women to take up 20 percent of leading management-level positions
- Encourage women to take up to 30 percent of the management-level positions at the central level, especially in organizations where women officials account for more than half of all officials
- Increase the share of women among owners of businesses and enterprises
- Increase the proportion of poor women with vocational education, skills, and stable employment to generate income.

In the 8th NSEDP monitoring and evaluation framework, despite the above and *Gender equality and empowerment of women and youth* being a cross-cutting output, no baseline data or targets are provided. As noted by Jones (2015), there are major issues with the availability and quality of demographic and labor force data in Lao PDR, making well-informed policymaking and strategic planning a challenge at all levels of government.

The national Ministry of Energy and Mines (MEM) DEPP is responsible for renewable energy policy development and electricity supply planning. Dr. Santisouk Phimpachanh, Director of the DEPP Power System Planning System Division, is one of the highest-ranking women in the energy sector at the national level, and has responsibility for electricity transmission and distribution policy and planning, of which around 90% is sourced from hydropower. Dr. Phimpachanh has worked on several major policy and planning efforts, including the Greater Mekong Sub-region (GMS) study led

by the Asian Development Bank (ADB), the National Energy Master Plan with Japan International Cooperation Agency (JICA), the Lao PDR-Vietnam inter-connection Master Plan with the World Bank, and the ASEAN Power Grid Consultative Committee. Dr. Phimpachanh's career has seen her rise through the ranks since achieving her Ph.D. in 2011. Dr. Phimpachanh observes that MEM, and the national government more broadly, affords women and people from ethnic minority groups priority when it comes to hiring and internal promotions due to a formal quota target. Further, the LWU is active within the MEM and other actors such as Electricité du Laos. MEM, in line with the national direction, has produced their own 10-Year Strategy on Gender Equality, as well as the First 5-Year Gender Equality Development Plan (2016-2020) for the energy sector which MEM is mandated to be responsible for in Lao PDR.

Overall, broad national socioeconomic development and gender equality policies in Lao PDR encompass the renewable energy sector, and therefore, the relevant gender-related targets, particularly in terms of employment and policy decision-making, should be strived for and even exceeded in the context of renewable energy sector development.

3.3 THAILAND

Thailand's renewable energy sector is significantly larger, more mixed, and more mature than in Cambodia and Lao PDR. Growth in major renewable energy technologies has been steady over the past decade and more in line with global trends of renewable energy capacities. As of 2015, Thailand's total installed renewable energy capacity is 8,354 MW, of which 32% is from biomass (2675 MW), 19% from solar (1600 MW), 3% from wind (223 MW), and <1% from small and medium hydropower (70 MW) [large hydropower – 29%] (IRENA, 2017). In terms of policy, two 1992 legislations – the National Energy Policy Act and the Energy Conservation Promotion Act – set the direction for renewable energy technologies in Thailand more than 20 years ago. More recently, in 2015, the Ministry of Energy introduced a set of five new plans known collectively as the Thailand Integrated Energy Blueprint 2015-2036 (TIEB). The timeframe of the TIEB plans is aligned with the National Economic and Social Development Plan, 2015-2036 (NESDP).

The Alternative Energy Development Plan of the TIEB (Thailand does not use “renewable energy” in policies but rather uses “alternative energy”) details the national renewable energy targets to 2036. For electricity, Thailand is targeting a renewable share of 15-20% in final utilization by 2036, which is equivalent to 19,684 MW of installed capacity. The power capacity targets for individual sources are 6,000 MW from solar, 5,570 MW from biomass, 3,000 MW from wind and 376 MW from small hydropower [large hydropower – 2,906 MW] (ACE, 2016). Unlike Cambodia and Lao PDR, Thailand uses selling tariffs for renewable energy sources, the details of which can be found in Table 1, which is considered a key success factor in the growth of the sector.

Thailand's economic and social development priorities are set by a 20-year National Strategy (2017-2036) and a series of five-year NESDPs, the 12th of which is to begin in 2017. Referred to as the “6-6-4 plan,” the 20-year plan consists of six areas, six primary strategies, and four supporting strategies. The six areas are (1) security, (2) competitiveness enhancement, (3) human resource development, (4) social equality, (5) green growth, and (6) rebalancing and public sector development. Renewable

energy (through (5) green growth) and gender equality (through (4) social equality) are at the forefront of Thailand's roadmap to sustainable development.

The 12th NESDP is not yet publically available, but the previous Plan highlights several gaps and potential entry points for pursuing gender equality. For example, the Plan notes that in the current situation opportunities for women at executive and decision-making levels are rare both in the public sector (e.g., just 5% of members of the current parliament are women (IPU, 2017)) and the private sector (e.g., just 22% of managers within stock exchange listed companies are women). Under the strategy for promoting a just society, the Plan states:

"...more attention should be given to improving understanding and attitudes toward the role of women within organizations and society. Methods should be developed to promote gender equality. Laws and regulations need to be developed to prevent all forms of discrimination against women... A Chief Gender Equality Office (CGEO) in public agencies should be encouraged as an important means to increase the number of female executives to an appropriate level, and it should be extended to public enterprises and organizations." (11th NESDP, 2011, p. 41).

Renewable energy policy in Thailand is the responsibility of the Department of Alternative Energy Development and Efficiency (DEDE) in the Ministry of Energy. DEDE has approximately 1,000 employees situated across seven offices in Thailand, 500 of which are based in the Bangkok head office. Historically, men have predominantly occupied the leadership roles within DEDE, and at present (according to the DEDE website) of the 17 people at executive level, just two are women (the Director of Central Administrative Bureau and a Renewable Energy Expert). According to interview informants with good knowledge of the matter, career advancement in DEDE is based on performance, relationship with colleagues and supervisors, educational background, and length of work experience. Management and executive level employees' academic backgrounds come mostly from civil engineering and science, which are male-dominated fields. Women are mostly concentrated in the administrative unit and in the information center, chiefly doing statistical collection. An energy research unit at DEDE has a more equal share of women and men doing research on biomass, biogas, waste and energy, wind energy and geothermal energy, but this unit is headed by men. The International Cooperation division also has a more even split of employees, as it is a non-technical division. Through mechanisms such as scholarships, women with engineering backgrounds are gradually entering the workforce at DEDE, but efforts could certainly be increased if the renewable energy sector is committed to meeting gender equality principles. The renewable energy public sector in Thailand could, and should, adopt the principles outlined in the NESDP.

The largest power producer in Thailand is the Electricity Generating Authority of Thailand (EGAT), a state enterprise managed by the Ministry of Energy. As of 2016, EGAT power plants provided approximately one-third of the country's electricity. EGAT employs close to 23,000, of which approximately 5,000 (23%) are women. Similar to DEDE, engineers form the core of EGAT's employees; around 50% are technical staff required to do on-site/field-based work on rotation. This has traditionally restricted women's career advancement. All eight of EGAT's executive officers are men. There are some women occupying assistant and deputy manager positions, but performing

largely administrative roles. Women are most concentrated within EGAT's administrative, accounting, human resources, and finance units. Some women are involved in the marketing of power to distributors, but they do not make up top representatives. An informant describes the EGAT culture:

"...there is no gender discrimination at EGAT; it just happens that more men are engineers. Twenty years ago, there were fewer women at EGAT compared with today, as there are increasingly more women who study engineering now. Promotion in EGAT depends largely on performance indicators rather than on gender."

Women's engagement in the renewable energy private sector is a quite a different story – there are a good number of women heading up enterprises or private firms. Ms. Wandee Khunchornyakon, CEO of Solar Power Company Group (SPCG), Thailand's biggest solar power operator, is widely credited with starting Thailand's move towards clean energy. Ms. Khunchornyakon's plans for a solar revolution began in 2008 when the government announced its plans to reduce its emissions by 20 percent over the next 15 years and double its renewable energy production by 2040. Ms. Khunchornyakon overcame many obstacles to secure loans for her business plan and even had to sell her house and land for use as collateral to secure the initial loan. In 2010, with support from the 'green' Kasikorn Bank, Ms. Khunchornyakon began with a small solar farm, producing 7.35 MW. SPCG currently operates 36 solar farms, totaling 260 MW, lighting 24,000 homes in Thailand. SPCG plans to double its solar power generating capacity in the next three years (Aguilar et al., 2015). Ms. Khunchornyakon is a renewable energy champion in Thailand and has paved the way for other women entrepreneurs to start their own businesses. With a more gender-responsive FIT policy, Thailand can set an example in the region for gender equality in renewable energy generation.

3.4 VIETNAM

With 17,973 MW of installed capacity, Vietnam has the largest renewable energy sector in Southeast Asia. The dominance of large hydropower (17,265 MW) ranks Vietnam 13th globally in terms of installed capacity, as of 2016. The remaining renewable capacity comes from small and medium hydropower (287.4 MW), biomass (255 MW), wind (159 MW), and solar (7 MW) (IRENA, 2017). However, data from the Institute of Energy show small hydropower (<30 MW) installed capacity increasing from 140 MW in 2006 to 1,984 MW in 2014. Discrepancies in the data may be due to adopting different capacity thresholds when defining small, medium, and large hydropower.

Vietnam's Electricity Law, which took effect in 2005, established the framework for encouraging the use of renewable sources for electricity generation, for instance by offering various investment, tariff, and taxation incentives, which remain in place today. The latest renewable energy targets, set in 2016 in the revised National Power Development Master Plan for 2011-2020 with an outlook to 2030, aim for a total renewable energy share of 31.8% by 2020, but also a diversification away from large hydropower. Electricity produced from hydropower is to account for 29.5% of total (i.e., renewable and non-renewable) generation in 2020, 20.5% in 2025, and 15.5% in 2030. Meanwhile,

wind is to increase to a 0.8% share in 2020 and 2.1% share in 2030, biomass to a 1% share in 2020 and 2.1% share in 2030, and solar to a 0.5% share in 2020 and 3.3% share in 2030 (ACE, 2016). The National Action Plan on Green Growth in Vietnam proposed by the Ministry of Planning and Investment was approved by the Prime Minister in March 2014. The Plan stipulated that the development of renewable energy was integral to realizing green growth in Vietnam through “. . . economic policies to promote producing and consuming new energy sources (solar, wind, biomass, thermal, and biofuel)” (Socialist Republic of Vietnam, 2014). While the enabling mechanisms for the advancement of renewable energy are already in place, current investment incentives however have had a limited effect on investment decisions. In an earlier study on renewable energy investments, investors felt that the current legal framework and incentive mechanism were not adequately developed as yet in Vietnam (Nam, Pham Khanh et al., 2013). To boost competitiveness in the power sector, the government is also privatizing the three biggest electricity generating companies; Vietnam Electricity, PetroVietnam, and Vinacomin. This process is envisaged to be completed by 2018, thereby opening the retail power market to private investors. Regulations on a competitive wholesale electricity market are scheduled for completion in June 2017, after which Vietnam Electricity will stop functioning as the single buyer in the power market. Following the wholesale market, electricity retail sales are set to be privatized as well. The Ministry of Industry and Trade (MOIT) has been asked by the government to cooperate with Vietnam Electricity to set this in motion, and Vietnam hopes to have a competitive retail electricity market by 2023. As early as 2013, the top firm out of eight local mostly hydropower developers registered an investment capital of VND 1,457 billion (about USD 6 million), and was poised to drive the renewable energy industry into higher gear (Nam, Pham Khanh et al., 2013).

USAID’s clean energy advisor, Tuong Du Duc, states the renewable energy sector is indeed growing steadily and is ready for more advanced market development as investors have become increasingly interested. Solar and wind energy, in particular, are sectors currently growing faster than hydropower, and many of these firms are local. “There are currently about 20 local developers in wind energy and 15 local solar energy developers,” he said, “and while they are mainly led by men, a few are notably led by women.” A case in point is Refrigeration Electrical Engineering (REE) Corporation, whose CEO is Ms Nguyen Thi Mai. After graduating with an electrical engineering degree from Karl-Marx-Stadt University (Germany) in 1982, Ms. Nguyen Thi Mai Thanh returned to Vietnam to work for REE, at the time a state-owned enterprise, in 1982, which is the predecessor of the current REE Corporation. She petitioned the government to privatize the company which she was then already leading, and REE became the first privatized company in Vietnam in 1993 after *doi moi* (economic reform) in the mid-1980s. Since then she has been holding the post of Chairperson and CEO of REE Corporation, and has diversified into other businesses such as developing hydropower and geothermal energy sources. Her company now registers as one of Vietnam’s top 50 companies.

Another example of a growing female-led renewable energy company is Hoa Phong E&C in Ho Chi Minh City that specializes in manufacturing solar chargers. Ms. Nguyen Quynh Trang formerly worked in a lawyers’ firm and then a government agency, and recalls attending government workshops on energy, mostly attended by men. Today as Hoa Phong E&C’s CEO, Ms Trang says, “People are less concerned about gender in this industry, but focus more on how the business is growing. I feel however that as a woman, I have an advantage, I can easily transact business with

investors and experts. Our company invested heavily on research and development, and we need to market our merchandise quickly to outpace the growing competition, especially since this year, the government announced that they will buy and redistribute electricity from solar energy sources for public use.” Ms Trang points out that “as a woman, I know how important electricity is in a home, and I study the electric bills. So, we target the sales of our chargers to women living in cities who are keenly aware of the rise in power rates, and show them how our product will reduce power rates, saving about 60%, in the long term.” Ms Trang recalls that she and friends who were aware of the need to seek solutions to climate change studied solar energy technology, and they set up the company. Another solar and wind farm energy company, Solar BK, is headed by two women, Mrs. Dương Thị Thanh (Chairwoman) Lương and Mrs. Sylvie Lam (Chief Operation Officer). SolarBK recently provided a 96 kWp solar power solution to An Binh Island Commune, Ly Son district, Quang Ngai province.

Given women’s leadership in private renewable energy businesses, is the Vietnamese government actively providing an enabling environment for women to equally participate in the country’s clean energy transition? Vietnam’s Gender Equality Law (2006) states that its goals are to “eliminate gender discrimination, to create equal opportunities for men and women in socio-economic development and human resources development in order to reach substantial equality between men and women.” Specifically, in the realm of economic development (Article 12), “Men and women are equal in setting up a business, carrying out business and production activities, managing business and are equal in accessing information, capital, markets, and labor sources.”

UN Women in Vietnam, however, point out that while Vietnamese women’s labor force participation is one of the highest in the region at 73.2% (2013), women have limited access to formal employment and are disproportionately engaged in vulnerable employment (69% in 2012) that does not provide social security. Specifically, more men from the total male employment population were employed in the energy sector (electricity, gas, and hot water supply) than women (UN Women, 2016).

Mr. Son, Deputy Chief of Party of the USAID Vietnam Low Emission Energy Program (VLEEP), also says that in the public energy sector, more men are employed. “At MOIT for instance, apart from a female vice minister, most other officials in high positions are men. There are, however, female modelers at the Institute of Energy, the government’s energy think tank, but they do not occupy the top posts. It’s a hard job to be an engineer in the energy sector due to many field visits, which will take away women from their homes. Therefore, most women are office-based, engaging mostly in modeling, accounting, and technical assessment work.” The National Strategy on Gender Equality 2011-2020 specifically aims to “intensify women’s participation in managerial and leading positions in order to gradually narrow the gender gap” in the political field. Additionally, the Strategy expresses the need “to ensure conditions for women to fully and equally access economic resources (such as cultivation land, credit sources, market information, law, and policy information) and enjoy equality in opportunity to participate in production and business” (Socialist Republic of Vietnam, 2012).

An interview with Ms. Nguyen Thi Bich Ha, Secretary General of the Ho Chi Minh City Association for Women Executives and Entrepreneurs, remarked that “women remain disadvantaged when

building personal business relationships, or '*guanxi*', outside of work. It is typical in our culture to meet after work for drinks to build '*guanxi*'. Women who attend these events feel pressure to drink less, in order to remain composed, while men are often encouraged to drink heavily. Many women often avoid these events altogether, for fear of losing respect within their professional circles. On top of work-related responsibilities, women are also expected to take care of household chores and family duties. Although we are seeing a change in the younger generation, women from previous generations still tend to prioritize their traditional family role to the detriment of their career advancement" (Emerging Innovation, 2016).

It therefore seems that the government is staunchly promoting gender equality in employment and business, but this is less felt in its effort towards energy transitions. Transforming existing cultural practices that persistently assign traditional gender roles to women that limits their opportunities continues to be a challenge.

4. CONCLUSIONS AND RECOMMENDATIONS FOR USAID CLEAN POWER ASIA

4.1 CONCLUSIONS

The research for this white paper has been organized according to the energy and renewable energy value chain: (i) policy environment: gender responsiveness in (renewable) energy planning that considers demand side issues such as benefits of sustainable energy to women and men in households and communities; (ii) leadership in employment in the private renewable energy sector; (iii) consultations for infrastructure development that consider the needs and interests of women and men stakeholders; and (iv) end use issues that favor equal well-being for women and men, the poor, and other social groups.

4.1.1 GENDER AND RENEWABLE ENERGY POLICY ENVIRONMENT

As renewable energy options are increasing in the region, most governments still have unclear policies and incentives regarding their adoption, but nevertheless have set up long-term targets. Driven by the private sector, hydropower and solar energy development is increasing, whereas biomass and wind power sector growth is lagging and remains relatively smaller in scale.

The policy environment for advancing gender equality and renewable energy is well placed in the region. Yet these concerns remain separate. National gender equality plans and commitments have been made by national governments, but they do not go far enough into technical sectors like energy. Thus, it is unclear how governments will include women in their energy transition efforts, which in the era of climate change mitigation and green growth schemes are pivotal in driving economic development.

4.1.2 WOMEN'S EMPLOYMENT IN RENEWABLE ENERGY POLICY AND PLANNING

Overall, the public energy sector in the Lower Mekong countries is traditionally dominated by men, who are mostly engineers. This has not changed significantly, although more women are employed, but top posts are usually occupied by men, especially in the public sector.

Energy planning continues to be supply side-driven, focusing more on technology requirements and getting prices right, rather than demand driven with a focus on end-users, specifically women and men's specific energy needs in communities, focusing on issues of energy poverty and access.

Women are usually concentrated in the financial, administrative, human resources, and promotional aspects of energy organizations. Perceptions that ‘energy work’ involves heavy labor and is not ‘suitable’ for women remains persistent. This is in large part due to the field-based aspects of installation and repair of power grids that are commonly associated with masculine labor, and that traveling afar for this purpose pose risks to women and pull them away from their families.

4.1.3 WOMEN’S ENTREPRENEURSHIP IN RENEWABLE ENERGY

A few notable renewable firms and enterprises are led by women executives, who are highly educated and largely from wealthy families. These companies were originally construction and appliance firms, but who diversified into renewable energy such as solar energy and small hydropower. These women are known to drive the business side of these firms, and rely on male technical specialists for infrastructure development and maintenance. It is not clear whether these firms took the renewable energy path because they were run by women, thus proving unable to validate notions that women essentially pursue sustainable options. Other renewable energy firms are also led by male executives. Despite women’s leadership in these firms, they also subscribe to gender norms that their first responsibility is care of the home, thus running a business allows them the flexibility of time and mobility to juggle work and domestic obligations more easily. There is also evidence that female entrepreneurship in community improved cookstoves using clean biomass energy (charcoal) is also on the rise, and may potentially economically empower women. However, despite some progress at economically empowering themselves, women still face prevalent gender norms that constrain their access to longer term finance beyond microcredit, education for finance and business management skills, and to networks that could lift their self-confidence and enlarge their opportunities. Women leading businesses, by itself, is not the only route for their empowerment, but the transformation of unequal norms that may disadvantage them in the first place, especially on some stages of the value chain.

4.2 RECOMMENDATIONS

As the Lower Mekong Region prepares for energy transitions, it is important to ensure that this process is gender- and socially-inclusive. Women – on equal footing with men – have the potential to realize a clean energy future. This opportunity has to be optimized, not only for men.

Finding 1: The policy environment on renewable energy and gender equality are in place in the Lower Mekong Region countries, but remain separate and siloed.

Recommendations

- a. Create a baseline on gender-specific data on employment and entrepreneurship potential in renewable energy.
- b. Enhance the capacity of gender specialists, women/gender organizations, and multilateral gender focal points on the gender dimensions of renewable energy and climate change mitigation.
- c. Create a network of gender champions in both the public and private sectors who will strategically initiate an enabling policy environment to ensure that gender equality in

- energy transitions can begin by developing examples of gender-responsive national renewable energy policy and budget using the value chain approach as a starting point.
- d. Develop gender-responsive low emission development strategies (LEDS) by collaborating with national women's ministries and NGOs to embark on a gender analysis of the proposed strategies, and to make specific recommendations to ensure that these strategies will lead to gender-equal and inclusive results and benefits.

Finding 2: Women in the public energy sector and planning agencies are typically confined to the accounting/finance, administrative, human resources, and promotional aspects of energy efficiency and utilization. Men occupy the top positions of decision-making and planning.

Recommendations

- a. Develop training modules on gender and large-scale clean energy for policy makers/planners, regulators, modelers and technicians. A useful tool is SEI's *Guidance Materials for Mainstreaming Gender Perspectives into Model-based Policy Analysis* (<https://www.sei-international.org/mediamanager/documents/Publications/SEI-2017-Gender-guidance-for-modelling-studies.pdf>) that could build capacities and understanding on incorporating gender issues into energy modeling for policy and planning.
- b. Enable engineering universities and programs to initiate affirmative action for gender-equal enrolment.
- c. Initiate dialogue with school and university leaders and networks to create an enabling climate for girls to excel and specialize in science, technology, engineering, and mathematics (STEM).

Finding 3: Most energy planning, including renewable energy, focuses on supply-side issues of capital build-up, infrastructure development, and price considerations. Demand-side issues such as gender-specific access and energy poverty do not figure prominently in energy planning and targets.

Recommendations

- a. Develop and explore 'community energy' models that address women and men's access needs for electric power, as well as explore how energy production equipment (solar panels, mini-hydro turbines) can be managed and owned by women's community associations.
- b. Document case studies of women and men's involvement in the (renewable) energy value chain and resulting benefits and constraints they experience.
- c. Engage end-users to articulate their energy needs, the business opportunities they seek out of (renewable) energy production, and possible innovations that they could be part of.

Finding 4: A number of women lead renewable energy businesses (e.g., solar energy, biomass, and clean energy cookstoves), and are socially accepted for being business leaders. Most successful women business leaders originate from wealthy families, whereas low-income women who lead small businesses like improved cookstoves have limited resources for expanding their enterprises.

Together, their opportunities for expansion are also circumscribed by persistent gender norms that require them to observe their domestic obligations.

Recommendations

- a. Develop a network of stakeholders on gender equality in the renewable energy sector and women's leadership in energy transitions.
- b. Apply a gender analysis to renewable energy investment tools such as FITs and competitive bidding, power purchase agreements, private sector subsidies, and other credit facilities for women business leaders.
- c. Engage women entrepreneurs and explore capital resources that can expand their medium-sized renewable energy businesses by linking them with innovation specialists and financial advisory services.

ANNEX A: LIST OF INTERVIEWEES

Country	Name		Position / Organization
Thailand	Ms. Munlika Sompranon	F	Director of International Cooperation Department of Alternative Energy Development and Efficiency (DEDE)
	Ms. Somruedee Tipmabutr	F	Transmission Operation Planning Department Power System Control and Operation Division Electricity Generating Authority of Thailand (EGAT)
	Dr. Sopitsuda (Jiab)Tongsopit	F	Researcher and Board of Directors member Energy Research Institute at Chulalongkorn University
	Ms. Piriyaorn Phaoleungton	F	Senior Professional, Strategy and Corporate Communication Department Office of the Energy Regulatory Commission
	Ms. Karnnalin (May) Theerarattananoon	F	Engineer, Bureau of Energy Research Ministry of Energy Department of Alternative Energy Development and Efficiency
	Ms. Divina Nidhiprabha	F	Clean Energy Finance Team Leader PFAN Asia / Deloitte
Cambodia	Ms. Marina Dubois	F	Technical Advisor - Community Mobilization & Inclusion StovePlus Regional Coordinator for Asia GERES
	Mr. Sov Leang	M	Chief Executive Officer Sun-eee
	Ms. Phearanch Hing	F	Climate Change Policy Analyst UNDP Cambodia
Lao PDR	Dr. Santisouk Phimpachanh	F	Director, Power System Planning Division Department of Energy Policy and Planning (DEPP) Ministry of Energy and Mines (MEM)

Vietnam	Mr. Do Duc Tuong	M	Clean Energy Advisor - Environment and Social Development Office USAID Vietnam
	Ms. Nguyen Quynh Trang	F	CEO, Hoa Phong E&C
	Dr. Ha Dang Son	M	Director, Centre for Energy and Green Growth Research Deputy Director, USAID Vietnam Low Emission Energy Program (V-LEEP)

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