

February 2017 | Conference Edition

# MINI-GRIDS & GENDER EQUALITY: INCLUSIVE DESIGN, BETTER DEVELOPMENT OUTCOMES

## KEY ISSUES, AND POTENTIAL ACTIONS



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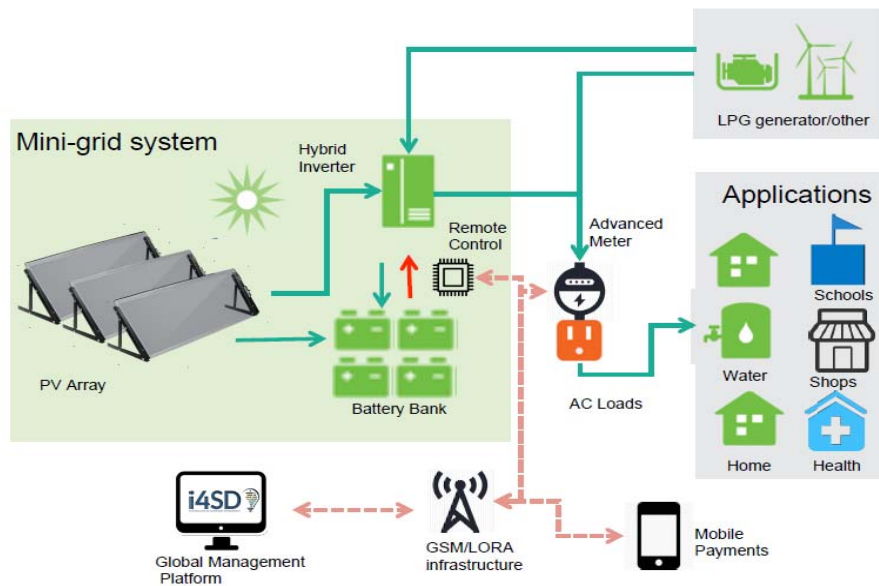
# INTRODUCTION

This note is intended to serve as a quick reference guide for applying a gender lens to the design and implementation of a mini-grid to enhance development outcomes. As mini-grids are increasingly seen as a potential solution to energy access issues, importance must be placed on ensuring that the benefits and opportunities of the intervention are realized for both men and women. The guidance below provides energy access, social development and gender specialists, with additional ideas and best-practice approaches to integrate at all stages of the project cycle in order to enhance gender equality.

## WHAT IS A MINI-GRID?

Of the 1.1 billion people globally without access to electricity, about 88 percent live in Sub-Saharan Africa and South Asia. Mini-grids offer a cheaper and more rapidly-available energy sourcing option for up to 400 million people in such regions where the costs and logistics of grid extension to low-income, rural settlements is often prohibitive.

Figure 1: A Mini-Grid System



Source: Innovations for Sustainable Development

A mini-grid is a stand-alone electricity generation source and distribution network, often powered by solar, hydro or wind energy. It delivers electricity to communities in locations where connection to the main grid network is inaccessible or prohibitively expensive. A mini-grid, also sometimes referred to as an “isolated grid”, comprises an electricity generation source (e.g., diesel, solar-hybrid, hydropower, or biomass), combined with an energy storage system (for example, battery storage) which is then connected to a distribution network supplying electricity to a localized group of customers. Mini-grids can range in size from micro (typically serving 20-100 customers) to full mini-grids (serving well over 500 customers). In rural settings, customers are typically individual households but may also include local businesses, as well as community facilities, such as churches, schools and health clinics. Figure above gives an overview of a mini-grid system and its related components including generation, operators and the applications for which the distributed electricity can be utilized.

### Box 1: Key Definitions

**Gender** refers to the social, behavioral, and cultural attributes, expectations and norms associated with being male or female.

**Gender equality** refers to how these factors determine the way in which women and men relate to each other and to the resulting differences in power between them.

**Gender mainstreaming** is a process that systematically integrates women’s and men’s concerns and perspectives into legislation, public policies, programs and projects, with the goal of achieving equality, and has until recently been the preferred approach to incorporating gender in many projects. However, the latest World Bank Gender Strategy (2016-2023) emphasizes a move away from gender mainstreaming because, contrary to early optimism, mainstreaming has not succeeded in embedding strong gender equality work in the institutional DNA of most development agencies. The Gender Strategy advocates a more strategic approach that uses analysis to identify key gaps between men and women that can be narrowed through our operations. It also places a stronger emphasis on outcomes and results.

## IMPROVING GENDER EQUALITY OUTCOMES THROUGH MINI-GRID PROJECTS

- **Drudgery and Time-Savings:** Mini-grids can significantly reduce women’s drudgery and save them time, particularly in female-dominated labor-intensive agricultural and food processing activities through uptake of electrical appliances, such as water pumps, grinders, mills, blenders, refrigeration and in a few cases, electric stoves. The provision of electric light further amplifies

time savings through increased efficiency and added flexibility in the scheduling of household tasks. Studies also show that electrified homes are more likely to switch to cleaner fuels for cooking (e.g. LPG), thereby reducing women's time spent on firewood collection.<sup>1</sup>

- **Employment:** Studies in South Africa, Nicaragua and Guatemala show that women are 9-23 percentage points more likely to gain employment outside the home following electrification. The time savings delivered by electric power and the ability to carry out domestic activities in the evening due to lighting, frees up women's time to participate in paid work. Findings from electrification programs in Bangladesh however suggest that the increase in time devoted to wage labor may not result in a decrease in unpaid work in the home, leading to women working longer hours overall.<sup>2</sup>
- **Health and Well-Being:** Electrification can help to reduce fertility levels through greater exposure to television.<sup>3</sup> Increased exposure to television often improves access to information and may depict new norms, such as family planning and smaller family sizes, leading to changes in desired fertility. In Indonesia, exposure to television increased the use of modern contraception by approximately 12 percentage points.<sup>4</sup> Anecdotal evidence from the Economic Community of West African States (ECOWAS) region suggests that electrifying clinics for lighting and refrigeration of medications has an especially beneficial impact on maternal health.
- **Gender Norms and Women's Agency:** Beyond the portrayal of new norms around fertility, evidence from several states across India highlights the role television plays in decreasing the acceptability of intimate partner violence and son preference. Women also report increased autonomy, measured by factors such as the ability to go out without permission and the participation in household decision making.<sup>5</sup> Mini-grid projects can also shape new community decision making and leadership models, for example, if local electrification committees are set up women and men can be given equal opportunities to run for key positions to voice community priorities and realities, thereby increasing women's voice in decision making (see box 2 examples). Additionally, electrification can help to increase safety through public lighting, which is particularly important for the socio-physical mobility of women and girls.
- **Intergenerational Effects on Education and Health:** Some evidence indicates that the improved lighting provided by electrification can promote more hours of study among children thereby contributing to better educational outcomes. In Bangladesh, schooling years for both boys and

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<sup>1</sup> Winther et al. (2016) 'Exploring Factors that Enhance and restrict Women's Empowerment through Electrification (EFEWEE) - Scoping study report': <http://www.energia.org/cms/wp-content/uploads/2016/07/RA1-Scoping-Report.pdf>

<sup>2</sup> Chowdhury, Shyamal K. "Impact of Infrastructures on Paid Work Opportunities And Unpaid Work Burdens On Rural Women In Bangladesh." *Journal of International Development J. Int. Dev.* 22, 997-1017, 2010

<sup>3</sup> Grimm et al. "Does Electrification Spur the Fertility Transition? Evidence from Indonesia". *Demography*. 2015 Oct; 52(5): 1773-1796; Chong, Duryea and Ferrara. "Soap Operas and Fertility: Evidence from Brazil" *Inter-American Development Bank Working Paper #633*, 2008

<sup>4</sup> Ibid.

<sup>5</sup> Jensen and Oster "The Power of TV: Cable Television and Women's Status in India" *Quarterly Journal of Economics*, Volume 124, Issue 3, pp. 1057-1094

girls improved as a result of electrification.<sup>6</sup> Reports from the ECOWAS region also suggest that lighting and refrigeration in clinics positively influence child health.<sup>7</sup>

### **Box 2: Feminist Electrification**

US based non-profit Earth Spark owns and operates a micro-grid in Les Anglais, Haiti, serving 449 homes and businesses with affordable, reliable electricity. Earth Spark has made a commitment to integrating gender equality in every aspect of their operations. Local women have been trained and employed to install parts of the grid, and 4 of the 10 members of the community management committee are women. Earth Spark has also supported local female entrepreneurs to start small businesses using power from the grid, and has become a strong advocate of gender inclusion for grid operators based on this experience.

Within the World Bank's energy portfolio, the Liberia Renewable Energy Access Project (LIRENAP) offers a good example of an operation where gender has been systematically integrated in project design, supervision and the overall country-level engagement strategy in the sector. Enabled by strong policies, the prioritization of gender equality as a national goal of the Government of Liberia, and the inclusion of a gender/social development specialist on the team, the project is identifying opportunities for men and women in the development of the mini-grid in Lofa County. Approaches being piloted in the mini-grid business and operational plan include diverse representation on the electrification committees, integrating women's productive uses of energy, enhancing connections to key social services and the simplification of connection procedures.

## **LEVELS OF GENDER ACTIONS IN MINI-GRID PROJECTS**

Actions taken at each stage of the project cycle, from planning to operations, should be based on a rigorous gender and social analysis. A gender analysis provides an understanding of how the relationships between men and women—their access to resources, their activities, and the constraints they face relative to each other—affect their ability to participate in and benefit from, the opportunities that the mini-grid projects provide. Approaches can be grouped into three broad categories that are aligned with the broader framework for addressing gender gaps in World Bank operations overall.

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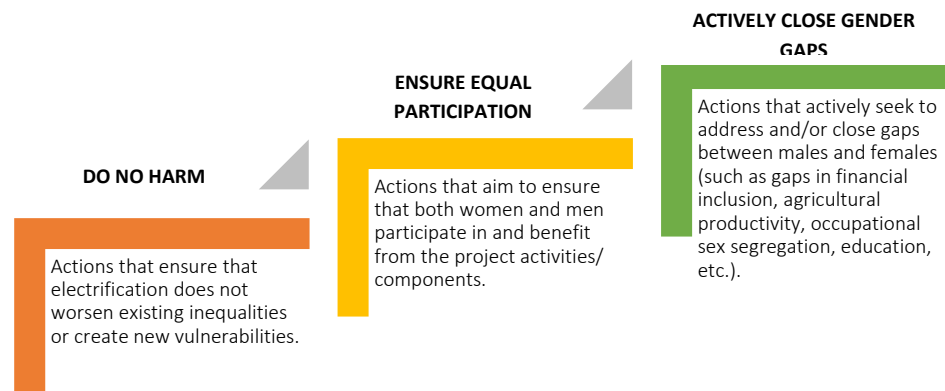
<sup>6</sup> World Bank, 2009. Welfare impacts of rural electrification. A case study from Bangladesh. Authored by Khander, S.R., Barnes, D.F., Samad, H.A. Policy Research Working Paper 4859, World Bank, Washington D.C.

<sup>7</sup> ECREEE & NREL *Situation Analysis of Energy and Gender Issues in ECOWAS States* (2015)



- 1 | **Do No Harm:** Actions in this category attempt to mitigate unanticipated risks or consequences that a project might create, such as gender-based violence, displacement from assets, like land or housing, and women’s unpaid work.
- 2 | **Ensure Equitable Participation:** These actions attempt to address gaps between males and females in participation, opportunities and access to resources. These include any employment or entrepreneurship prospects that may be created as a result of the project.
- 3 | **Actively Close Gender Gaps:** Interventions in this group explicitly seek to use operations to create transformational change in the lives of males and females.

**Figure 2: Levels of Gender Actions in Mini-Grid Projects**



## ENTRY POINTS IN MINI-GRID BUSINESS MODELS

Mini-grids can be operated by governmental utilities, dedicated private companies, community-based organizations, or a combination of these. Each of these models varies in the type of motivation behind the investment, and what level of financial return is expected by operators. Mini-grid revenues must cover the initial investment, as well as operation, management and maintenance (O&M&M) costs, are typically operated locally and designed to serve a specific number of costumers. Therefore, the long-term commercial viability of a mini-grid relies on an efficient operation, collecting sufficient revenue to ensure financial viability of the mini-grid, along with adequate levels of consumer satisfaction. Mini-grid operators have a vested interest in increasing the service demand of their existing customer base, as expansion to new consumers can be prohibitive. Given how closely women’s gendered responsibilities within the home are connected to their under-recognized role as energy consumers and producers (as well as energy entrepreneurs), mini-grid operators have an incentive to enhance women’s participation in mini-grid operations.

Depending on the scope of the mini-grid, other entry points related to the business model include the market analysis which can help collect sex-disaggregated data, the marketing and community outreach activities and training programs that will be delivered on at various levels. It is also worth assessing the potential win-win interventions that could be adopted, such as balancing the grid through subsidized electricity rates for productive activities at certain times during the day and through the provision of key social services such as lighting to increase safety.

## ENTRY POINTS IN CONSUMER FINANCE MODELS

When considering consumer finance models, it is important to pay attention to equity issues related to gender, for example, can female-headed households afford high up-front connection charges? Do connection requirements such as land-titles prohibit women from gaining a connection in their name? Some innovative financing and design mechanisms that take into consideration poverty and gender issues, include the use of: **1) subsidies**, often targeted at the poorest using poverty mapping approaches or provided through an output-based-aid model supported by donors; **2) credit schemes**, with third-party financiers supporting poor households in borrowing the amount of the high-upfront connection fee and wiring costs and repaying it back over time to reduce the initial burden on household budgets;<sup>8</sup>**3) ready boards**, which eliminate the cost of internal wiring by providing ready-to-use sockets directly at the point where the household electrical service drop connection is established; and **4) smart end-to-end operation**, where the operator provides support to clients to invest in energy-efficient appliances, therein reducing the need for additional investment in mini-grid capacity, while contributing to enhanced local economic opportunities through productive uses of energy investment.

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<sup>8</sup> Chapter 5 Making the Poor Count—Targeting the Gender Dimension of Rural Electrification-  
<http://siteresources.worldbank.org/INTEAPASTAE/Resources/LaoPDR-PowertoPeople.pdf>

### Box 3: Economic Rationale of Mini-Grid Investment and Operation

Mini-grid operators aim to maximize utilization of locally-generated power. For this reason, operators have a vested interest in the income growth of poor consumers, and thus even an incentive to support productive use investments at the local level, for example, through appliance retailing or development of credit lines for consumers. This is a clear point of differentiation for mini-grids, compared to larger power grid systems. In larger grids, operators can view connection of a poor household as having little marginal value compared to the high costs of extension. Rural grid extension costs can run over USD 500 per connection in sub-Saharan Africa – thus a rural customer paying only USD 5 per month would likely present a feasibility issue to such an operator. Communities served by mini-grids interact with operators primarily as customers, but potentially also as employees or contractors engaged in construction, maintenance, or retail electricity sales. Recent technological innovations such as smart meters and mobile money through cell phones are facilitating direct purchase of power from operators by customers on a pay-as-you-go basis, which is more affordable and enhances energy access for poorer consumers. When the customer's account is out of credit, grid operators will manually or remotely shut off power to the household until a new payment top-up is undertaken.

## ENTRY POINTS IN COMMUNITY CONSULTATION AND PLANNING

Encouraging and enabling women and men to participate in the planning and design of mini-grids helps ensure that services provided are beneficial to the whole community, and are implemented with full public support. Although women make up the majority of the agricultural labor force, they are more likely than men to be less productive and illiterate. For this reason, simply posting information without specific communications outreach and facilitation might not enable women to be aware of initiatives like subsidies or understand how to pay their bills, manage their energy consumption, or know which tariff rates apply. Moreover, men and women often respond to different marketing messages and may use different communication channels. Women may also have less time to attend public meetings due to their domestic responsibilities and might be discouraged by social norms to participate in the public sphere. In some countries, women may prefer female-only consultations, arranged at a time that does not conflict with their other home-based or work commitments.<sup>9</sup>In addition, the development of a mini-grid often involves the establishment of new local organizational and management structures which opens up a space to

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<sup>9</sup> See discussion from energy efficiency sub-sector in CIF and EBRD. 2016. *Gender Mainstreaming in District Heating Projects in the Commonwealth of Independent States: A Toolkit*. London: EBRD. Available at <http://www.ebrd.com/gender-tools-publications.html>.

ensure women and men are both represented to contribute diverse perspectives and insights to the design, operation and management of a mini-grid.

## ENTRY POINTS IN CUSTOMER ENGAGEMENT

Women are important energy customers and are therefore a valuable source of service feedback. For instance, in Ukraine women often pay the household energy bill and are therefore in good position to monitor household energy expenditures.<sup>10</sup> In sub-Saharan Africa, Consultative Group to Assist the Poor (CGAP) research shows that women are the primary drivers of mobile-based payment transfers, which they mainly use to send money to relatives, load airtime, pay for household goods and services, and run their own businesses.<sup>11</sup>

Women are also increasingly important as enterprise customers. A recent USAID report states that women also make up an important segment of sub-Saharan Africa's micro and small business sector. Micro-enterprises with less than ten employees constitute over 99 percent of the micro-, small- and medium-sized enterprises in Ethiopia, Kenya and Tanzania. Of that, the share of women business owners was reported to be roughly 65 percent in Ethiopia, 45 percent in Kenya, 43 percent in Tanzania.<sup>12</sup> The Global Entrepreneurship Monitor Women's Report (2012) states that sub-Saharan Africa has the highest rates of female entrepreneurship of any region in the world. However, in Ethiopia, Ghana, and Zambia, survey findings indicate that more female-headed firms give bribes to secure an electrical connection and face more delays when trying to obtain an electrical connection.<sup>13</sup> Given these findings, practical approaches can be designed to ensure transparent and simple customer inscription processes for new connections as part of the overall operations of the mini-grid.

## ENTRY POINTS IN PRODUCTIVE USES OF ELECTRICITY

Studies show that a disproportionate amount of women's labor is spent on agro-processing activities, particularly in sub-Saharan Africa. Applications of electricity in rural areas such as milling, grinding, carpentry, food processing, phone charging and tailoring help save the time and labor burden of men and women. Studies from several African countries suggest it can take up to 13 hours to pound enough maize for a family to eat over 4-5 days. The following time-use estimates were obtained for Nigeria: 2-3 hours each day for just preparing grains for pounding (i.e., threshing and milling); 82 women-hours for processing one drum of oil palm fruits; and 2 hours to grate a basin of cassava (totaling 2 days per week)

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<sup>10</sup> Ibid

<sup>11</sup> CGAP blog, 18 October 2011: 'Customers – Especially Women – Drive Mobile Money' <http://www.cgap.org/blog/customers—especially-women—drive-mobile-money>

<sup>12</sup> USAID *Constraints to Female Entrepreneurship in Sub-Saharan Africa* (2010)

<sup>13</sup> Alstone P, Niethammer C, Mendonça B and Eftimie A. "Expanding Women's Role in Africa's Modern Off-Grid Lighting Market." IFC and World Bank, 2011.

without a grating machine that can process a basin in one minute.<sup>14</sup> Ensuring power from mini-grids is connected to shared community facilities such as mills – with all users contributing to operating costs of the facility – can help alleviate the physical and time burden of these activities, particularly for women. Mini-grid operators can support these efforts by educating consumers about the varied power requirements of different appliances; and by providing information (or direct retail provision via credit lines) for buying energy-efficient, quality versions of these appliances. Mini-grid electrification can offer budget savings to households, relative to diesel, kerosene or charcoal fuel source expenditure. The combination of savings and more reliable power delivered by mini-grid electrification presents a myriad of opportunities for entrepreneurship, for instance, phone charging; refrigerated drinks sales; and trading of clothing, beauty products, vegetables and small homewares. Lighting also helps to extend business hours.

SolarAid research from East Africa on the solar lighting market found that 38 percent of households interviewed re-invested energy cost savings directly back into agricultural production, or used the savings to seed other small enterprises.<sup>15</sup> One study of mini-grid electrification in Nepal reports that income from small businesses rose by 50 percent on average for newly-electrified households, while the likelihood of starting a small business increased by 5 percent.<sup>16</sup> However, evidence suggests that introduction of electricity alone does not necessarily result in a significant increase in entrepreneurship and female-led businesses in an area, unless investments in outreach and capacity-building are also made. Complementary programs, such as creating cross-sectoral linkages with departments of rural development, are required to support goals for women’s entrepreneurship. The World Bank’s work in Mali below illustrates some of the challenges in applying a gender lens to foster productive uses of rural electrification.

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<sup>14</sup> Kes, Aslihan, and Hema Swaminathan. “Gender and Time Poverty in Sub-Saharan Africa.” *Gender, Time Use, and Poverty in Sub-Saharan Africa*, World Bank Discussion Paper No. 73. Mark C. Blackden and Quentin Wodon (eds.). World Bank, 2006.

<sup>15</sup> SolarAid research (2012-15): <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/10229.pdf>

<sup>16</sup> [http://aepc.gov.np/docs/resource/subreport/20130818074911\\_Impact%20of%20Minigrid%20Electrification-2011.pdf](http://aepc.gov.np/docs/resource/subreport/20130818074911_Impact%20of%20Minigrid%20Electrification-2011.pdf)

#### **Box 4: Learning Lessons from Gender and Productive Uses of Energy in Mali**

The World Bank's AFREA Gender and Energy Program has worked to support gender mainstreaming in rural energy with the Government of Mali through its Agency for the Development of Household Energy and Rural Electrification (AMADER) via two energy sector projects – Household Energy and Universal Access (HEURA) and subsequently the Rural Electrification Hybrid System (SHER) project in Mali in order to ensure that the different needs of men and women are taken into account in rural electrification efforts. AFREA's gender assessment of the electrification efforts carried out under HEURA found that while some women who gained electricity access were leveraging this for income generation (e.g., selling cold drinks or offering device charging), they were still doing so at a lower rate compared to men. Barriers identified to women's enhanced economic benefit included limited number of female-owned enterprises; lack of access to credit and training for those that did exist; and that the design of energy projects focused on technological solutions rather than women's energy needs *in situ*. A second assessment and pilot project focused on the role of energy access in female-led agro-processing and marketing units. The project assessment showed that these units enhanced business skill development in women, but that financial sustainability was affected by insufficient technical expertise to properly operate and maintain the equipment; oversubscription of available equipment relative to demand from female beneficiaries; and poor technical capacity and productivity of the equipment itself. These findings illustrate both the opportunities and the complexities of supporting effective and gender-responsive enterprise development linked to electrification.

## **ENTRY POINTS IN MONITORING AND EVALUATION**

Incorporating gender into monitoring and evaluation enables project stakeholders to track how successfully grid services are meeting the needs of men and women and whether connection rates for female-headed households and enterprises are comparable to those headed by men. The process typically starts with a gender analysis as well as consultations that ensure both male and female perspectives are incorporated into planning, design and operating procedures of the grid. Barriers to women's participation should be identified early on. Sex-disaggregated data should be collected as part of the project baseline for example, on the number of female and male headed households and enterprises to be electrified, or on the time-savings or the productivity of female and male headed households and enterprises. The change over time from the baseline can then be tracked as the project progresses towards project completion. Developing a monitoring framework and training designated officers to collect and analyze data at regular intervals enables verification of predicted gendered impacts, examination of the effectiveness of mitigation measures, and real-time course correction.

One evaluative area growing for mini-grid projects is gaining a deeper understanding, from a gender perspective, of the intra-household dynamics related to energy consumption and household budgetary

constraints e.g. who and what determines if a refrigeration and other appliances are added or connected in the households. Such data is important in helping to avoid over-investment in mini-grid capacity, which can be left idle without sufficient power demand.

## ENTRY POINTS ON POLICY AND PROCUREMENT

As important as it is to focus on project level opportunities to integrate gender considerations in a mini-grid, there are also various entry points at the policy level and through procurement. When national energy dialogue and energy policies are being shaped related to mini-grids, attention needs to be paid to who is participating and providing input into the formulation of the energy policy or rural energy development plans. Diverse perspectives from groups such as women's business associations and various civil society organizations are essential to inform and shape the discussions on energy use (from household level realities to industry demands), social services, job creation and the ability and willingness of consumers to pay for electricity connections.

An additional entry point, includes integrating non-price factors in the bid evaluation of independent power providers or operators. For example, in South Africa the Independent Power Procurement Process to foster renewable energy development including social and gender requirements on topics such as e.g. job growth, domestic industrialization and community development.<sup>17</sup> Procurement evaluation gave preference for women-owned vendor procurement expenditure and community benefits in order to secure successful project bids.

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<sup>17</sup> South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons : <http://www.gsb.uct.ac.za/files/ppiafreport.pdf>

### **Box 5: World Bank Group Initiatives**

ESMAP has recently launched the Global Facility on Mini-Grids, which works with World Bank project teams, governments and other stakeholders along the value chain and life-cycle of mini-grids to enhance the enabling environment through adequate regulations, access to finance, and flexible and innovative payment models. It also acts as an interactive platform for knowledge sharing to strengthen the global mini-grid community. In addition, regionally focused programs such as the Africa Renewable Energy Access (AFREA) Gender and Energy Program and the East Asia and Pacific (EAP) Gender and Energy Facility have supported World Bank operations to integrate key gender considerations in mini-grid and energy access projects.

The Scaling Up Renewable Energy in Low Income Countries Program (SREP) of the Climate Investment Funds has a large focus on mini-grids which has key impacts for women's energy access and participation as energy entrepreneurs. In Vanuatu, for example, a USD 7 million Energy Access Project by the ADB will directly benefit 1,050 households with increased electricity access through a 400 KW run-of-river hydropower plant and extension of the distribution grid. One hundred female headed households will receive connections at subsidized rates. Newly-connected households will also participate in workshops about power safety, household energy budgeting, and business skills, with 40 percent of the trainees being women.

## **CONCLUSION**

In the energy sector, the gender dimensions of access to services, access to benefits, and the diverse experiences and impacts, are being increasingly recognized as important elements to be considered for effective policy making and project design. Practically this translates to ensuring that a gender perspective is part of the design and operation of mini-grids across issues such as business model choices, community consultations, consumer interface and productive uses of energy. This is critical so that the millions of dollars flowing towards energy access initiatives around the globe have an impact on closing key gender gaps and enable women's economic empowerment.