STRATEGIES TO MAKE LAST-MILE ENERGY MORE INCLUSIVE: EXAMPLES FROM INDIA





A C K N O W L E D G E M E N T S

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INTRODUCTION

Sustainable access to energy has the power to catalyze social and economic development and promote better educated, healthier, more productive and resilient communities. Yet many families across the globe continue to live with inadequate access to reliable and affordable energy. More than 1.1 billion people, most of them in rural areas, have limited or no access to electricity, and 2.8 billion people still do not have access to clean fuel and technologies for cooking. Studies also reveal that energy exclusion is more endemic among the poor and suggest that women are often more likely to be excluded. This is because they tend to be more income constrained and can have different energy needs and preferences — a result of gendered economic and social roles — which may not be reflected in the energy solutions.

To address this gap in access to dependable, affordable energy in poor communities, in 2015 The Rockefeller Foundation launched the Smart Power for Rural Development (SPRD) initiative in India, sub-Saharan Africa and Myanmar, where achieving last-mile energy connectivity has been challenging. SPRD promotes partnerships around decentralized renewable energy solutions, specifically mini-grid electricity, to ensure that high quality, reliable energy is provided to all segments of the community — and that it drives inclusive local economic growth. In India, the initiative is implemented through Smart Power India (SPI), which brings together a diverse set of stakeholders, including energy service companies (ESCOs), local businesses, national and local governments, as well as the private sector for marketbased energy solutions. Since its inception in April 2015, SPRD has made significant strides toward enhancing rural communities' access to energy through mini-grids. However, certain challenges remain, particularly around ensuring that mini-grid energy reaches all segments of the population in communities and stimulates economic growth.

In 2016, The Rockefeller Foundation partnered with the International Center for Reserach on Women (ICRW) to explore how to make the SPRD mini-grid energy distribution initiative in India more inclusive. The goal of this effort was to identify ways in which SPRD could intentionally address and improve equity in terms individuals' and households' access to and utility from energy, including mini-grid powered income-generating opportunities that promote equitable development, and more inclusive, resilient local economies.

Based on the analysis of new*and existing data, as well as discussions with SPI and other key stakeholders, ICRW identified the following menu of strategies for last-mile energy inclusion as it relates not only to creating wider access and more productive use of electricity, but also to spurring more shared local economic growth.

*ICRW conducted a Preference Survey in 4 ESCO sites (Gausganj served by OMC, Pasanga served by Mlinda, Bansdih served by TARA Urja, and Jataha served by Husk Power Solutions) covering 42 user households and 42 non-user households. In each household, one woman and one man was interviewed to understand some of the gendered differences in energy preferences and decision making bringing the total sample size to 193. Interviews were also conducted with 18 user and non-user enterprises.

These strategies focus on developing a more inclusive supply chain through design, human capital, pricing and marketing, among other mechanisms, as well as market and non-market solutions aimed at stimulating demand among currently unreached households and enterprises. These strategies, focus on both the demand and supply side and bring a gender lens to the analysis of current and potential energy reach and use. Some of the strategies have direct and immediate returns — which presents a more pronounced business case for energy companies — while others may require time, resources and maturation for the business to see the full benefits. The strategies highlighted in this document include those that are currently being tested by SPI, as well as other innovative approaches that have the potential to create large impacts. These strategies were chosen in close collaboration with SPI to ensure they are appropriate and feasible to implement in the SPRD context, given these sites' geographic, socio-economic, and political contexts. Due to SPI's collaboration with for-profit ESCOs, a priority was placed on market-based solutions that

could be wrapped into the ESCOs' operations. In that sense, it is not a universal assessment of best practice in inclusion strategies, but rather examples of strategies that could be effective in this particular context. For these ESCOs, and for energy distribution companies in general, we aimed to leverage and build the business case for how inclusive energy distribution and access can create a larger customer base and increase demand among new and existing users, as well as spur economic development and income growth within communities to catalyze further increases in demand in the medium and long term.

While the energy access landscape and list of strategies were designed for SPRD India, they are applicable to enhancing inclusion within energy expansion initiatives across the globe.

INCLUSION STRATEGIES

Enhance Capacity of Energy Company Supply Chains

- Enhance capacity of supply chain actors to better understand and meet the energy demand of different segments of the population
- Employ women and those from other marginalized groups as sales agents and after-sales customer service, maintenance, and repair agents

Test Innovations in Energy Package and Supply

- Leverage relationships between energy companies and local governments to facilitate electrification of community facilities and public goods
- Provide full energy coverage a total energy solution to a community
- Introduce energy-using, time-saving appliances that will reduce women's unpaid time burden

Offer More Accessible and Affordable Financing and Payment Methods

- Use smart meters to enable low-income customers to align energy consumption with their ability to pay
- Facilitate women and marginalized groups' access to financing for connection costs and purchase of energy-using appliances

Generate Demand through Local Economic Development

- Create energy powered micro-enterprise development that is inclusive, sustainable and good for business
- Identify and promote opportunities for energy-enabled and/or enhanced value chain engagement that use local resources and stimulate local economy and incomes

Energy inclusion at SPRD sites in India

A majority of India's energy demand remains unmet. India's power system needs to almost quadruple in size by 2040 to catch up and keep pace with electricity demand that — boosted by rising incomes and new connections to the grid — increases at almost 5 percent per year. Of India's rural population, 26 percent lack access to energy. In some states, this number is much higher: 69 percent in Bihar and 54 percent in Uttar Pradesh, the sites of the SPRD initiative. While SPRD's mini-grids are already reaching previously excluded populations, analysis of existing and new data collected by ICRW at select ESCO sites suggest some barriers remain in the way of inclusive energy access via SPRD.

Current grid location and outreach strategies result in exclusion and disparities in reach

In a majority of ESCO sites (4 out of 6) surveyed, the serviced or "catchment" areas include a lower percentage of socially excluded groups (SEGs), or households from scheduled castes, scheduled tribes, and other backward classes (See Figure 1). Within SPRD catchment areas, outreach seems to favor general households. Households belonging to SEGs constitute a smaller share of those with mini-grid connection, even when they are located within the catchment area (See Figure 2). For example, at two sites, while all scheduled caste/tribe households fell within the catchment area, a very low percentage of these households are connected (0 percent and 25 percent).

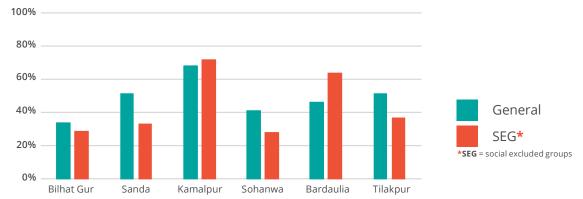


FIGURE 1: Percentage of households that are within the SPRD catchment

FIGURE 2: Within the SPRD catchment area, percentage of households that are connected to the mini-grid

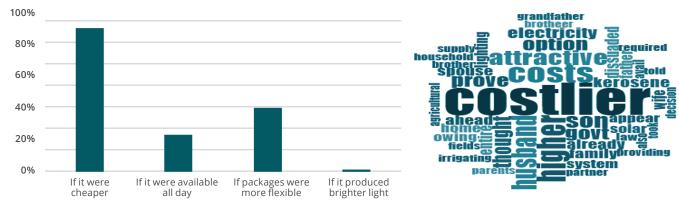


Cost is a major concern among mini-grid users

More than half of interviewed users wished that connections were cheaper and 90 percent of non-users cited the cost as being prohibitive (See Figures 3 & 4).

FIGURE 3: What would influence mini-grid use

FIGURE 4: Reason for not connecting to the mini-grid



A latent demand for energy can be revealed with targeted outreach

When asked, neither users nor non-users express an unmet need for energy. At the same time, almost all of them use diverse energy sources because their energy needs are not being met. Whether this diversification is by choice or to meet fluctuating demand and supply is unclear. Diversification can be a strategy to overcome unreliable energy supply or frequent brown and blackouts. This tells us that there is potential to build customers' demand for energy in general, and specifically for mini-grid energy, through messaging about the benefits of reliable, high-quality energy.



INCLUSION STRATEGIES

The below strategies lay out options for creating more equitable energy access and use, and also for using energy to catalyze inclusive local economic development. The strategies focus on both the supply and demand side of energy distribution and represent a diversity in level of effort and resources required and potential impacts. Each strategy includes a scorecard of the level of potential business and social impacts, as well as the level of resources and partnerships that will be required. While we have included insights that are specifically relevant to the SPRD context in India, the strategies are universally applicable.

ENHANCE CAPACITY OF ENERGY COMPANY SUPPLY CHAINS

To reach customers from marginalized populations, and build local economies through equitable energy access and use, energy company leadership needs to actively think about incorporating these populations and their needs throughout their supply chains. Creating a company that values and thinks about how to reach a diverse customer base starts at the top with including women and members of other marginalized groups in company leadership as designers of energy packages and pricing, as sales agents, etc. Not only does this promote employment opportunities for those from marginalized groups, but it also helps to ensure that products and outreach are designed to reach and meet the needs of the most marginalized. IIn addition, energy companies can enhance their marketing and outreach strategies, specifically through training sales agents to educate communities about the benefits of energy usage that will be relevant to them. Sales agents can also help energy companies better target marketing messages and distribution methods to ensure that those who currently are not connecting to the mini-grind are included.

SPRD INCLUSION CHALLENGE

There are currently many households and enterprises within SPRD's geographic catchment area that are not connected to the mini-grid. At many sites, households from privileged groups are more likely to be connected than households from socially excluded groups. Those who are not connected feel that the mini-grid is too expensive and/or that their energy needs are already being met through other sources. Current company structures and staffing, as well as marketing and outreach strategies hinder energy companies from reaching this underserved group. While diverse staffing within the company can ensure that energy companies think about the needs of and target these marginalized groups, currently companies are primarily comprised of all male staff. Additionally, customer sales agents currently target customers who they feel need electricity and will be able to pay the monthly fees — a smart strategy, but one that excludes those who are most marginalized.

Strategy: Enhance capacity of supply chain actors to better understand and meet the energy demand of different segments of the population

Trainings for supply chain actors can explore how reaching a diverse customer base can increase the number of customers in the short-term, but can also contribute to broader economic development, ultimately contributing to greater demand for energy over time. Training could be conducted both among energy company leadership and sales agents. With company leadership, it is important to explore how reaching women and other marginalized groups can grow business, stimulate local economic development and generate demand. With sales agents, marketing and inclusion trainings could be incorporated into



orientations, as well as a roster of refresher trainings to be conducted at regular intervals. These periodic trainings would help to reinforce the sales agents' learning as well as address the issue of lost knowledge that comes with high field staff turnover.

	Low	Medium	High
Business impact >			\checkmark
Social impact >		~	
Resources >	~		
Partnerships >		~	

BOX 1: SPRD MARKETING INSIGHTS

Current marketing efforts are not reaching men and women equally. Men and women both report energy company representatives as their main source of information about the mini-grid, however, men more often reported having seen advertisements about mini-grid than women.



CHALLENGE

- Sales agents often only reach out to those within their immediate social networks. Due to the fact that those who are employed in these roles are likely to be middle-class, educated men, this is who is reached by energy sales efforts, excluding a large potential customer base.
- Sales agents often do not know what types of marketing methods and messages they could use to reach out to more diverse and hard-to-reach customers.
- Sales agents may have never thought about the benefits that different types of customers could gain from using the mini-grid energy.
- Energy company leadership may not be aware of how a more inclusive approach to customer outreach could help stimulate demand, sales, and local economic development.

SOLUTION

TRAINING FOR SALES AGENTS

Creating a systematic training curriculum that covers basic and comprehensive marketing skills with an inclusion lens is expected to enhance sales agents' understanding of their own customer segments. This will enable sales agents to more effectively target their marketing methods and messages to those they currently are not reaching. These trainings should focus on 1) reviewing basic elements of marketing; 2) exploring which groups are currently being reached and which groups are being left out; 3) understanding customer energy preferences, experienced benefits, and willingness to pay; 4) identify what they can do through marketing methods and messages to reach groups who are currently excluded; and 5) determine how to receive feedback from customers and covey this to the energy company.

ICRW has developed and piloted a curriculum for marketing and inclusion trainings with sales agents; the curriculum is available upon request.

TRAINING AND SENSITIZATION FOR COMPANY LEADERSHIP

With company leadership, trainings should sensitize and orient leadership and senior management on the barriers to inclusion and its impacts on business sustainability. Trainings can take leadership through a process of understanding who they are reaching, who is being left out, and how reaching these marginalized groups not only increases their customer base, but can also dynamize local economies, ultimately contributing to greater energy demand. Trainings should help leadership think through how energy packages, pricing and sales, and outreach strategies can be used to reach these excluded groups and the potential benefits that can be achieved when these inclusion initiatives are implemented.

These trainings could also include a focus on how the energy companies can be more inclusive through their own institutional policies and practices. This could include hiring practices, equal pay for men and women, leave policies, anti-sexual harassment policies, flexible work arrangements, and employment contracts, among others.

Strategy: Employ women and those from other marginalized groups as sales agents and aftersales customer service, maintenance, and repair agents

The segment of the mini-grid supply chain that is embedded in local communities is small. Since the technology (solar panels, batteries, etc.) often is not manufactured locally and rarely nationally, the design and production processes do not provide opportunities for integrating women and marginalized groups into the supply chain.

After the installation of the mini-grid at the community level, a small team is needed to maintain the plant and undertake any needed repairs. Additionally, marketing, sales, and after-sales service should be undertaken by the most localized and visible sales agents of the energy companies. These local jobs, which are often occupied by men, represent an important opportunity for engaging women in these roles. There is a strong business and social case for employing more women in energy companies' last mile distribution chains to reach a larger portion of the community.

	Low	Medium	High
Business impact >		\checkmark	
Social impact >			\checkmark
Resources >		~	
Partnerships >		~	



- Women are often not employed in energy supply chains due to gender norms that limit their mobility and their
 roles as economic agents; perceptions around what kinds of jobs may be more appropriate for women versus men
 (maintenance jobs considered labor and tech intensive); and the selection criteria for the positions which implicitly
 disqualify women (e.g., work hours, education requirements, etc.).
- Energy companies may have difficulties reaching and building relationships with female customers and customers from other marginalized groups when sales agents are not able to relate to these individuals and form trusting relationships.

SOLUTION

Employ women and those from other marginalized groups as sales agents

Female sales agents can be valuable assets in efforts to reach a higher number of female customers. The strongest evidence on how this strategy can deliver comes from the agricultural sector, where there is now consensus that women agricultural extension agents are significantly more successful in reaching out to female farmers. Social norms allow easier interactions between women: Women extension agents better know and can respond to female farmers' needs; they also know where and with what messages to approach the farmers; and female farmers feel more comfortable with female agents. This has also been proven to be the case in the clean energy sector wherein, organizations such as Solar Sister (East Africa) and Frontier Markets (India) use teams of female sales agents to sell clean energy products, such as solar lanterns and energy-efficient cookstoves in rural markets. A similar initiative from another sector is Shakti, which was rolled out by Hindustan Unilever Limited (HUL) (See Box 2) with proven success. A comparable outcome is very likely for the women mini-grid sales agents, though of course, potential backlash and security issues need be considered. If promoted in an effective way and with buy-in from community gatekeepers, this strategy can have much larger positive impacts, by not only generating employment for women but also empowering them as change agents in their communities.

Employ women and those from other marginalized groups as after-sales customer services, maintenance, and repair agents

One role in which women and those from other marginalized groups might be particularly effective is as a cadre of aftersales service providers trained as local technicians to undertake basic repair and maintenance work of appliances and devices introduced under the project. These women could specifically be trained on managing Smart Meters — how to operate the meter itself, how to analyze the data, and how to feed the data back to the customer in a way that will be digestible and informative. Customer complaints and grievance redressal could be managed by a specifically identified group from the community through the introduction of a remote toll-free number. This could be especially effective to convey a strong message to internal as well as external stakeholders on mainstreaming of marginalized communities from all walks of life. Having women in these roles may help the company to increase customer satisfaction and referrals as customers have increased trust in the company and know where to turn to if they encounter any challenges. (See Box 3 for an example of how Barefoot College has employed a similar approach with female solar engineers).



BOX 2: UNILEVER'S SHATKTI INITIATIVE

With its Shakti initiative, Hindustan Unilever Limited (HUL) pioneered the concept of training local women as rural sales agents who sell Unilever products door to door in their communities. As of 2015, the initiative had grown to 70,000 sales agents serving 165,000 Indian villages, and HUL had equipped them with smartphone apps to help them manage inventory and other aspects of their business. The company has created variations in Bangladesh, Vietnam, Sri Lanka, Egypt, and other countries.

Source: Harvard Business Review https://hbr. org/2016/12/how-unilever-reaches-rural-consumersin-emerging-markets

BOX 3: BAREFOOT COLLEGE'S FEMALE SOLAR ENGINEERS

In rural India, Barefoot College trains women, especially grandmothers from rural villages, to become solar engineers. They learn the skills of solar electrification, water heating, and filtering through solar-powered desalination. Once trained as solar engineers, the so-called "Solar Mamas" or "Barefoot Grandmothers" return to their villages equipped with the skills and equipment to electrify more than 50 homes each. These women are then able to provide follow-up maintenance for solar products and systems. This enables these solar technologies to last longer and provides these women with a viable income-generating opportunity. A similar approach could be used to train women or members of other marginalized groups to become mini-grid technicians to provide after-sales support, maintenance, and repair.

Source: https://www.barefootcollege.org/



TEST INNOVATIONS IN ENERGY PACKAGE AND SUPPLY

Mini-grid packages have brought electricity to communities that were previously mostly excluded from the national grid system or had only unreliable energy access, expanding the reach of reliable, guality electricity around India. The scope of mini-grid packages, however, remains somewhat limited, as most suppliers only offer one or two electricity packages and pricing models. While the cost of mini-gird energy may be more than the government grid, customers appreciate the reliable nature of the energy provided and have expressed willingness to pay for higher quality energy. Testing innovative energy package and pricing options may help energy companies attract new customers and increase overall demand for electricity in communities. Some of the suggested energy solutions can potentially increase productivity of households, increase demand of electricity, and increase business for energy companies in the long run.

Strategy: Leverage relationships between energy companies and local governments to facilitate electrification of community facilities and public goods

Often, lack of access to electricity limits the services offered by public institutions. On the flip side, when public institutions have access to electricity, they are able to provide higher quality services to a larger population who otherwise, likely, would not be able to access these services. For example, primary health centers in remote locations face significant limitations in terms of services they can provide and when; vaccines and medicines expire and, in the absence of adequate technology that requires electricity, proper diagnosis and treatment cannot be provided. As a result, people often have to travel long distances for their health care needs. Electricity at health centers and clinics allows facilities to provide better care through refrigeration of medicines and vaccines and lighting for child deliveries and other emergencies during the night.² Having reliable sources of energy in health clinics leads to fewer infections, facilitates disease detection and treatment, more successful child deliveries, and other improvements in women's health.^{3,4,5} When schools have electricity it enables students to study later into the evening. It can

also attract and retain teachers, as they are able to prepare lesson plans at night, have proper sanitation facilities, and have the ability to make photocopies and use media in lessons.⁶ Additionally, having electricity in the village may spur new economic development and opportunities by improving communication at the markets, bringing new processing facilities, and generally lengthening the working day. The presence of electricity can also improve mobility and safety, particularly for women.

While these developments are not necessarily pro-poor in that they do not specifically aim to help marginalized populations, nor aim to upset the status quo, they may provide services and opportunities to those who otherwise would not have access. Another potential outcome of electrification of public spaces relates to the demonstration effect. As community members see and experience the benefits of electrification, they better understand its added value and, as a result, their willingness to pay may shift, producing positive business outcomes for the energy companies.

SPRD INCLUSION CHALLENGE

In the Preference Survey data, both users and nonusers listed cost as the largest barrier to using minigrid energy. Additionally, both user and non-user households use a variety of energy sources, including kerosene, the government grid, solar, and diesel, to meet their energy needs. This shows us that the current combination of mini-grid supply and price is not fully meeting customers' energy demand and preferences.

	Low	Medium	High
Business impact >		\checkmark	
Social impact >			\checkmark
Resources >			~
Partnerships >		~	

- There are some households and enterprises that will not be able to afford energy connections in the current context.
- When communities and public facilities lack access to energy, all suffer: health clinics aren't able to deliver as high quality of services; schools have to close their doors at an earlier hour; community members' mobility is limited as individuals; and people, particularly women, avoid moving around in public after dark for fear of violence.
- In communities that have not previously had access to reliable energy, demand for household purchase of energy connections may be limited. Those who have never had reliable energy access may not realize the benefits they are missing.

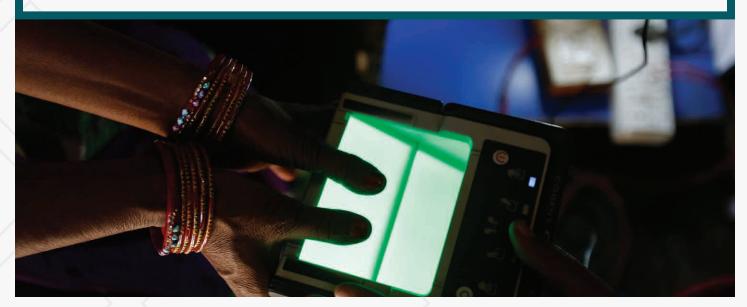
SOLUTION

Providing electricity at the community level can contribute to more equitable development in that individuals who might not be able to afford electricity connections are still able to benefit from the advancements that electricity brings.

When providing electricity at this level, special considerations should be made to ensure that these services are meeting the needs of marginalized groups, such as ensuring lighting for female sanitation facilities and for those living in more remote locations, or electricity to maintain medicines and medical equipment for those suffering from stigmatized illnesses.

Potential inclusive impacts of this strategy include:

- **Reaching the poor**: Enables energy companies to include customers who might not be able to afford a connection
- **Reaching those who are geographically excluded**: Enables energy companies to reach individuals who live outside of the catchment area with the benefits of electricity access
- Enhancing impacts of energy access beyond what is feasible through household energy access: Electrification of each sector/institution has the potential to create specific inclusion impacts:
 - Lighting: Improves women's mobility through enhanced safety; improves access to markets
 - Health clinics: Improves maternal health; improves health of those who live in more geographically isolated areas
 - Schools: Enhances educational resources; could enhance education of girls and those from marginalized groups as they are able to study later into the night
 - Banks and post offices: Improved access to high-quality, safe banking and mailing services as these institutions may become more efficient through use of electronic technology and may be able to provide safe services later into the evening



Strategy: Provide full energy coverage — a total energy solution — to a community

One challenge that is encountered with energy expansion is the lack of demand and willingness to pay for energy connections within communities that previously had little or unreliable energy access. These communities may not see how energy access could benefit them, and thus do not have the desire to purchase a connection. To jump-start both demand generation and local economic development it may be necessary to offer subsidies to bring energy costs to an affordable price for all. This enables all members of a community to connect and experience the externalities of local economic development as diverse aspects of domestic and enterprise work are made more productive and efficient.

TOTAL ENERGY SOLUTION

24-hour supply at a reduced price point so that all members of the community can afford a connection

	Low	Medium	High
Business impact >			\checkmark
Social impact >			\checkmark
Resources >			\checkmark
Partnerships >			~

CHALLENGE

- At market-rate prices, a significant portion of the community is unable or unwilling to purchase mini-grid electricity. Lacking access to electricity, they are unable to recognize whether they have latent demand for electricity, and furthermore, are channeling resources towards other fuels such as kerosene, that could potentially be spent on mini-grid packages.
- There is little demand for energy among the most marginalized customers, and thus their willingness to pay is very low. In order to increase their willingness to pay, these customers first must be able to access energy, experience its benefits, and then be willing to pay increasing prices for continued access.

SOLUTION

The total energy solution (TES) explores how enabling all members of a community to gain energy access using a combination of loans, subsidies, and grants for mini-grid energy affects the nature and type of economic activity in a community, secures greater social inclusion, and improves welfare and wellbeing. Expanding supply, both geographically and in terms of hours of access, and lowering the price will enable the mini-grid to meet customers' current energy demand and stimulate economic development. This then will enable customers to gradually pay higher rates, eventually converging on a sustainable supply/demand nexus. Specifically, with highly subsidized total energy coverage, local economic activity may be sufficiently dynamized to increase demand by raising incomes and willingness to pay, allowing for gradual price increments and convergence on a more sustainable price that covers mini-grid costs.

To date, all the mini-grid strategies implemented in India have involved some degree of fixed or variable costs subsidy, either in terms of initial capital expenditures, lower interest rates for loans, or coverage of costs for the accompanying demand stimulation strategies for households and enterprises. The TES makes this subsidy explicit and sets out to subsidize total energy inclusion at the outset. The hypothesis is that price convergence will occur faster under the TES than with micro-enterprise development strategies that incrementally build the customer base and cherry-pick customers who are willing to pay or that stimulate local demand by creating or expanding micro-enterprises. It is a strategy with a long-term maturation period, but encompasses many of the benefits that would accrue from the other strategies presented.

Strategy: Introduce energy-using, time-saving appliances that will reduce women's unpaid time burden

An important aspect of inclusion involves understanding and addressing intra-household inequity in time use and energy consumption. In many parts of the world, women spend a disproportionate amount of time on unpaid household work, limiting their time for other activities. A study in India found that women have an average working day of 11-14 hours, compared to 10 hours on average for men.⁷ Rural electrification projects have the potential to increase women's work outside of the home by reducing the amount of time they have to spend on domestic chores and/or by lengthening their day, freeing time to be spent on income-generation activities.⁸ In fact, research from a number of studies has shown that gaining access to electricity has an even greater impact on women's employment and income than it does for men.^{9,10,11,12} A study in South Africa found that electrification of rural communities was associated with an increase in female employment by 9 percentage points, but only a 3.5 percentage point increase in male employment.¹³

Electrification in Bhutanese households was found to reduce fuel collection time by 30-35 minutes per day.

In India, rural household electrification is suggested to be linked to increased school enrollment for girls, due to an ability to reallocate domestic tasks to the evening.

	Low	Medium	High
Business impact >		~	
Social impact >			\checkmark
Resources >			~
Partnerships >			~



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- Energy service companies struggle with low energy usage per household as the vast majority of households use energy for lighting purposes only.
- Globally, and specifically in India, women experience a disproportionate unpaid time burden due to the large amount of time they spend on household tasks such as the collection of firewood and water and cooking. Because women are spending their time on these tasks, they have less time to dedicate to income generation, as well as to leisure.
- Households may be unaware of or do not have access to energy-using, time-saving appliances that could increase their energy consumption, decrease time burdens, and increase household productivity.

SOLUTION

To ensure that the introduction of electricity in a household has an inclusive impact and enables women to spend a reduced amount of time on household tasks, and possibly engage in income-generation activities, the introduction of energy-using/time-saving appliance packages with special relevance to woman is essential. For example, appliances that relieve the time burden and drudgery of household tasks can free women's time for other productive or leisure activities, can also improve women's health and well-being. Designing appliance packages with women's preferences in mind can also have a direct business impact in terms of both (a) potential to attract new customers; and (b) increased energy demand/consumption of households. Energy companies would need partners to supply the appliances, and potentially also to provide financing for these appliances. Examples of relevant appliances could include: energy efficient cookstoves, household water pumps or irrigation systems, or motive power equipment for processing agricultural inputs, such as flour mills (See Box 4 for examples). An added benefit of this strategy is that the appliances might attract customers who otherwise would not be interested in electricity access, but are attracted to the possibility of using a specific time-saving appliance; it will also likely increase energy demand among customers as they experience the benefits of this time-saving device.



BOX 4: INCLUSIVE ENERGY-USING, TIME-SAVING APPLIANCES

Clean and efficient cookstoves: Clean cooking has the potential to create sustained social, environmental, and financial impacts that have a high social return on investment. The traditional cooking solutions and practices prevalent in Bihar, Uttar Pradesh, and Jharkhand are not only adding to the environmental burden, but are also increasing the health hazards and drudgery of the women and children in those communities. Force-draft cookstoves present the greatest potential for utilizing the mini-grid energy to reduce women's time burdens, reduce emissions, and increase energy demand. The stoves have built-in fans for enhanced combustion of fuel and thus need to be connected to a power source for best functioning. This more efficient burning of fuel causes the stove to consume less biomass fuel and to produce fewer emissions. While the stoves consume fuel very efficiently, they often are challenging due to the lack of complementary quality and reliable energy. However, with the SPRD mini-grid, this can be a win-win solution for the energy companies as well as the communities.

While force-draft stoves only use low levels of electricity, and thus are often not seen as appliances that increase customers' energy consumption, they may attract new customers to connect to the grid, and they also have the potential to greatly increase the impacts that energy use has on gender equity. As force-draft stoves reduce time spent on fuel collection and cooking, women — who are primarily the ones engaged in these tasks — will have more time to be spent on other activities.

Irrigation pumps: Household water pumps have the potential to increase energy consumption, while at the same time increasing the efficiency of household tasks such as watering kitchen gardens. Water pumps that are used for household irrigation can reduce the amount of time spent on water collection and increase the productive yield of the gardens. This not only frees women's time, enabling them to spend time on other activities; it can promote better nutrition at the household level, and, in some cases, produce excess crops that can be sold at the market. Packaging these pumps with the energy connection to attract new customers and offering financing to purchase these pumps to existing customers can increase their energy consumption.

Flour mills: Flour milling is something that households spend many hours on for both household consumption and for selling in the market. Providing motive-powered flour mills will enable households to make this process more efficient, allowing families to mill a larger quantity of flour and reduce the amount of time required for this activity. Like water pumps, this new technology can free time to be spent on other activities, and can potentially enable households to sell excess flour at the market. Flour mills can be sold as a package with new energy connections and/or as an add-on for existing customers. Energy companies may think about running specials on flour mills during harvest season when there is high demand for quick and efficient flour milling.



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PROVIDE MORE ACCESSIBLE AND AFFORDABLE FINANCING AND PAYMENT METHODS

The mini-grid is often more reliable and can produce higher-quality lighting compared to other sources of energy, such as the government grid. However, it also tends to be more expensive to the point of being cost-prohibitive, especially for households with little or no savings and low, inconsistent and unreliable income streams.

Strategies that can help make the mini-grid affordable for these households while maintaining the business bottom line are key to expanding the mini-grid customer base and achieving inclusion. Innovative pricing schemes and financing options can be explored to find solutions that will allow customers, particularly those from lower income groups, to purchase initial connections and/or larger energy packages and pay monthly fees. Among these strategies is the introduction of smart meters and financing schemes that can help households with the upfront costs of installing the mini-grid and purchasing appliances.

SPRD INCLUSION CHALLENGE

Cost is cited as the main barrier that households encounter in connecting to and using the mini-grid energy. The largest proportion of non-users, in the Preference Survey data, came from the lowest wealth quintile, signifying that it is the poorest who are most excluded from accessing mini-grid energy. Additionally, the majority of those surveyed who were connected to the mini-grid cited that the mini-grid would be more useful if it were cheaper (51 percent), and among those who were not connected, the main reason they were not using the mini-grid was that it was too costly (90 percent). Those who were not connected stated that what would influence them to use the mini-grid energy would be "if it were cheaper" (67 percent).

Strategy: Use smart meters to enable low-income customers to align energy consumption with their ability to pay

Smart metering systems, which may take different modalities (See Box 5), allow households to better control how much energy they use and their spending, which may in turn increase their demand. Smart meters allow energy companies to collect a reliable base level of revenue, regardless of whether customers consume the initial tier of energy. They also allow companies to monitor and predict energy consumption patterns and adjust their supply accordingly, which is essential given that energy companies may only have so much energy to distribute to rural communities. In addition to helping new customers connect to the mini-grid, using smart meters can help encourage customers to convert to larger energy packages as they may see their increasing demand and consumption over time, and feel that they are ready for a larger package.

	Low	Medium	High
Business impact >			\checkmark
Social impact >		✓	
Resources >	~		
Partnerships >		~	

BOX 5: TYPES OF SMART METER PAYMENT SYSTEMS

Tiered metering system:

Customers choose a level of electricity use according to their financial ability and the meter dispenses that much electricity every month.

Pre-paid/mixed metering system:

Customers pay for a certain amount of electricity and can top-up when they want or when paid amount runs out.

Post-paid system:

Customers use electricity and pay every month based on volume of use. Note that post-pay systems present the potential for theft, as the unlimited supply allows for illicit use of energy that will only be registered at the end of the month.

- Households at the bottom of the pyramid are very sensitive to economic shocks and frequently have to adjust consumption patterns to survive. Additionally, low-income households, often with family members who work primarily in the informal sector, may have inconsistent and unreliable incomes, making it difficult to commit to a flat rate monthly energy payment.
- Smart meters are expensive; energy companies need to subsidize heavily in order to roll out metered plans. Even though meters are associated with increased energy usage, it often takes several years to recoup the costs of the initial meter installation. The high cost of meters can also lead to only higher income households being able to opt in.
- Some meter models are prone to malfunction and may need continued maintenance.

SOLUTION

The use of smart meters is, in itself, a strategy to make mini-grid energy expansion more inclusive in that it enables households with inconsistent incomes to align energy consumption with their ability to pay. However, as they are often expensive to install, companies can explore the following options to make smart meters more inclusive while strengthening their business model.

- Use a mobile payment system to allow households to easily make payments and reduce transaction costs for revenue collection, which in turn can reduce the cost of subsidies that may need to be extended to customers for purchasing meters.
- Provide differential pricing, available with some meters, which can allow energy companies charge higher prices during peak hours and control peak loads. Differential pricing can also be used to supply energy at lower prices during day time when women are more likely to use energy for household tasks.
- Provide financing for the meter itself, which will enable lower-income households to connect and gradually pay off the cost of the meter. This can be wrapped into monthly energy payments.
- Start with a very low kW package so that low-income customers can overcome this barrier to entry. Then allow larger wattage tiers or top-up amounts, which will enable these customers to gradually increase their demand and consumption over time.



BOX 6: SMART METER POTENTIAL WITHIN SPRD

Meters might contribute to more customer satisfaction by giving users greater autonomy of choice over supply. Based on the Preference Survey data, there seems to be an inverse correlation between use of meters and customer complaints, i.e. energy companies providing metered electricity were less likely to get customer complaints. The survey also found that while most customers reported being satisfied with customer services, few were willing to recommend the connection to others.

More flexible packages that allow customers to control their cost may make mini-grid connections more popular. Cost was the main factor listed by non-users for non-adoption. Non-users mentioned that lower prices might influence their adoption decision, followed by the desire for flexible packages and 24-hour energy supply.

Strategy: Facilitate women and marginalized groups' access to financing for connection costs and purchase of energy-using appliances

There are a variety of financing options that could help households to access an energy connection and/or an energy-using appliance. After providing this initial financing, energy companies may be able to build demand for energy over time and ultimately increase both their customer base and energy usage among households and enterprises.

	Low	Medium	High
Business impact >			\checkmark
Social impact >			\checkmark
Resources >		✓	
Partnerships >			~

CHALLENGE

The poor and the marginalized — including women — face significant barriers to accessing financing. This can affect their ability to connect to the mini-grid and also to purchase energy-using appliances that might help build their demand and create added benefits to their lives.

- Initial connection fees: For many low-income households, even if they could afford the monthly fees for electricity usage, they cannot surmount the start-up fees to connect to the mini-grid. The use of mini-grid energy may enable households to save on other forms of energy, thus being able to afford the monthly fees. But if families are not able to overcome this initial barrier to entry, they will not have the ability to benefit from mini-grid energy use.
- Purchase of energy-using appliances: Promoting energy-using appliances may increase demand for a larger quantity, more reliable, and higher quality energy as well as alleviate time poverty and drudgery faced by many households, particularly the women in those households. However, these appliances may be too costly for many who live just above the poverty line, further contributing to exclusion.

SOLUTION

Various financing options could help women and marginalized groups connect to the mini-grid and purchase appliances that would increase their consumption and demand over time:

• Self-help or savings groups: These groups are important vehicles for saving and for access to credit for the poor who are often left out of formal financial systems. Many of these groups overwhelmingly consist of women, offering them not only access to finance, but also a space for social networking and information sharing. Energy companies can leverage these existing platforms to reach women with information on mini-grid electricity and link women with financing for the upfront installation costs.

Energy companies can also use these groups to market, sell, and finance the purchase of energy-using appliances. Members of these groups can contribute small amounts of money, allowing them to purchase one appliance, either to be shared by the group or to go to one member, and then the next month purchase another appliance for a different member. This method would likely require a third-party organization to connect the group with distributors of a particular energy-using appliance and possibly also to market and teach the group how to use the appliance. Alternatively, this is a role that could be taken on by sales agents.

- **Revolving loan**: The energy company or a partner nongovernmental organization (NGO) can provide a revolving loan to an existing self-help group. This group can use the loan to purchase a mini-grid connection and/or appliance for one member, and then over time, for other members.
- Commercial non-banking financial companies and micro-finance institutions: Energy companies can work with local commercial non-banking financial companies and microfinance institutions to develop loan packages that are specifically tailored to the needs of micro-grid customers for the purchase of a mini-grid connection and/or for an energy-using appliance.
- Installments: The energy company could simply allow the customer to pay off the installation fees in installments wrapped into their monthly fees.
- NGOs: Partner organizations can provide energy-using appliances at subsidized rates or enable customers to pay for appliances in installments over time.

BOX 7: EXAMPLES OF FINANCING INNOVATIONS PILOTED BY SPI

Self-help groups. SPI has already engaged with farmer groups in financing for the purchase of energyusing appliances such as irrigation systems, pumps, pipes, etc. Members pool money to purchase the system and then pay to rent the pump to irrigate their farms. This money is used to top off the energy account and cover management costs.

Commercial non-banking financial companies (NBFCs) and micro-finance institutions (MFIs). SPI has already partnered with NBFCs, such as Bajaj Finance, and MFIs to provide financing for energy-using appliances free of interest. SPI covers the 18-20 percent interest knowing that appliances such as fans and TVs, will increase energy consumption. This practice has also been used by BioLite to sell energy efficient cookstoves in Orissa. These stoves used charcoal, but a similar method could be used to sell draft stoves that would run off of mini-grid energy. An appliance provider could partner with the microfinance institution to design a loan specifically for that product, and then the loan officers could promote this appliance as part of their suite of products and services.

BOX 8: CREATING FEMALE-FRIENDLY FINANCING FOR GRID CONNECTION

The Lao People's Democratic Republic electrification project was able to tailor their financing mechanisms to female customers in order to increase their customer base. The project found that of those who were not connecting to the electricity grid, 43 percent were female-headed households who could not afford the connection. To overcome this challenge, the project piloted a component called Power to the Poor that established financing mechanisms targeted to these female-headed households and specifically scheduled meetings at times that were convenient for women. Power to the Poor provided a revolving loan fund that covered 80 percent of households' upfront connection and wiring costs. This initiative was able to increase electrification rates from 63 percent to 90 percent and from 75 percent to 96 percent among female-headed households.

Boatman, M. & Vilaythong, C. (2009). Rapid Assessment of the "Power to the Poor" Pilot Project, Lao PDR Rural Electrification.



GENERATE DEMAND THROUGH LOCAL ECONOMIC DEVELOPMENT

Targeting market segments that have a higher potential demand and willingness and ability to pay can accelerate the demand generation process. A possible target is to create and support economic enterprises (businesses, service providers, processing and manufacturing plants, etc.) that use energy for their operations. These enterprises may consume larger volumes of energy and can accelerate the demand for energy. Furthermore, mini-grid energy can also enhance productivity, promote growth and increase profitability from economic activities, with likely spillovers to the larger community. Creating a vibrant, thriving local economy can generate further demand for energy in communities.

SPRD INCLUSION CHALLENGE

Field visits and interviews with key informants suggest that mini-grid energy is not stimulating the local economy at desired levels nor in an inclusive manner. From the business point of view, this also means that demand for energy is not increasing at levels that could be possible. In the Preference Survey, both users and non-users report low levels of unmet need for energy, suggesting that they do not understand the potential value add of energy access and use to enhance their economic wellbeing.

While SPRD has engaged in microenterprise development through converting enterprises to productive energy use, expanding enterprises that are already using energy, and building energy-enabled industry value chains, these efforts have largely benefitted those who are relatively better off in the community, leaving out women and marginalized populations.

Strategy: Create energy powered microenterprise development that is inclusive, sustainable and good for business

Microenterprises' productive energy use tends to create higher demand for energy, particularly if paired with technologies that can enhance their productivity and profits. Promoting mini-grid powered microenterprise development therefore has the potential to increase short-term as well as long-term demand, particularly if the enterprises can grow and expand their energy needs. To the extent that these enterprises generate additional business, employment, and income opportunities within the community, they can also stimulate further energy demand at the community level in the medium-to long- term.

	Low	Medium	High
Business impact >		\checkmark	
Social impact >			\checkmark
Resources >			~
Partnerships >			~



- Energy service companies struggle with low and slowly growing demand for mini-grid electricity as a vast majority of households use energy for lighting purposes only. While energy companies would benefit from households and enterprises using productive loads, there often is not enough or the right type of economic activity to generate this type of energy use at the local level.
- In communities that have not previously had access to reliable energy, households and enterprises may not know how energy access could increase their productivity and profitability.

While local microenterprise development is a potential strategy for stimulating demand and economic activity, these approaches often leave out those who are most marginalized, presenting additional challenges:

- New enterprise development often targets existing entrepreneurs and financially better-off community members who have capital to invest and the necessary know-how, and therefore are better placed to take risks.
- When women or marginalized groups are targeted, the effort requires significant subsidization and support.

SOLUTION

Microenterprise development efforts can: (1) create new enterprises that use energy (e.g., tailoring); (2) convert existing enterprises to productive energy use (e.g., salons); or (3) expand operations of enterprises that are already using energy due to access to more reliable, high quality energy (e.g., cold storage facilities). Because the government grid is so unreliable, people are often hesitant to start or build businesses that rely on energy access; however, using mini-grid energy presents an opportunity to have reliable, consistent access to high quality energy. Microenterprise development efforts have the potential to create jobs, increase demand for mini-grid energy consumption, and stimulate local economic development. In order to ensure that microenterprise efforts are creating inclusive development by reaching women and those from other marginalized groups, these efforts should:

- Prioritize cases where conversions and expansion can generate employment and stimulate the market for other enterprises (creation of strong backward/forward linkages);
- Identify enterprises that are frequently operated by or that employ women and those from marginalized groups who would benefit from mechanization and power (See Box 9 for examples);
- Explore enterprises with potential positive social and health externalities (e.g. water purification, workforce capacity building; see Box 9 for examples);
- Consider how end users will benefit from the enhanced product or service and how to ensure the benefits accrue to a diverse group of community members (See Box 9 for examples); and
- Identify and involve collectives to scale enterprise development activities, including training, and use these as basis for creative financing solutions.

BOX 9: EXAMPLES OF MICROENTERPRISES WITH GREATER INCLUSION POTENTIAL

Enterprises that energize traditional industries, often operated by members of marginalized groups: In India, most of the traditional skills and small enterprises (e.g., weaver, blacksmith, cobbler) are generally run by members of marginalized social and economic groups. Prioritizing traditional skills and enterprises over other types of shops and enterprises therefore could improve inclusion and have multiple social and economic impacts. Mechanization of these low-end industries does not require significant power or capital supply; small manual equipment can be converted to mini-grid powered equipment to enhance productivity, saving time and drudgery.

Enterprises where women have stronger presence and comparative advantage:

While women-owned enterprises are not very common, they do exist and can benefit from mini-grid energy, which can increase their productivity and enhance the quality of their goods or services. An example of such a conversion is the introduction of power-enabled appliances for beauty parlors — a highly feminized sector — enabling owners to add services and increase productivity. This adoption can be leveraged for larger impacts: In contexts where women have relatively low mobility, small networks, and limited sources of information, women-owned businesses such as beauty parlors can be part of a marketing strategy that allows women to see the technology and learn about it.

Enterprises that can benefit women and households as end users:

This strategy involves introducing technologies that are significantly tied to enhancing household and community welfare and wellbeing. For example, irrigation pumps reduce the time burden and drudgery of the task of water collection for which women are frequently responsible, thus, this technology is likely to have great benefits for women.

Enterprises that use electricity for workforce capacity building:

Enterprise development that would help grow the capacity of the local workforce and prepare them for employment in industries with higher productivity and return could focus on the employability of women, youth, and marginalized groups. Examples include: tailoring, computer literacy, or other ICT related vocations.

Strategy: Identify and promote opportunities for energy-enabled and/or enhanced value chain engagement that use local resources and stimulate local economy and incomes

Local economic development activities can be brought to scale through an explicit focus on energy-enabled and/or enhanced value chain development initiatives. This type of effort involves identifying an industry with existing or potential local value chain elements that could be made more productive and profitable through the productive use of energy. These initiatives may require more detailed planning and coordination as well as larger upfront investment. However, their long-term benefits may be greater, particularly if the efforts draw from and strengthen localized backward and forward linkages, which in turn can dynamize the local economy and generate more economic opportunities at the community level.

	Low	Medium	High
Business impact >			\checkmark
Social impact >			\checkmark
Resources >			~
Partnerships >			~

- The energy demand and usage generated by households and microenterprises is still very low, and often not enough to enable energy service companies to make mini-gird energy distribution profitable. If companies could find customers with much larger energy consumption patterns, this could help to offset the costs of smaller users.
- In communities that have not previously had access to reliable energy, industries that rely on energy for productive use have not been established.

While initiatives that aim to promote energy-enabled value chain development can both greatly increase energy demand and consumption and create income-generation opportunities for community members, they offer a number of pitfalls that can minimize their impact and sustainability:

- Value chain initiatives can be extractive and do not form strong backward and forward linkages, therefore they do
 not generate enterprise or employment opportunities within communities. These factors result in limited or no local
 economic stimulus and limited benefits to the community.
- Value chain initiatives may not be sustainable if they do not draw from locally available resources (including labor because of skill mismatch).
- Conceptualizing and mobilizing these large-scale engagements are time and resource intensive and may not
 produce the sustained increases in energy demand envisioned.



SOLUTION

Creating energy-enabled value chains can spur local economic opportunities both directly through those employed in the enterprise and indirectly through increased activity for suppliers and markets, and greatly increase energy consumption, potentially enabling energy companies to offset costs of other smaller scale users. To ensure the sustainability and scalability of energy-enabled value chain development, companies should:

- Focus on value chain development opportunities that draw from local resources (backward linkages), which will
 increase the likelihood of sustainability and higher rates of local economic stimulus. For example, rice hulling that
 utilizes agricultural waste produced through rice farming.
- Ensure the wider context is amenable for a sustained and potentially growing role in the value chain (e.g. infrastructure, human resources, etc.). This includes ensuring strong and stable upstream market linkages to secure consistent sustained demand.
- Consider the employment generation potential within the node as well as in auxiliary economic activities.
- Be mindful of additional training and capacity needs that come with value chains, such as formalization, quality standards, etc.
- Consider value chain development opportunities that build on existing economic activities in the communities. In many contexts, this may be related to agriculture.

To ensure that energy-enabled value chain development is inclusive, efforts should:

- Ensure that opportunities generated by the value chain development initiative accrue to women and other marginalized groups. This may require additional training or active recruitment and organizing of women or other marginalized groups. Note that having women and other groups actively engage in a value chain may require a certain output volume and quality that these groups may not readily have. There may therefore need to be additional measures to bring them up to the level necessary for engagement. Organizing several smaller enterprises (cooperatives, trade groups, etc.) may help achieve the required volume. Once again, women and marginalized groups are less likely to be organized and represented in such groups or the organizations they are a part of may have lower capacity and networks.
- Ensure that equal opportunities are provided for all—particularly in the context of agriculture, value chain development introduces commercialization and as a result, co-option of the more profitable opportunities by men or other powerful individuals. Make sure that does not happen.
- Ensure that fair labor standards and work place conditions are in place. Women and other marginalized groups may not have the power to negotiate these terms and may need support.
- Consider the labor conditions that are amendable to women in the community. Will women be able to work full days
 or do they have other responsibilities at home? What support would enable them to commit more time to the job?
 Or how could additional women be pulled in to fill this gap?

BOX 10: SPI'S ENERGY-ENABLED VALUE CHAIN DEVELOPMENT

SPI has been leading several efforts around energy-enabled value chain development including an operational garment factory, a bee keeping operation, and a rice hulling operation with plans to expand similar initiatives. While there have been some initial successes with these initiatives, SPI also has encountered several challenges. For example, with the garment factory, it has been difficult for women to transition from manual sewing machines to mechanical methods. In addition, as women are the primary domestic caretakers they cannot commit as many hours to the garment work as the SPI envisioned. To more successfully bring women into this value chain, SPI may want to conduct a needs assessment to better understand the unique challenges women face when participating in formal working environments — such as hours of commitment, need for childcare, and mobility — and strategize around how to overcome these barriers.



CONCLUSION

The strategies presented in this brief provide a menu of options for energy inclusion and last-mile connectivity that focus on strengthening mini-grid energy supply and on stimulating demand for mini-grid energy. They underscore the importance of enhancing the capacity of supply chains to employ and reach those from underserved populations; testing innovations in energy package and supply to generate demand and spread benefits of energy access; developing more accessible and affordable financing and payment methods; and generating energy demand through a host of local economic development initiatives. While they were developed for the specific case of SPRD in India, and thus build off exiting efforts and include context-specific considerations, these strategies are relevant in other countries and contexts. By construct, last-mile energy distribution initiatives are intended to reach marginalized populations, however, without close examination of the client base and their preferences and targeted strategies shaped by these insights, inclusion and inclusive growth may not be achieved.

The strategies described here provide a foundation for applying an inclusion lens to energy expansion initiatives and developing more explicit practices to reach women and those from marginalized groups in energy access and productive use, ultimately contributing to shared economic development. ¹International Energy Agency (IEA). (2017). Energy Access Outlook 2017: *From Poverty to Prosperity*. OECD/IEA. Available at: https://www.iea.org/publications/freepublications/publication/ WEO2017SpecialReport_EnergyAccessOutlook.pdf

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