Shared Value Initiative

Smart Power for Rural Development

Creating a Sustainable Market Solution to Energy Poverty

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By Kyle Muther, Senior Consultant

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Rohit Chandra is passionate about powering rural economies with electricity—specifically, bringing power to the more than 300 million rural Indians who currently lack it. Without rural electricity, the most remote and economically at-risk populations in India also lack the means to grow their businesses, educate their children, and access health services. "For me, this is much more than a job," Chandra says. "We see the potential to have huge social impact by using a more grassroots power model that can profitably serve the base of the pyramid consumer market."[1]

To follow through on this passion, Chandra co-founded OMC Power, a renewable energy services company (ESCO) based on the idea that demand will increase if electricity is made affordable and reliable in rural areas.[2] OMC is the pioneer of a unique and innovative "ABC" model, whereby it provides power to telecom towers as "A"nchor loads, rural small and medium "B"usiness enterprises, and rural "C"ommunities via reliable solar mini-grid power plants that produce approximately 25-100 kilowatts (kW).

Chandra's dream is to facilitate the economic empowerment of rural Indians by growing OMC into the world's largest rural electrification company.[3] OMC is committed to build 1,000 solar mini-grid power plants in the next four to five years and scale to 25,000 in the next 10 years, capturing at least 20% of the Indian mini-grid market.[4] He also sees great opportunity for innovation. His goal is to reduce the cost of electricity production by half within the next three years.[5] As OMC reduces these costs, Chandra says, "we will soon be at an inflection point—the market will explode and we will be the innovators and the first movers."[6] Chandra has 30-plus years of experience in the telecom space, and his experience has convinced him that the rural electricity sector, like mobile telecommunications, lends itself to extraordinary economies of scale if the business model is implemented successfully.[7]

By delivering electricity to rural businesses, which can increase output and productivity with a reliable source of power, OMC is significantly improving local economies. As one OMC customer who was accustomed to spotty electricity from unreliable generators noted, "When electricity came, it was like magic… [A] 24/7 power supply raised my earnings by around Rs 40,000 [~USD $600] a month. Most of the irrigation pumps in the area operate only for a few hours a day because there is no electricity. But I can run [my pump] up to 16 hours a day."[8] Providing cost-effective and reliable electricity has the potential to dramatically improve long-term prosperity and well-being in the developing world, building a more resilient and inclusive rural economy.

Introduction

The Rockefeller Foundation is supporting ESCOs* such as OMC, DESI Power, Tara Urja, and others to create shared value through its Smart Power for Rural Development Initiative. Shared value is a management approach that enables companies to increase profits, reduce costs, and enhance competitiveness by solving social problems, such as limited access to electricity.

Rockefeller's Smart Power for Rural Development Initiative provides affordable financing to ESCOs and links them to an ecosystem of Rockefeller grant-funded partners, which provide project and business development support as well as policy and regulatory recommendations. Rockefeller's partners are coordinated by Smart Power India, a Rockefeller-incubated entity and wholly-owned subsidiary. The Foundation set an ambitious target to reach one thousand villages within the first three years of the initiative, with a goal of building a viable market quickly and spurring interest, action, and innovation among key players in the ecosystem.

Rockefeller's strategy to support the shared value ecosystem for renewable mini-grids is already delivering significant results for ESCOs. OMC is seeing a rise in its number of rural business customers and enhanced community engagement—and, as a result, higher revenue.[9] Beyond direct business results, OMC is experiencing considerably enhanced brand recognition—critical for a market still unfamiliar to investors.[10] As Chandra notes, "Rockefeller plays a very important role of providing the needed financing and visibility for the sector in general, reducing overall market risk and making other lenders more comfortable in investing."[11]

The Problem and the Opportunity

Despite great effort and the huge sums of money spent on promoting the expansion of national grids, poor rural communities worldwide continue to lack affordable and reliable electricity. For 1.3 billion people (18% of the global population), accessing electricity to power homes and businesses remains a distant reality.[12] 95% of the 1.3 billion live in either Sub-Saharan Africa or developing Asia, and 84% live in rural areas.[13] 304 million, or nearly one in four, live in India—making it home to the largest un-electrified population in the world.[14] In India, only 67% of households in rural areas have access to electricity, compared to 94% in urban areas.[15] In some predominantly rural states, such as Bihar and Uttar Pradesh, only 10% of the population has access to electricity.[16] The Indian national government recognizes the lack of access to electricity as a social concern, and there are programs in place to extend grids in rural areas where access to electricity is the lowest.[17] However, according to an industry report, "progress has been slow, and the number of underserved households is expected to decline by only 5% over the next 10 years."[18]

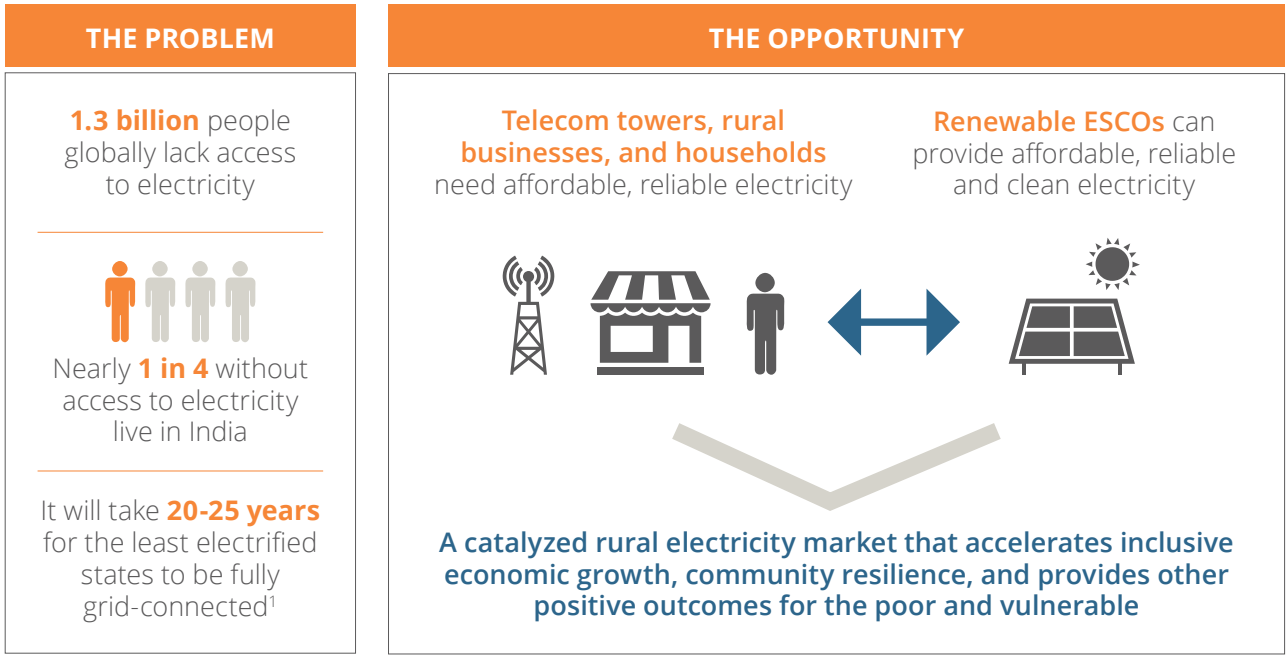
*This case study will use the term ESCO to mean a company that provides electricity for a wide variety of users. An ESCO operates and manages the generation and distribution of de-centralized renewable energy.

WHAT IS A RENEWABLE ENERGY MINI-GRID?

A renewable energy mini-grid power plant is normally composed of a primary alternative power source (e.g., solar PV panels, biomass facilities, wind turbines, hydropower stations, or hybrid generation sources) and a source of back-up power supply, such as a diesel generator or battery storage. The mini-grid supplies electricity to multiple customers, including households and businesses. ESCOs build, manage, and maintain these systems.

They are used in areas not connected to the main electricity grid. Telecom towers provide ESCOs with an example of an "anchor load," meaning they provide consistent and reliable demand, therefore improving overall economic viability.

FIGURE 1: THE PROBLEM AND THE OPPORTUNITY



1. Ministry of Power, Rockefeller team analysis

Lack of access to reliable electricity has a negative impact on social and economic development, limiting people's ability to enhance their incomes, improve their health, increase their food security, educate their children, and access key information services.[19] It especially burdens women with physically taxing activities and decreased safety.[20] Lack of access to electricity constrains rural business development by increasing operational costs, and lowering agricultural productivity.[21] Perhaps most importantly, it is a major barrier to achieving a more inclusive economy and to building the resilience of poor or vulnerable populations.

In India, at least half of rural household power demand will need to be met by solutions beyond the traditional grid.[22] While a range of rural electrification solutions such as solar lanterns and solar home systems are available for basic household lighting, few meet the needs of *multiple productive electricity users*, including rural infrastructure (e.g., telecom towers, banking facilities, gas stations), rural businesses (e.g., milk chillers, agro-mills, cold-storage), and rural households.

Mini-grids provide a unique solution because of their ability to connect rural businesses and industries to reliable and affordable power—spurring local economic development. As Jaideep Mukherji, CEO of Smart Power India, noted, "I worked with solar lanterns for some years, but kept getting the question: 'What's next? We want to work and have an income. We need more energy.' [The rural poor] desire to have the same electricity connection as anyone else, [and] solar devices would never meet these needs. It's about powering economic activity."[23]

There is growing interest among businesses, the government, and policymakers to address energy poverty. Renewable mini-grids are increasingly being recognized as a key solution to address the inability of the national grid to meet those most in need. Increased penetration of telecom towers in rural areas with high demand for affordable and reliable electricity and the growth of rural economies are creating

sustainable demand sources for ESCOs. Other rural anchor loads, such as irrigation pumps, can also provide significant demand.

One report estimates that the total market size for decentralized renewable energy systems in India could be $150 million by 2018.[24] Rockefeller identified the importance of large institutional or anchor customers as an important first step in helping ESCOs take advantage of the market opportunity. Serving only businesses and households can be difficult due to spikes in demand or insufficient demand to spread costs out over a wider group. Anchor loads, which consume more consistently and reliably and are therefore able to sign long-term power purchase agreements, help improve the financial sustainability of the ESCO model. Rockefeller explored which anchor customers could play this role. In India, telecom towers were a natural candidate because of their deep penetration in rural markets, increasing energy demand, and high operating costs due to the use of expensive diesel fuel.

The Indian telecom tower industry provides potential opportunities for ESCOs to realize economies of scale. A single telecom company can directly or indirectly own 100,000 of the country's 400,000 total towers.[25, 26] India's growing demand for mobile phones—from 6.4 million subscribers in 2002 to 752 million subscribers in 2010—has driven the proliferation of towers.[27] Energy demand from these telecom towers is projected to grow 13% per year, with less than half supplied via the grid.[28] Most telecom towers in rural locations use expensive diesel fuel,[29] resulting in higher operating costs and reduced profitability. The revenue potential for electricity providers serving rural telecom towers alone in India is forecasted to grow to at least $95 million by 2018,[30] which should increase with a recent government mandate that 50% of all rural telecom towers shift to renewable energy.[31]

Those ESCOs that have been providing solar power to telecom towers are now considering expanding their consumer bases to include households and rural enterprises.[32] Smaller ESCOs, which have traditionally served rural households, are interested in supplying electricity to telecom towers or other rural anchors, such as irrigation pumps, as well as to local businesses. By electrifying telecom towers, rural businesses, and households, the mini-grid delivery model strengthens the financial viability of ESCOs, improves productivity of rural businesses, and increases access to lighting for households—contributing to overall economic opportunity and a more inclusive economy. A more dynamic rural economy in turn leads to an increase in the consumer base of paying electricity consumers.

Business Needs and Barriers to Scale

Beginning in 2010, Rockefeller undertook a period of research, analysis, prototyping, and testing to better understand the ecosystem of organizations involved in rural electrification and the barriers to scaling potential solutions. Rockefeller established a set of pilot mini-grid plants to begin to test project development tools; link ESCOs to NGOs to foster improved community engagement; explore opportunities for standardization, innovation, and bulk purchasing to reduce technology costs; build financial models to identify risk capital needs; and identify policies and regulations that would strengthen market confidence.[33] Rockefeller's leadership on the research and design phase demonstrates the unique role that foundations, as neutral entities with the ability to de-risk new markets in unfamiliar geographies, can play in helping a broad range of stakeholders understand past system failures and identify the key leverage points for change.

In the Indian market, ESCOs struggle to reach scale due to concerns over demand, operational constraints related to doing business in rural areas, uncertainty over the policy and regulatory environment, and lack of access to financial capital. This represents the classic pioneer gap, where a market-based solution has the potential to drive change at scale, but requires external support, such as philanthropic funding, to be fully realized.[34] Each of the following business needs formed the building blocks for Rockefeller's Smart Power for Rural Development approach.

ESCOs need assured, predictable demand: Rockefeller found that facilitating power purchase agreements (PPAs) between ESCOs and telecom tower operators would provide a baseline level of demand, enabling ESCOs to more quickly recover upfront plant construction costs and sell electricity to rural businesses and households. Pooja Raman, Legal Counsel and Investment Lead for OMC Power, says, "Apart from telecom towers, we focus on rural business because they assure the needed electricity demand to make the project feasible."[35] Desi Power, an ESCO focused on clean, affordable power provision in rural India, connects with smaller local industry to aggregate demand and calibrate supply. However, though renewable electricity is often cheaper than kerosene and diesel, rural consumers are skeptical.[36] Consumers wait to ensure alternatives to established energy sources are reliable.[37] Businesses are often seasonal, making it difficult to properly size a grid and balance load. Also, ESCOs lack data on rural consumers' needs and willingness to pay. This leads to an unpredictable load ramp-up timeline, reducing ESCOs' ability to plan and allocate resources. Ensuring sustained demand remains a key barrier to scale for ESCOs.

ESCOs require the skills and experience to serve rural markets and reduce technology costs: Many ESCOs have been traditionally focused on selling to telecom towers or to consumers and businesses in high-density urban areas. Therefore, they lack experience and the skills necessary to create and maintain a rural customer base, and perceive risk around collecting payments, and often lack the knowledge to successfully site a plant that will serve multiple electricity customers (e.g., households, rural businesses, anchor loads, etc.).[38] In addition, fragmented supply chains and low order volumes create high technology sourcing costs for solar panels, batteries, and mini-grid components, further limiting the scalability of the model.

ESCOs need access to low-cost capital and government subsidies: Since the business model delivers modest financial returns, involves high risk, and requires a long-term investment, ESCOs struggle to access low-cost capital. The financial viability of the business model is heavily dependent upon the cost and availability of the funds required for the initial capital investment, the speed with which consumers

are connected to the power source and their payments collected, and the availability and timeliness of funding from government subsidies from the Ministry of New and Renewable Energy (MNRE).[39] For example, the internal rate of return (IRR) on a mini-grid project is reduced by nearly half when the ESCO does not receive a government subsidy from the MNRE.[40]

ESCOs need a regulatory environment that reduces risk and is conducive to long-term growth of the market: The lack of clarity around the Indian government's grid extension plans and difficulty in accessing government subsidy has led to some skepticism about the viability of the ESCO business model. Raman notes, "The biggest challenge that we face right now is that this industry is relatively unregulated, so we don't have a clear-cut policy around mini-grids, thus no framework within which we need to operate."[41] In addition, the uncertainty around the long-term strategy for linkages between the mini-grid and the main grid—whether the mini-grid will become the last-mile distributor or feed into the main grid directly—makes it challenging to obtain visibility into the long-term model.

The developmental phase of the initiative, which included ground-level prototyping, also focused on developing an understanding of the needs and aspirations of rural customers and creating a business model to address those needs affordably. Through this intentional process and the active development of the above hypotheses in collaboration with private sector actors, Rockefeller was in a strong position to develop the market-based platform and suite of services needed to catalyze action in the sector. As Sanjay Khazanchi, an independent consultant and implementing partner since the beginning of the initiative in 2010, remarked, "This phase was really about laying the groundwork for the program. We established a very strong platform in which to engage all of the various stakeholders. The market-based approach makes the model a bit challenging, but at the same time sustainable."[42]

The Rockefeller Foundation's Approach: Fostering Shared Value Ecosystems for Rural Power

In 2014, the Foundation officially launched the Smart Power for Rural Development initiative by committing $75 million (including $10 million in the exploratory phase) in grant funding and affordable loans† to an ecosystem of partners, including ESCOs, NGOs, and civil society organizations. With a goal of demonstrating the financial viability of the market, it set the ambitious target of connecting one thousand villages and one million people to renewable mini-grid plants. Connecting one thousand villages provides the scale necessary to bring credibility to the business model and demonstrate the investment opportunity for the private sector.

To quickly demonstrate results, encourage new partnerships, and build the evidence base of what works, Rockefeller fast-tracked 26 plants during the summer of 2014. These plants provided an important platform to test and validate various assumptions about the business model and to build momentum in the market. According to Clare Boland Ross, Associate Director of the Rockefeller Foundation, "The main plan was to get some plants on the ground so we could start validating and challenging assumptions in

†These affordable loans are called program-related investments (PRIs). PRIs are investments made by foundations to support charitable activities that involve the potential return of capital within an established time frame. They are similar to private sector instruments like loans. They are used when the borrower has the potential for generating income to repay a loan but faces challenges in securing financing from traditional sources.

the model. This was important to act as a proof point for both telecoms and ESCOs. It has turned out to be even more valuable than we thought, as we learned so much through the implementation and can now continue to use these sites as a way to test and showcase new innovations before rolling them out to ESCOs."[43]

Smart Power's vision is to accelerate inclusive economic growth, community resilience, and other positive outcomes (e.g., improved access to education, increased health and safety, improved women's empowerment, etc.) for poor and vulnerable people in India by catalyzing a rural energy transformation. The approach centers on a simple but profound realization: in order to catalyze the market for renewable mini-grids that serve multiple users, the Foundation must work in close collaboration with partners to demonstrate a financially viable business model and address barriers to scale.

Addressing barriers to scale

The Foundation fosters the creation of a shared value partnership ecosystem that strengthens the financial viability of ESCOs by focusing on three critical components of rural electricity delivery: electricity supply, electricity demand, and the enabling environment. To coordinate these various partners, Rockefeller established Smart Power India to be a strategic advisor to the ESCO market, providing financing, project, and business development support.

On the electricity demand side, Smart Power India partners such as Technology and Action for Rural Advancement (TARA) help ESCOs develop demand generation strategies to convert rural businesses to renewables, enable new rural businesses to start up and expand, and educate consumers about the benefits of renewable energy. Partners such as PANI help with community engagement and general marketing and visibility.

On the electricity supply side, Smart Power India and its partners, including CKinetics, help to promote adoption of best practices and subsidize initial start-up costs by: (i) providing project development support (e.g., site selection, energy assessment, project feasibility reports); (ii) sharing on-the-ground learnings and emergent innovations across a network of ESCOs (e.g., collection methodologies, metering); (iii) providing training on practical business development tools (e.g., models for plant economics, data collection tools, standardized contracts with customers and suppliers); and (iv) facilitating bulk procurement and investment in technology innovation to reduce costs.[44]

Within the enabling environment, Smart Power India works to bring greater clarity to the policy and regulatory environment and increase access to financing options. Rockefeller's main policy partner, Shakti Sustainable Energy Foundation, helps inform policies and regulations in India that impact the growth of the mini-grid market. Shakti is currently working with the MNRE, the Central Electric Regulation Commission, and the various state regulatory commissions to develop state and national mini-grid policy frameworks to answer three key questions:[45]

- Where and when will the national grid most likely be extended, and what geographies should be prioritized by off-grid solutions?
- What government financial and non-financial support will be available for mini-grids?
- What will be the protocol for connecting mini-grids to the traditional grid?

Shakti works closely with other Rockefeller Foundation partners, including ESCOs and NGOs, to incorporate a diverse range of opinions into the policy framework development process. As Deepak Gupta, Senior Program Manager (Power) at Shakti, noted, "These multiple perspectives help us define our policy prescriptions. We don't want to lose out on any good ideas. We reach out to each partner one-on-one and the group as a whole to get their perspectives, host debates, and try to help engender cross-pollination of ideas around policy."[46]

To get ESCO businesses off the ground, Rockefeller provides financing through program-related investments (PRIs). A pioneer, the Foundation has been making PRIs—investments expected to generate both social impact and a concessionary financial return—since the 1990s. In the case of Smart Power India, Rockefeller is investing approximately $23 million in PRIs. The use of proceeds for the PRIs is to partially finance the capital expenditures incurred by the ESCOs when building plants. ESCOs are required to raise debt and equity to finance the remainder of the cost of the plants. To ensure social impact, the Rockefeller loan agreements require ESCOs to provide a substantial proportion of their electricity to rural businesses and households. In addition, Rockefeller's support reduces the risk for other potential impact investors and funders to enter the market, and increased financial viability of ESCOs serves to reinforce the investor value proposition.

Providing a range of services

Today, Smart Power India contracts with existing Rockefeller Foundation-funded grantees, but will eventually move toward a more autonomous selection process, directly contracting with support partners. Ultimately, the goal is for Smart Power India to attract additional investment as well as

potentially its own revenue streams so that it can directly offer services to ESCOs. In the end, of course, the ultimate objective is to create a self-sustaining market for renewable ESCOs.

As Jaideep Mukherji notes, "I think it would be SPI's ambition to put itself out of business. If we can create a self-propagating and commercially sustainable system with private capital coming in and a supportive government, that would be a tremendous success for SPI and a legacy that the Rockefeller Foundation would be really proud of."[47] Smart Power's partners provide services across this ecosystem to address the business needs and barriers to scale that inhibit the overall growth of the ESCO market. Figure 2 illustrates these business needs and the range of services that Smart Power India provides, and Figure 3 showcases the initiative's partnership ecosystem. These elements showcase the comprehensive approach the Foundation has taken to support the growth of shared value solutions in this marketplace.

	ECOSYSTEM	BUSINESS NEEDS	SMART POWER
ENABLING ENVIRONMENT	Policy/ Regulatory	• Regulatory environment that reduces risk and is conducive to long-term growth of the market • Access to low-cost capital and government subsidies	• Shape policies and regulations to bring greater clarity in the mini-grid market • Enable access to subsidies at scale • Provide risk capital and bridge financing for subsidy delays
	Funders/ Financiers		
ELECTRICITY SUPPLY	ESCOs	• The skills and experience to serve rural markets and reduce technology costs	• Project development support (e.g., site selection, project feasibility) • Business development support (e.g., plant economics data collection, standard contracts) • Technology and business model innovation (e.g., collection methodologies, bulk procurement, metering)
ELECTRICITY DEMAND	Rural Households	• Assumed, predictable demand	• Support ESCOs with load development strategy • Engage with communities to educate consumers about benefits of renewable energy • Engage with partners to development micro-enterprises to renewables • Facilitate purchase power agreements between telecom towers and other anchor loads and ESCOs and engage with industry associations
	Rural Businesses		
	Telecom Towers and Other Anchor Loads		

FIGURE 2: SMART POWER INDIA SERVICES TO ADDRESS ESCO BUSINESS NEEDS

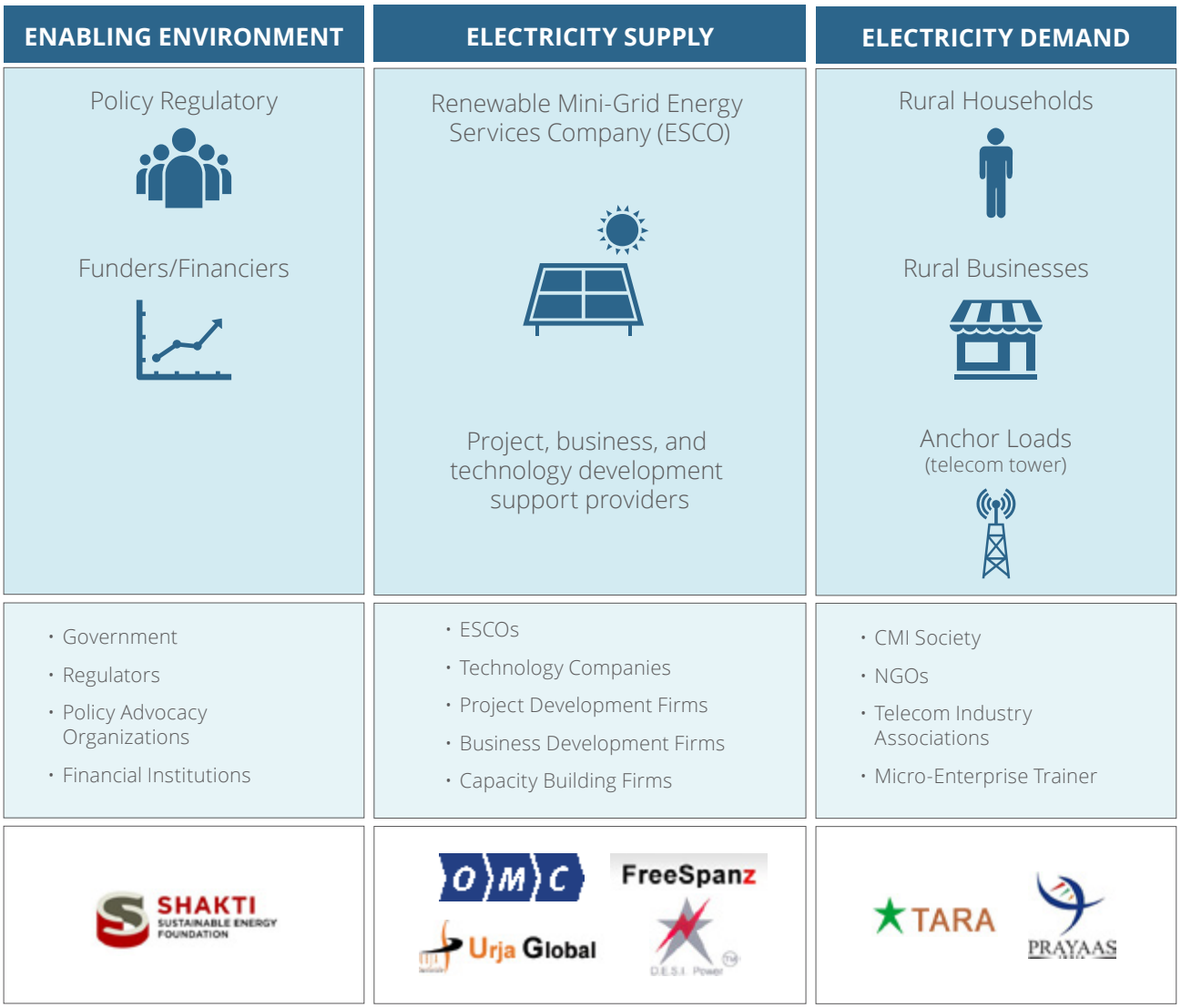


FIGURE 3: SMART POWER INDIA PARTNERSHIP ECOSYSTEM

The Foundation recognizes that much work remains. Rural electrification is not just about plugging in fancy technology; it requires the creation of the conditions and leaders which will promote a long-term, sustainable business model serving multiple users. By drawing upon its unique ability to influence and facilitate across market sectors, Rockefeller is creating the on-the-ground market infrastructure in India that can catalyze and scale up renewable mini-grids, which will serve the power needs of rural consumers.

OMC POWER SHARED VALUE PARTNERSHIP

Engaging with communities and rural businesses to build a strong presence in rural markets requires OMC, an ESCO based in New Delhi, to build new capabilities to generate the needed demand. The company faces challenges in acquiring rural customers, developing the business model for new markets, getting the needed approvals for project development, and complying with local and state regulations. OMC's partnership with the Rockefeller Foundation and Smart Power India enables OMC to quickly deepen relationships with rural businesses and local communities in order to connect rural consumers in a cost-efficient manner. Smart Power India provides value to OMC in three distinct ways, resulting in direct business benefits:

1. **Customer acquisition:** Smart Power India partners help connect OMC to potential rural businesses, enabling the company to acquire rural customers and increase revenue and reduce costs.

2. **Business modeling:** Rockefeller-provided data analytics on the size and composition of the potential electricity consumers in each village help OMC properly size its plants to meet demand and load ramp up needs, resulting in higher profitability and reduced costs.

3. **Policy advocacy, influence and visibility:** Smart Power India brings greater clarity to the mini-grid development and financing process—critical to increasing investor confidence, reducing risk, and strengthening long-term access to affordable capital.

Due in part to the partnership with Rockefeller, OMC is poised for future growth and expansion in the Indian mini-grid market. OMC has leveraged Rockefeller's brand reputation and ecosystem of partnerships to raise the visibility of its business model and importantly enter into discussions with domestic and foreign capital providers. According to Chandra, "I think that many pieces of this are continually evolving towards positive outcomes; the business model is getting more and more refined, streamlining expenditures across units. We are driving it, lots of players are driving it. Cost of production could be reduced by half in the next three years. Rockefeller will continue to play a key role in helping to scale the model."

DESI POWER SHARED VALUE PARTNERSHIP

DESI Power's leadership has long believed that traditional electricity grid extension efforts will not be able to meet the development needs of India's villages that lack access to reliable power. In 1996, the company began to develop an integrated electricity solution for India's rural poor. As DESI Power founder Dr. Hari Sharan notes, "We have to look at these three aspects—social, environmental, and economic value—simultaneously. Any business has to be profitable, but we do not try to maximize profit at the expense of the village development—we actively work with villages to generate the demand via small businesses that also have a social impact. Electricity is used as the motor of development rather than the end in and of itself." To measure impact, the company has developed a robust monitoring system that tracks various social metrics, including job creation and agricultural productivity.

This social impact ethos parlays into DESI's primary focus on developing local economies through electricity delivery. Rather than taking a telecom tower-focused approach, DESI connects smaller-scale but growing industrial actors—such as irrigation pump operators, water companies, energy service businesses, and cold storage companies—to the mini-grid system. Effectively matching electricity supply to the various needs of different types of consumers and enterprises, with daily and seasonal load variation, is the key to profitability of the business model. DESI works closely with Smart Power India partners that provide financing and training to electricity providers and rural businesses.

DESI has benefited substantially from partnership with Rockefeller:

1. **Building load demand:** Smart Power India has connected DESI to enterprise development providers and improved the company's internal capacity to effectively target rural enterprises from project management, plant construction, and O&M and training through scale.

2. **Financing rural businesses:** Smart Power India has identified other sources of financing for rural businesses, facilitating stronger local economies and generating more demand.

3. **Improving visibility:** Smart Power India's integrated approach is beginning to demonstrate the viability of the model to potential investors and policymakers.

Dr. Hari Sharan envisions a future in which all 700 villages in Araria district will have their own power plants and enterprises, starting with 100 power stations in 100 villages within the next three to four years. Over the longer term, he hopes the system will evolve so that a national power system consisting of centralized and decentralized grids sources 40-60% of its power from CO2-emission-free mini-grids. These partnerships will ultimately lead to a sustainable business model that secures greater access to electricity and jobs for India's rural poor.

Results to Date

The Rockefeller Foundation and Smart Power India teams have embedded learning and evaluation throughout their approach. The Foundation leverages a subset of mini-grid plants to continually prototype and test business model innovations before offering them to the ESCO network. Smart Power India has also implemented a systematic monitoring and evaluation process that informs strategic decision-making and enables adaptive management of its projects. Operating at three levels, the monitoring and evaluation process involves: 1) close-to-real time information on the implementation of power plants through the Smart Power Implementation Monitoring System (SIMS); 2) monitoring of intermediate and longer term outcomes; and 3) independent impact evaluation and rapid reviews of key socioeconomic metrics such as income generation, education, and health improvements.

SIMS analytics have been used by grantees, ESCOs, and the Foundation to identify risks in implementation and support ongoing learning efforts, in particular around ensuring Smart Power India's services meet ESCO business needs.[48] The independent impact evaluations highlight gaps in addressing customers' concerns and offer recommendations for ways that ESCOs can improve their processes to increase customers' satisfaction.

Since the launch of the full initiative in mid-2014, Rockefeller has focused on improving the economics of the business model, sharing insights among a diverse network of partners, and transitioning key roles and responsibilities to the Smart Power India entity.[49] As of January 2016, the Rockefeller Foundation has facilitated the development of 85 renewable mini-grid plants.[50] These plants are currently supplying quality power to more than 15,000 people, 1,952 rural businesses, and 81 telecom towers.[51] A first step to achieve the initiative's objective to reach one thousand villages is to motivate rural consumers to switch to renewable energy—and use it to develop and expand local businesses, enhancing the local economy. ESCOs are responding to evidence of increasingly sustainable rural electricity demand.

Increased demand for power from households and businesses

- **Shift from diesel power to renewable power:** In the most recent data from July 2014, seven in ten households and eight in ten rural businesses are using the power from the mini-grid as their primary source of electricity. For rural business consumers using Smart Power mini-grids, diesel generator use has been reduced by 84%, and kerosene lamp use has been reduced by 90%.[52] For household consumers using Smart Power mini-grids, kerosene lamp use has been reduced by 72%. This shift from diesel and kerosene lamps to renewable power indicates that consumers perceive significant benefits from the renewable power. The main reasons consumers are willing to switch to renewable energy include enhanced reliability and consistency of supply, increased supply hours, improved quality of light, and reduced costs.
- **Increasing demand for renewable electricity:** After experiencing consistent and reliable Smart Power connections, many consumers indicate a willingness to consume more power (some diversify consumption by adding more appliances, including fans and televisions) and also pay proportionately more for it. This has built confidence among rural businesses, leading to observed increased operating hours. For rural business consumers using Smart Power mini-grids, electricity demand has increased by 33%. For household consumers using Smart Power mini-grids, electricity demand has increased by 25%. Anecdotal evidence points to telecoms reducing operating costs through shifting from diesel to solar power.

Socio-economic impacts

- **Improved overall vibrancy of the local economy:** Evidence from Smart Power-connected consumers points to increased hours of operation for rural businesses and village markets, suggesting a more vibrant local economy. Smart Power is connecting businesses that have a wide range of social and economic benefits including pharmacies and learning support centers (for school tutoring and computer instruction).
- **Education:** Smart Power-connected households are using added hours of electricity for studying, leading to qualitative evidence that indicates children are more engaged in school. Parents also suggest that brighter Smart Power LED bulbs make studying more comfortable and less stressful for their children's eyes.
- **Health:** Households perceive reduced eye problems due to elimination of flickering lights.[53]
- **Enhanced sense of safety:** Smart Power consumers perceive greater safety, particularly among women and young girls, due to more reliable street lights.
- **Improved quality of life:** Women suggest that availability of consistent and luminescent light makes their engagement in household chores more convenient. With reliable and predictable supply, they have more time available for socializing and leisure activities.

Business Impacts (ESCOs, and rural businesses)

It is still too early in the project's implementation process to fully demonstrate business outcomes. However, below are some early results for ESCOs and rural businesses:

ESCOS

- By the end of the first quarter of 2016, 100 plants are up and running with plans to bring more online, demonstrating ongoing interest from the market
- Bulk purchasing of parts resulted in discounts of 6-7% for the first 30 ESCOs working with the initiative
- Performance has varied widely across sites with some performing well and others lagging behind targets. Local teams are studying these differences to identify the conditions and interventions that drive success
- The model is well-known among sector stakeholders and has generated a strong appetite to learn more and engage with the initiative going forward

RURAL BUSINESSES

- Significant ground-work has been done to create new rural businesses
- About three-quarters of rural businesses reported an expanded customer base
- When connected, rural businesses save significant money on monthly energy expenditures, resulting in increased income and business expansion[54]

Lessons Learned

Despite the achievements listed in the previous section, Rockefeller is facing challenges related to meeting the scale (number of plants) and efficiency targets of the ESCOs (revenue and cost targets) that were originally outlined. These challenges are not surprising given the nascent nature of the market. Three lessons that potentially shed light on these challenges include:[55]

1. **Actual costs are higher and revenue is harder to capture than originally anticipated.** Given the early stage of the market, it is unsurprising that a focus on improving plant level economics will be important. The Foundation is beginning to address this by investing in innovations to help bring down the cost of capital expenses and by supporting the growth of rural businesses.
2. **More flexibility is required to meet the needs of the market.** A private sector-led approach to the energy market requires less prescriptive approaches to outcomes and solutions. This will require Rockefeller to continue to evolve the model to allow for the unique needs of each ESCO, and facilitate innovative responses and strategies to market pressures and individual customer needs.
3. **ESCOs value financing support and diversified services, but different business models will continue to require tailored offerings.** Individual ESCOs have different business considerations, existing skills, and unique gaps in their capabilities. The Rockefeller Foundation has realized that this diverse pool of partners has needs that cannot be met with a "one-size-fits-all" support package. As the model evolves, a focus remains on customization of services to the specific strengths, challenges, and needs of each ESCO.

These insights have enabled the Rockefeller Foundation to build greater flexibility into the business model by broadening engagement to new potential institutional/anchor load customers, identifying areas of innovation to bring down costs, more effectively tailoring services to different types of ESCOs, and focusing efforts on local economic development to ensure continuous growth in the demand for power. More detail on each of these insights is offered below.

1. **Creating a flexible business model with the potential to engage additional anchor industries:** The opportunity for telecom towers is clear—they are located in many rural villages without access to electricity and ensure a steady demand base. However, Rockefeller has learned that the key is to develop a diverse and healthy load mix, and that telecom towers are only part of the solution. Servicing a telecom tower comes with its own challenges, requiring the ESCO to provide continuous, uninterrupted power for 99.9% of the time. ESCOs are penalized financially by tower owners for every minute of down time.

Therefore, Smart Power India seeks to engage additional anchor industries including financial institutions/ATMs, water irrigation systems, and fuel stations, among others. By creating a healthy mix of different customers, Smart Power India strives to ensure that ESCOs are not overly reliant on one or two anchor loads to provide reliable demand. As Smart Power India CEO Mukherji notes, "We always wanted to create some flexibility in the business model. It is not just telecom towers that can be the anchor loads and provide the demand that ESCOs need. If these entities help us achieve the impact we want to achieve, we should embrace them."[56]

2. **Driving new business model innovations to bring down cost of electricity distribution and promote more efficient use:** In its first year of operation, Smart Power identified payment collection inefficiency, load ramp-up, and technology costs as significant drivers of higher CAPEX and OPEX costs. To address these concerns, Rockefeller is currently in the process of standardizing a variety of technical and operational tools to improve the profitability of the business model. For example, the Foundation put more energy into bulk purchasing contracts for technology parts and identified mechanisms needed to incentivize connecting productive loads. Another prospective strategy would be to engage partners to implement mobile payment collection and pre-paid metering.
3. **Tailoring services to a broad range of ESCOs:** Each ESCO is unique in its strengths and capabilities. Some are already well connected to the community and do not need Smart Power's support to engage consumers. Others need assistance with technical issues, business processes, or partnerships with telecoms. Smart Power India must therefore build each ESCO relationship based on its particular strengths and weaknesses. As Khazanchi notes, "After we worked with many ESCOs to build more plants, we realized that it is absolutely critical to customize ESCO services based off of their specific business needs."[57]
4. **Keeping rural business as a central focus:** Mini-grid connections alone don't automatically make rural businesses successful. The Rockefeller Foundation understood the need for a much more concerted effort to develop rural businesses that meet local needs and have access to a market to supply their goods and services. The Foundation views the focus on rural business development as central to achieving the economic growth that it seeks. To this end, it is working with grassroots development agencies which are specialized in providing services to build the capacities of rural business. Rockefeller is also cultivating other corporate partners who are planning to extend their supply chain into villages where ESCO mini-grids are located. Rockefeller has created a village-level Gross Domestic Product (GDP) tool to track changes of GDP within the Smart Power mini-grid coverage area. This data will help Rockefeller understand overall market dynamics in order to provide the necessary services to scale rural businesses.

Looking Ahead

The Rockefeller Foundation understands that the rural electrification challenge is complex, and that technological interventions will not be sufficient in moving the needle and achieving long-lasting change for rural economies. With hundreds of millions of Indians still without access to reliable electricity, the need for a financially viable, market-driven, and systemic solution is urgent. The Foundation critically framed the problem not just as electricity access for access's sake, but through the prism of market development and serving the electricity needs of a growing rural economy—ensuring that renewable mini-grid ESCOs are linked to demand from rural businesses and households.

To date, Smart Power India has progressed toward providing a sustainable solution to the local energy crisis. The initiative has developed a business model and is actively addressing barriers to scale. Through this work, the Foundation has fostered the creation of a shared value partnership ecosystem, leveraging its influence and convening power to bridge key stakeholder divides and develop a sustainable solution that provided mutually beneficial solutions for households, rural businesses, telecoms, ESCOs, and the broader system. Smart Power India, in collaboration with its partners, has brought significant experience and expertise to the renewable mini-grid market, helping to develop the initiative into a market leader and

one-stop shop where ESCOs can access financing, refine a viable business model, and identify consumer engagement strategies. An iterative process, the Foundation is committed to improving energy access in India and beyond and expects to continuously refine the business model and its own interventions to most effectively address the barrier to scale.

As Rockefeller seeks to achieve its goal of providing renewable electricity to one thousand villages in India—a target selected for its significant need, market opportunity, and potential to demonstrate scalability—it is also developing the business case to utilize the same principles globally while taking local factors into account. To do so, it will continue to prove the business model in India, position Smart Power India as the market facilitator, and begin to understand the key contextual factors of other rural areas in India, Southeast Asia, and Africa. These new markets will likely have vastly different considerations, needs, and solutions, but the Smart Power India model can provide a set of principles and key insights that will drive adoption and impact within different contexts.

The greatest opportunities (and challenges) for the Rockefeller Foundation and the Smart Power model in its next phase include:

- **Improving plant-level economics:** Anchor loads remain critical for stronger economics, and the definition has widened to incorporate "tenants" beyond telecom towers to bring down costs. The Foundation is also working with technology partners to invest in innovations that will bring down the cost of mini-grids thereby improving plant-level economics. Additionally, the Foundation has determined that increasing ramp-up speed by providing access to affordable consumer goods such as energy-efficient fans and televisions will help meet customer needs, increase demand, and improve service delivery. Rockefeller will continue to identify tools and processes that can help strengthen the business model across these many dimensions.
- **Making a strong case for public and private sector engagement:** Continued investment in a replicable learning agenda and strong messaging on key successes will enhance advocacy efforts and build support among policymakers. In addition, these proof points will also strengthen private sector engagement and promote market-driven investment and innovation.
- **Expanding and replicating the model:** With the proof point being developed in India, Rockefeller is starting to look at other countries that would be well positioned to support decentralized power. The model will need to be adapted to meet the social and business needs of future replication sites and their contexts and enabling environments.

The Smart Power model has tremendous opportunity for replication across markets, and potential for enabling economic development in rural communities at scale. The Rockefeller Foundation's unique ecosystems approach to market-based solutions in this sector showcases the benefits of complex partnerships for shared value, and the value-add that de-risking investments by innovative investors can play in creating new opportunities for both business and society to flourish.

Glossary

ANCHOR LOAD	The major consumer of electricity from a power plant (i.e., utilizes at least 25% of plant's capacity daily) and provides a significant portion of the plant's revenue (e.g., a telecom tower).
CAPITAL EXPENDITURE (CAPEX)	Expenditure incurred to acquire or upgrade fixed assets, such as property, plant, and equipment.
OPERATING EXPENSES (OPEX)	Represents the ongoing costs a company pays to run its basic business.
DECENTRALIZED RENEWABLE ENERGY (DRE)	All off-grid generation and distribution projects based on renewable energy.
ENERGY SERVICE COMPANY (ESCO)	A provider of electricity for a wide variety of uses, such as lighting, electricity for rural businesses, irrigation, or servicing anchor loads, such as telecom towers.
GRID	A physical network that supports electricity generation, transmission, and distribution.
INTERNAL RATE OF RETURN (IRR)	A rate of return used in capital budgeting to measure and compare the profitability of investments.
KILOWATT (KW)	A unit of power equal to one thousand watts.
LOAD	Demand created by an appliance or machine, which requires electricity to operate, e.g., bulbs, fans, mills.
LOAD RAMP-UP	A progressive increase in demand of electricity over a time period.
RURAL BUSINESSES	An enterprise engaged in production or services set up with investment of approximately USD $400 to $5,000 that generates approximately $2,000 to $20,000 in annual revenue, employing 1 to 8 persons.
MINI-GRID	Stand-alone installations powered by solar panels or a biomass engine, providing power for household lighting, appliances, small businesses, and irrigation within a 1-2 km radius.
MINISTRY OF NEW AND RENEWABLE ENERGY (MNRE)	National government ministry that handles all matters related to new and renewable energy in India.

OFF-GRID	Any electricity network not connected to the national grid.
PLANT	A power plant (using renewable energy) operated by an ESCO.
PRODUCTIVE LOAD	An electricity load used to support a livelihood activity (beyond lighting), e.g., person using electricity to run his/her flourmill.
SITE	A village where a power plant is located.
TOWER LOAD	A cell phone tower, which requires electricity to operate.

Appendix Graphics

APPENDIX FIGURE 1: SMART POWER INDIA SERVICES ACROSS THE ESCO PROJECT LIFECYCLE

PHASE	PRE-LAUNCH	CONSTRUCTION	RAMP UP	STEADY STATE
BUSINESS ACTIVITIES	• Project development (e.g., site selection and feasibility assessments) • Identity suppliers and other key partners • MNRE subsidy application • Initial community outreach	• Ground breaking, construction • Community outreach intensifies	• Customer acquisition • Continued marketing and community outreach	• 100% of targeted loads connected • Customer retention and payment collections • Ongoing plant maintenance and operations
ILLUSTRATIVE SMART POWER SERVICES	• Facilitate purchase power agreements with telecoms • Service providers supply project and business development support	• Service providers lead community engagement • Rockefeller provides equity, debt and bridge financing	• Support load development and help with payment collection	• Ongoing support as needed
ESCO OUTCOME	• ESCOs are well-positioned to be financially viable	• Access to low-cost debt and bridge financing reducing CAPEX	• Increased customer acquisition and revenue • Reduced cost of production and operations	• Increased customer acquisition and revenue • Reduced cost and production and operations

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