



RURAL ELECTRIFICATION: HOW POLICY MITIGATES AND COMPOUNDS RISKS TO PRIVATE SECTOR DEVELOPMENT OF OFF-GRID ENERGY SERVICES IN INDIA

PREPARED BY: KIERAN COLEMAN, JULIA HECKMANN, NEDA OREIZY AND YIQIAN "SUNNY" XU

RESEARCH ASSOCIATE: MWANGI CHEGE

FACULTY ADVISOR: DR. IRVING MINTZER

Prepared as part of the Smart Power for Environmentally-Sound Economic Development (SPEED) Practicum for the Energy, Resources and Environment department in collaboration with the World Bank's Climate Change Group and the Rockefeller Foundation

TABLE OF CONTENTS

LIST OF ACRONYMS	2
INTRODUCTION	3
SECTOR OVERVIEW	3
BUSINESS CHALLENGES	4
A. Regulatory and Policy Environment.....	4
B. Technology.....	5
C. Financing.....	5
D. Capacity Building.....	5
THE PLACE OF POLICY	5
A. Investments and Subsidies.....	5
B. Capacity Building.....	6
C. Central Grid Expansion.....	6
OPPORTUNITIES	7
RECOMMENDATIONS	8
FOOTNOTES AND REFERENCES	9

LIST OF ACRONYMS

CERC	Central Electricity Regulatory Commission
GDP	Gross Domestic Product
GW	Gigawatt
IREDA	India Renewable Energy Development Agency
MNRE	Ministry of New and Renewable Energy
MoP	Ministry of Power
REC	Rural Electrification Corporation
RGGVY	Rajiv Gandhi Grameen Vidutyikaran Yojana / Rajiv Gandhi Rural Electrification Program
RPO	Renewable Portfolio Obligation
RVEP	Remote Village Electrification Program
SE4All	Sustainable Energy for All
SERC	State Electricity Regulatory Commission
UN	United Nations
VESP	Village Energy Security Program

INTRODUCTION

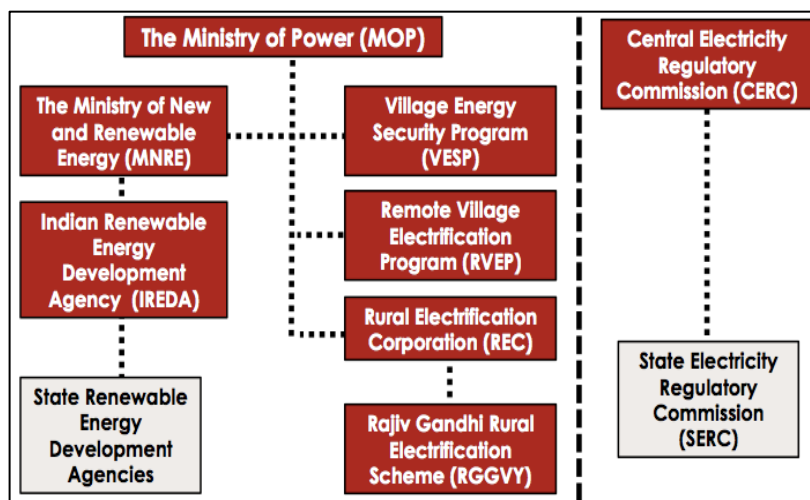
The Sustainable Energy for All (SE4All) initiative, launched in September 2011 by UN Secretary General Dr. Ban Ki Moon aims to make modern energy services accessible to the approximately 1.3 billion people worldwide with poor energy access. Rural India, which is home to 70% of the nation's 1.2 billion national population and over 25% of the world's poor, has significant unmet demand for reliable electricity services. Approximately 55% of the households are currently electrified, leaving over 20 million households without access to a resource that has the potential to contribute significantly to poverty alleviation and welfare improvement initiatives in the country. Despite India's economic growth spurt in recent decades (averaging 5% growth annually for the last 20 years), benefits of this growth have been slow to diffuse to individuals in rural areas. Sustained economic growth will have to be more inclusive, requiring improvements in the quantity and quality of electricity supplied to rural populations. The remoteness of rural areas, the high capital costs involved in extending the grid beyond urban and peri-urban locations and the distributional inefficiencies involved in doing so help explain the low access to electricity among rural communities. However, the rapid expansion of the telecommunications infrastructure and growth of the sector, even in rural communities, suggests that there is commercial demand for electricity even in remote areas, and that innovative efforts to meet this demand in a cost-effective fashion can be used as the fulcrum for extending electricity access to other businesses and households.

The focus of this report is the provision of rural electricity services from renewable energy resources by the private sector. India has made impressive strides in this respect, building upon the convergence of technological innovations, evolving business models and the increased focus on rural energy investments. Yet India's persistent battle with rural energy poverty demonstrates that significant obstacles remain to be overcome if current and future electricity demand is to be met. For rural electrification to be reliable, affordable and sustainable, government policy will have to coordinate, guide and encourage the development of energy services. Creating an environment that promotes and enables private sector involvement is an important step towards reaching universal energy access. This report will highlight select areas where policy in the Indian context can move to enhance private sector participation in decentralized energy service provision. The range of technologies encompassed by the term decentralized energy services includes household lighting devices, solar home systems and small and large mini-grids.

SECTOR OVERVIEW

India currently has an installed electricity generating capacity of 245 GW, an amount that is relatively low given the size of its economy and its projected economic growth. Coal-fired plants provide 57% of the country's total electricity generation.¹ Transmission losses average 25% nationally and rise to as much as 75% in some states, reflecting high levels of inefficiency, low levels of investment, technical losses and some electricity theft.² India also has one of the most highly-subsidized electricity sectors worldwide with approximately 1.5% of national GDP being directed toward electricity subsidies.³

Figure 1: Key Bodies Involved in Rural Electrification



India’s Ministry of Power (MoP), working in conjunction with the relevant state-level agency, form the country’s primary policy and regulatory authorities addressing the challenge of rural electrification. The 2003 Electricity Act outlines the government’s plans to ensure electricity access to all areas, including rural locations, in partnership with state governments and commissions. Subsequently, the 2005 National Electricity Policy drew attention to

the role that decentralized generation could play in areas where central grid extension was not feasible.⁴ While there are national programs that provide financing for rural electrification, each respective state government is ultimately responsible for building and maintaining energy infrastructure. However, many state utilities face financial shortfalls due to high levels of subsidization and low levels of cost recovery, resulting in financial stress and ineffective rural electrification efforts. Although the MoP has opened the door for private sector participation in energy service provision by easing regulatory requirements for their entry into the market, entrepreneurs have not rushed to fill in the gap due to challenges in the regulatory and policy environment, technology, financing and capacity building.⁵

BUSINESS CHALLENGES

A. Regulatory and Policy Environment

Central Grid Expansion – A key question facing the long-term operation of decentralized energy projects is what happens when the central grid is extended to an area of existing operations. There is no certain roadmap or timeline showing the geography of central grid expansion, which creates tremendous uncertainty for mini-grid developers.⁶ This uncertainty is further compounded by the unwillingness of financial institutions to provide loans to mini-grid projects.⁷ Additionally, there are no clear “exit” options for mini-grid developers once the grid arrives. For instance, details on interconnection, such as financial cost, technical standards and tariffs, have not been worked out.^{8,9} The sum of the uncertainties surrounding central grid expansion serves to discourage both existing and potential mini-grid entrepreneurs.

Tariff policy – Whether the price that electricity service providers charge to customers is subject to government regulation or not is generally unclear across India. State electricity boards have the regulatory responsibility of determining tariffs charged by central grid utilities. Some states impose this tariff structure on mini-grids, others use measures such as rate-of-return and price-cap regulation to determine tariff levels, while some do not regulate mini-grids at all.¹⁰ The inconsistent application and

the uncertainty about tariff regulation introduces immediate risks to energy entrepreneurs adversely impacting the viability of their projects.

B. Technology

Rural energy service providers cite the lack of access to appropriate technology for accurately determining current and future community load profiles as a major challenge. Affordable technology that would be flexible enough to meet the volatile electricity demand of a rural village and keep costs low is also an issue, as communities may not have the economic wherewithal to cover the energy service provider's costs.

C. Financing

Access to finance is a fundamental challenge for decentralized energy service providers. Practitioner experience reveals that banks would rather focus on grid-based providers who are sponsored by the government. Investments required by energy service providers also fall in a category that has been dubbed the 'missing middle.' Their needs straddle the gap between 'small investments' (\$50,000 - \$100,000), which are often met by philanthropic support, and 'large investments' (\$3 million - \$5 million), which are typically met by large financial entities and development agencies. Companies in this position may require several infusions of capital that are each between \$500,000 and \$3 million, but only limited sources of investment are available to them.¹¹

D. Capacity Building

Both existing institutions and individuals require support in developing and enhancing the skills needed to utilize resources, make choices, perform highly technical functions and solve problems sustainably.¹² The institutional level encompasses public bodies such as ministries, regulatory authorities, state utilities and private actors including investors, energy service providers, non-profits and donor organizations.¹³ At the individual level, local entrepreneurs, household consumers, electricians, and technicians all require strengthening in their capacity to best operate and utilize the services.

THE PLACE OF POLICY

Each of the above critical business challenges may be mitigated by clear and consistent implementation of state and national policy. This policy would balance the benefits of market competition among firms with their insurmountable business needs. These areas for policy include the delivery of investment and subsidies, capacity building, and minimizing risk from central grid expansion.

A. Investments and Subsidies

The Indian government provides financial support to decentralized energy service providers both on the national level (through the Ministry of New and Renewable Energy (MNRE) and for projects involving renewable energy technologies) and at the state level. At the state level, some investments are made directly by the government while others provide financial incentives to offset costs in a project whose social welfare benefits they want to promote. However, some entrepreneurs have demonstrated a reluctance to accept subsidies and financial support from the government as they perceive it as a way to expose their business to higher levels of regulation.

Government could address the challenge of the ‘missing middle’ in private sector financing through the provision of concessional loans to commercial institutions and project companies alike. The India Renewable Development Agency (IREDA) has launched an initiative to reduce the cost of financing for renewable energy-based service providers by refinancing 30% of the loans offered to renewable energy companies and limiting the interest rates that commercial banks can charge borrowers. However, the initiative’s stringent requirements may limit its success by excluding the bulk of the companies it is targeted toward.¹⁴

Government policy at a national level may also be useful in helping to form alternative financing arrangements involving development finance institutions, multilaterals, banks and equity investors. Other policy measures such as the reduction of diesel subsidies and introduction of Renewable Portfolio Obligations (RPOs) have faced challenges in their implementation due to a lack of political will (in the case of the former), poor enforcement, and inadequate clarity (in the case of the latter).^{15, 16}

B. Capacity Building

India has a skilled workforce in certain sectors of the economy and a well-established policymaking and regulatory environment. Rural electrification, however, requires capacity building at every stage of the project development cycle for government officials, the financial sector, potential electricity service providers and consumers. At the institutional level, existing institutions need to be supported and expanded. In situations where these institutions are not present, capacity development should be targeted at aiding in their establishment.

On the individual level, government officials working in the rural electrification agencies require training that provides them a basic understanding of the technical aspects of electrification planning.¹⁷ Private companies and entrepreneurs require training in business, financial management and other relevant aspects of project development. For instance, Husk Power Systems from Bihar has found its partner entrepreneurs to be knowledgeable about the business but unable to effectively navigate the government bureaucracy.¹⁸ Local decentralized energy operators and technicians also require equipment training and business management skills.

Consumer awareness and support is essential to ensure community buy-in for the projects. Decentralized energy service consumers may also require capacity building in order to fully realize the benefits of power provision. Consumer education in the operation and maintenance of off-grid electricity devices and mini-grids is essential to ensure the continued running of the systems. For instance, solar panels in Tuluka, Orissa, were found to be coated in dust as the villagers did not realize that they should be washed. This lack of knowledge was compounded by the poor responsiveness on the part of Orissa Renewable Energy Development Agency to villager’s complaints about declining output from the solar panels.¹⁹

C. Central Grid Expansion

Policy that facilitates the integrated planning of mini-grid development along with central grid expansion is required to reduce the uncertainty that entrepreneurs face, avoid redundant infrastructure and ensure reliable electricity supplies in the long-term. Information on the timeline and geography of

central grid expansion will assist entrepreneurs in developing relevant business strategies.²⁰ Policy that outlines exit options for decentralized energy service providers upon arrival of central grid is also required. If interconnection is to occur, technical standards and financial incentives are essential to ensure the safety and reliability of electricity supply. Should a mini-grid convert to a central grid-connected distributor and the government specifies that this new distributor must sell electricity at the state's tariff levels, government should provide financial support in the form of direct and indirect subsidies to ensure the mini-grid operator has a sustainable distribution margin.²¹

On the state level, key challenges that policy should aim to address are:

- Simplified business registration process with standardized documents;
- Design and enforcement of quality standards that would prevent entry of poor quality products into the market while ensuring that the available offerings are still affordable;
- Tariff policy should provide clear and transparent guidelines for decentralized energy services that are applied consistently across the states;
- Arrangements with channel partners (recipients of IREDA funding for renewable energy projects), which are designed to scale up rural electrification, should be transparent with competitive bidding processes

OPPORTUNITIES

The diverse and complex set of challenges confronting the private sector in rural electrification should not take away from the progress that energy policy has achieved in India toward incentivizing and supporting its growth. This success is evident on the national and state level:

National Government Support – Government-backed programs such as the Rajiv Gandhi Rural Electrification Program (RGGVY), the Village Energy Security Program (VESP), the Remote Village Electrification Program and the Renewable Portfolio Obligation demonstrate the national commitment to rural electrification and rural economic development. The 2013 Companies Act, which requires corporations to direct 2% of their profits to corporate social responsibility programs could facilitate increased funding toward rural electrification.

State Government Support – The nodal agencies of the MNRE play an important role in bringing national policy to the local level. Energy service providers that are unable to access national agency support have been able to turn to state level bodies for similar levels of backing.

Key Industry Support – The telecommunications and banking sectors present opportunities for scalable and cost-effective mini-grid and energy service provision. In 2012, the Telecom Regulatory Authority of India directed the telecommunications industry to ensure that 50% of rural telecom towers are powered by hybrid sources by 2015 and 75% by 2020. This has the potential to enlarge the market for renewable energy mini-grids in rural areas. Mobile banking also presents opportunities, as it could help to reduce transaction costs, grow the customer base and induce purchases of energy at volumes necessary to sustain small energy producers in rural locations.

RECOMMENDATIONS

India has made impressive strides toward rural electrification. National and state-level energy policy has created substantial opportunities for further development. Nevertheless, sustainable and inclusive electrification remains absent for over 20 million households. The following suggestions illustrate how policy could help to reduce the rural electricity deficit:

- 1. Close the Implementation Gap** - While India has a variety of policies in place on the federal level that have the potential to provide a good framework for electrification, it is essential that these policies are extended to and practiced consistently at the state level.
- 2. Improve Coordination** - It would be extremely beneficial if the MoP and the MNRE could improve the coordination of their strategies in order to allocate available resources most efficiently and strengthen implementation of policy.
- 3. Transparency Over Central Grid Expansion** - Central grid expansion is one of the most important uncertainties for the developers of off-grid energy services in India. In order to manage expectations and provide investment security, national policy should provide a clear roadmap that lays out the schedule of the planned grid expansion. Furthermore, policy should provide clear guidelines for technical interconnection standards and tariff setting when the macro-grid meets the micro-grid.
- 4. Focus on Results-Based Financing** – The policy of considering a village “electrified” once it attains a 10% connection rate to the central grid, should be re-thought in order to provide comprehensive energy access to all citizens of India. In this way, financing should be tied to true electrification successes rather than nominal connectivity. In addition, the variations in subsidy administration regimes pose a challenge. The national target of 100% grid connectivity allows state electricity boards to provide operational subsidies to electricity producers that reduce the retail price of electricity to levels where mini-grids would struggle to compete.
- 5. Minimize Bureaucracy** – Standardizing the necessary documents across the state or even the country can ease private sector efforts. Making them available for download in an online portal makes these documents more easily accessible to developers. Additionally, the creation of a ‘One-Stop-Shop’ for obtaining construction, operating, and other permits can further simplify the process.
- 6. Preferring a light-handed approach to regulation** – While the provision of electricity in rural areas requires policy to create certainty for investors and developers, many of the details can be adjusted along the way as consumers, developers and entrepreneurs gain experience. Policies should be sensitive to this changing landscape, the introduction of new technologies, and the application of innovative business models that may be more effective in achieving the nation’s goals.

FOOTNOTES AND REFERENCES

- ¹ Economist Intelligence Unit, “Energy Report: India 1st Quarter 2014”. 14 March 2014.
<http://www.eiu.com/industry/article/681662652/electricity/2014-03-26>
- ² Planning Commission, Government of India. “Twelfth Five Year Plan 2012-17.”
<http://planningcommission.nic.in/plans/planrel/12thplan/welcome.html>
- ³ Swain, Ashwini, and Olivier Chamois. “In Pursuit of Energy Efficiency in India’s Agriculture: Fighting ‘Free Power’ or Working with it?” Working paper, Agence Française de Développement: August 2012.
- ⁴ GEA. “Global Energy Assessment - Toward a Sustainable Future.” Cambridge, MA: Cambridge University Press and the International Institute for Applied Systems Analysis, 2012.
- ⁵ Ernst & Young. “Models of Rural Electrification: Report to Forum of Indian Regulators.” Ernst & Young Transaction Advisory Service, 2003.
- ⁶ Johns Hopkins School of Advanced International Studies interview notes, April 3, 2014.
- ⁷ Johns Hopkins School of Advanced International Studies interview notes, April 4, 2014
- ⁸ Harshita Bisht, “Policy Perspective for Decentralized Renewable Energy Based Rural Electrification in Bihar” 2014: accessed April 22, 2014.
- ⁹ Government of India, “Guidelines for Village Electrification through Decentralized Distributed Generation (DDG) under Rajiv Gandhi Grameen Viduytikaran Yojana in the XI Plan-Scheme of Rural Electricity Infrastructure and Household Electrification.: Ministry of Power, Government of India, No. 44/1/2007-RE, 2009.
- ¹⁰ Johns Hopkins School of Advanced International Studies interview notes, April 21, 2014.
- ¹¹ “Business Models for Scaling up Energy Access.” International Finance Corporation. Page 139.
- ¹² Mytelka, Lynn (2012): Policies for Capacity Building, Global Energy Assessment, pp. 1745-1802.
- ¹³ ECOWAS (2006): White Paper for a Regional Policy on Access to Energy Services for Populations in Rural and Peri-Urban Areas for Poverty Reduction in Line with Achieving the MDGs in Member States. Economic Community of West African States (ECOWAS), Twenty Ninth Summit of the Authority of Heads of State and Government, January 12, 2006 , Niamey, Niger.
- ¹⁴ “Financing Review of NSM: Phase I of the NSM: Has it Made Off-Grid Solar Affordable?” Renewable Energy Working Group, SELCO Foundation. December 2012.
- ¹⁵ “India Energy Subsidy Review: A biannual survey of energy subsidy prices.” Global Subsidies Initiative and the International Institute for Sustainable Development. Issue 1, Volume 1, February 2014. <
http://www.iisd.org/gsi/sites/default/files/ffs_india_review_february2014.pdf>
- ¹⁶ Johns Hopkins School of Advanced International Studies interview notes. April 4, 2014.
- ¹⁷ ARE (2011): *Hybrid minigrids For Rural Electrification: Lessons Learned*. Brussels: Alliance for Rural Electrification.
- ¹⁸ United Nations Foundation (2014): *Microgrids for Rural Electrification: A critical review of best practices based on seven case studies*. New York: Daniel Schnitzer, Deepa Shinde Lounsbury, Juan Pablo Carvallo, Ranjit Deshmukh, Jay Apt, and Daniel M. Kammen.
- ¹⁹ United Nations Foundation (2014): *Microgrids for Rural Electrification: A critical review of best practices based on seven case studies*. New York: Daniel Schnitzer, Deepa Shinde Lounsbury, Juan Pablo Carvallo, Ranjit Deshmukh, Jay Apt, and Daniel M. Kammen.
- ²⁰ Johns Hopkins School of Advanced International Studies interview notes, April 16, 2014.
- ²¹ Tenenbaum et al, “From the Bottom Up: How Small Power Producers and Mini-Grids Can Deliver Electrification and Renewable Energy in Africa”