POLICY BRIEF

CUTS Centre for Competition, Investment & Economic Regulation
CUTS C-CIER

1/2013

Ensuring Sustainability of Off-Grid Projects

The policy brief discusses the need to introduce off-grid power systems as a viable option to overcome challenges in access to power. This is in response to a felt need to enable access to consistent quality and quantity of power that in turn, can be expected to reinforce other developmental initiatives, further correlated to costs in the immediate and long-term. The paper cites some cases that reveal challenges in establishing such off-grid systems, substantiated with tried and recommended solutions. These insights are presented through the policy lens essential for appropriate mainstreaming of off-grid systems.

Introduction

Penetration of electricity is a critical factor for the overall development of a nation. It is one of the basic infrastructure requirements for economic and social development, and an important driver of growth, especially in rural and remote areas. Rural electrification is a major objective of both the Central and state governments in India. To achieve this, governments have taken up the task of integration of the national electricity grid, and extending the transmission and distribution (T&D) network to reach rural and remote areas.

However, there is a physical limit to which the grid can be connected, due to various challenges, including physical and geographical constraints in extending the network, extent of network losses, lack of economic viability of grid expansion in certain areas. This creates the need for off-grid electrification in areas, such as hilly regions, islands and remote areas, where it is more economically viable to set up an off-grid system with a relatively high initial capital cost but low running costs. Diesel generators prove to be costlier in terms of running costs, and come with the added hassle of the need of a regular supply of diesel.

In addition, the level of CO_2 emissions and noise levels emanating from diesel generators have made them a less preferred choice. Renewable energy systems based on solar energy and biomass have proven to be the most efficient off-grid electrification systems, in terms of both cost effectiveness and long-term sustainability, and are thus the systems of choice for off-grid applications.

This policy brief aims to address the issue of ensuring the sustainability of off-grid projects installed in areas where it was earlier economically unviable to extend the national electricity grid, but with the advent of time and the availability of funds, extension of the grid to those areas has become feasible. In such cases, the off-grid power generation system becomes obsolete and may be left to ruin, such as in Gosaba and Mosuni islands, where the off-grid power system that provided a boost to the local economy now faces an uncertain future. There is, hence, a need for a state-level policy regarding off-grid projects. Benefits of such a policy would include:

1. ensure sustainability of off-grid projects once grid power reaches the region
2. secure the investment made in the project
3. maintain confidence of non-governmental investors, typically development funding agencies, such as the World Bank, the Asian Development Bank etc. so as to protect them from the risk of their investment getting sunk. This is much needed since there is a need for these agencies to continue funding off-grid projects, especially in areas where grid connectivity stands little or no chance.

Overview of Off-grid Power in India

The importance of off-grid power systems cannot be over emphasised, especially for a country like India. About 40 percent of India's population still

has little or no access to electricity, and a major share of these people dwell in rural and remote areas, where difficult terrain and forested areas make grid connectivity infeasible. Hence, decentralised renewable energy systems provide an economically viable means to enable such areas to access the benefits of electricity. Renewable technologies used for such purposes include biogas, solar lighting and heating, wind pumps and micro-hydel plants.

In light of India's northern grid failure of August 2012, off-grid power has shown another major advantage – it provides the control of the power to the local communities, breaking away from the limitation of centralised transmission. While capacity shortages or grid failures lead to power cuts in grid connected areas, areas supplied by off-grid power remain unaffected.

The Ministry of New and Renewable Energy (MNRE) has been actively facilitating implementation of off-grid power systems under its distributed generation programmes. The MNRE supports research, development and deployment of such systems, working towards making them more reliable and cost-effective through demonstrations, field-testing and strengthening the manufacturing base of components for systems. Table 1 shows capacities of various systems installed in India up to December 31, 2012.

In addition to programmes and systems promoted by the MNRE, innovations in technology and financing systems have helped expanding the reach of off-grid power to rural India. Companies, such as Selco India and Gram Power have provided innovative solutions to rural communities, helping them gain access to electricity.

For a country like India, decentralised systems seem to be the solution for electrifying the population dwelling in areas away from the grid. However, off-grid power needs to be looked at in the context of the government initiative of maximising grid connectivity. It needs to be ensured that grid connectivity does not become a factor that makes previously operating off-grid systems obsolete, as has been the case in Gosaba.

Challenges in Off-grid Power

Off-grid power in India faces a number of challenges, but with innovative thinking and concentrated efforts, numerous off-grid solutions have been deployed successfully. Some of these issues and the manner in which they have been addressed are discussed.

1. **Concentration of Demand:** Most of the demand centres for off-grid power are remotely and sparsely located, creating less concentrated demand. Economies of scale are thus difficult to achieve when deploying off-grid solutions. A key reason behind the low demand is low level of power-intensive activities. In addition, people are less enthusiastic about power as they are unaware of benefits they could realise from it. This hurdle can and has been addressed by creating awareness among the local population about how electricity can be used effectively to increase economic activity, and improve the living standards of the people.
2. **Ability to Pay:** People living in areas which need off-grid power has lower ability to pay than the grid-connected population in general, since such areas are usually rural ones with low per capita incomes. Innovative business models need to be used in order to make the off-grid solutions affordable for users, as well as viable for developers. One such model that has been used successfully is a demand-driven model, in which new connections are given out only once to a certain number of households who show willingness and pay a token amount.
3. **Local Operation & Maintenance:** O&M of the off-grid system requires skilled human resources with a level of technical know-how that is usually not available in the local population. Posting trained professionals is not only expensive but also reduces the economic benefit the locals could obtain by being a part of the staff. A process of training, initial guidance and then handing over the job to local persons can be worked out, so as to also ensure that the locals understand the benefits of the off-grid system.
4. **Financing for Upfront Cost:** Initial capital requirements tend to be high for off-grid systems, which needs to be financed by willing institutions. By creating a business model based on the ones being successfully run, and customising it for the local needs, the project can be shown to be viable.
5. **Round the Clock Supply:** A typical off-grid system is based on renewable energy sources such as

Table 1: Off-grid Power in India

Off-Grid/Captive Power	Capacity Installed (MW)
Waste to Energy	113.6
Biomass (non-bagasse) Cogeneration	426.04
Biomass Gasifiers - Rural	16.696
Biomass Gasifiers - Industrial	138.9
Aero-Generators/Hybrid systems	1.74
SPV Systems (>1kW)	106.33
Water mills/micro hydel	2121 Nos.
Total	**803.306**
Source: MNRE	

biomass, wind or solar, which, at the small scale level do not provide 24-hour supply, limiting the use of the power to certain hours of the day when the resource is available.

Off-grid systems deployed so far have had a positive impact on the local communities, as well as on the perception of developers and other stakeholders towards off-grid power. First and foremost, they have busted the myth that rural populations cannot afford and maintain the technology. The perception that a commercial venture that fulfils a social objective is not viable has also been shown to be wrong. Among the locals, off-grid systems provide employment opportunities not only at the site itself but also elsewhere, through the training and experience provided. Biomass projects that provide charcoal have improved the quality of life by replacing the highly polluting household cooking fuel such as fuel wood with charcoal.

Case Study – Gosaba

Gosaba is a major island, part of the Sunderbans area in West Bengal. Due to its wide separation from the mainland, extension of the electricity grid to the island was considered economically infeasible. In 1997, the West Bengal Energy Development Agency (WBREDA) and Ankur Scientific Energy Technology Ltd, a private development firm pioneering biomass gasifier systems in India, addressed this concern by setting up a biomass-based gasifier plant at Gosaba, which provided the lowest cost renewable power, due to the specific local conditions and easy availability of raw material.

With the advent of time and increased availability of funds with the West Bengal transmission utility, it became feasible to extend the grid to the island of Gosaba. With grid power now being available, the power from the biomass gasifier system has lost its off-takers, chiefly due to the lower tariffs being charged for the grid-connected power by the state utilities, especially to rural consumers. In such a situation, the investment made so far in the plant, which is almost ₹ one crore to date, is expected to be laid to waste.

The plant could have continued to be operative by selling power directly to the state utility. However, the average power purchase cost for state utilities of West Bengal in 2010-11 was ₹2.44/kWh. For biomass plants in West Bengal, the Feed-in Tariff is ₹2.86/kWh for existing plants, as per the national policy. Thus, under current policy scenario, West Bengal's utilities cannot offer the same level of tariff to the Gosaba biomass plant as it was obtaining earlier, making continued operations financially unsustainable for the plant.

Though the Government of West Bengal showed intentions to sustain the off-grid plant, the ban on cutting trees in Sundarban area and inefficiency of the plant were major roadblocks, though mechanisms could have been worked out for both these problems. But as the possibility of grid connection became real, further investment in improving and sustaining the gasifier project became prohibitively unviable.

Possible Solutions

Keeping in view that off-grid projects are typically renewable energy generation systems, sustainability can be ensured if continued off-take of power from these projects is ensured. Possible off-takers of the power can be:

1. **Existing consumers** – If the power from the off-grid system is cheaper and more reliable than the grid connected power, previous consumers would wish to continue purchasing power from it rather than obtain grid connections.
2. **Dedicated load centre** – The off-grid system could be dedicated to serve a major load centre, such as a small or medium scale industry, and enter into a bilateral contract with it. This would also be viable only if the power price is competitive and quality of supply is dependable.
3. **National Grid** – The ultimate off-taker of power for any generator is the national grid itself. The off-grid system could become a supplier of power to the grid and receive payments from the state distribution utilities with which it forms a Power Purchase Agreement (PPA).

However, there needs to be a policy in place at the state-level for transition of the off-grid system from being a local power supplier to an Independent Power Producer supplying power to the grid. State Electricity Regulatory Commissions should develop such a policy in consultation with key stakeholders, such as financers, T&D utilities, state energy development agencies etc.

Table 2: Details of Gosaba Biomass Gasifier

Capacity	5x100 kW
No. of consumers	1185
Operation hours	14 hours
Tariff structure	Domestic: ₹5/kWh
	Commercial: ₹5.50/kWh
	Industrial: ₹6/kWh
Fuel	70 percent biomass, 30 percent diesel
Source: MNRE	

Key Policy Recommendations

Following are the key points that the policy needs to cover:

1. **Facilitate transition to renewable energy generator status:** The policy should lay out the procedure for transition of the off-grid system from its status of off-grid IPP to a grid-connected renewable energy generator. This would lay the basis on which it would enter into PPAs. This is also to ensure that the system can avail any benefits given to renewable energy generators.
2. **Allocate burden of cost of evacuation system:** The policy should clarify whether the cost of installing the evacuation system from the off-grid generator to the nearest grid connected sub-station should be borne by:
   a. The current governing body of the off-grid power plant; or
   b. The transmission utility under which the sub-station lies.

In the first case, the costs would be passed on to the discom by charging a higher tariff until recovery. The power purchase price would increase for the discom, which would then pass on this increase by requesting the regulatory commissions to approve higher tariffs to be charged from consumers with the capacity to pay, mainly industrial and commercial consumers, in their annual revenue requirement petitions.

In the second case, the costs would appear on the transmission utility's financials, passed through to the discoms as transmission charges, ultimately being passed on to the consumers. Thus, in either case the cost is ultimately socialised, and recovered from consumers.

3. **Obligate discoms to purchase power from the off-grid system:** The policy should obligate discoms to purchase power from the off-grid system, even if it is at a higher rate from other available sources. Since the quantum of power from these systems is typically low, it would have a low impact on the overall power purchase price of the discom. If possible, off-grid power should get priority over other renewable sources.

A comprehensive policy would, however, only be a facilitative piece of regulation. Long-term sustainability of the off-grid projects required further efforts on part of the government, power utilities and private players involved. Some of the key recommendations are:

1. **Long term handholding:** Keeping in view the limited capacity of local population to maintain and operate off-grid system, it must be ensured that the system is regularly checked; rules and regulations regarding usage, payments and maintenance are followed; and the project staff are properly trained and paid on time. A case in point is the solar photovoltaic off-grid system in Moushuni Island, Namkhana (West Bengal). The system has fallen into disrepair, and the concerned authorities have not taken any steps to revive it.
2. **RECs for off-grid systems:** As mentioned earlier, the high upfront cost of off-grid systems is a disincentive for developers. The Renewable Energy Certificate (REC) mechanism, which allows developers to sell the renewable and physical component of the power generated separately, can be an important enabling framework for making off-grid projects economically viable. By selling RECs on the power exchanges, developers can offset higher costs and sell cheaper power to consumers who need it. The Forum of Regulators has already come up with model draft regulations for RECs for off-grid projects.

Conclusion

Off-grid power systems are necessary to provide electricity in remote and rural areas where grid connectivity is economically unviable. A state level policy is needed to ensure their sustainability. The policy should provide the facilitation of transition of the off-grid system to the status of a renewable energy generator, allocating the responsibility of building the necessary evacuation infrastructure, and obligating the discom under which it lies to enter into a PPA with it, even if it has to be at a higher cost than other available sources.

Lastly, the policy should also facilitate the connection of off-grid system to the grid, if the system is suitably compatible. Further, long-term handholding by the government and introduction of RECs for off-grid systems could be important steps that enable sustainability of off-grid systems.

This Policy Brief is written by Aneesh Jain, Junior Consultant, ICF International for CUTS Centre for Competition, Investment & Economic Regulation (CUTS C-CIER) as part of the project entitled, 'Demand Side Management & Renewable Energy in India: Capacity Building of CSOs' with support from the Shakti Sustainable Energy Foundation (SSEF), India.

© CUTS International 2013. This **Policy Brief** is published by CUTS Centre for Competition, Investment & Economic Regulation (CUTS CCIER), D-217, Bhaskar Marg, Bani Park, Jaipur 302 016, India. Ph: +91.141.228 2821, Fx: +91.141.228 2485, E-mail: c-cier@cuts.org, Web: www.cuts-ccier.org. CUTS Briefing Papers are to inform, educate and provoke debate on specific issues. Readers are encouraged to quote or reproduce material from this paper for their own use, but CUTS International requests due acknowledgement and a copy of the publication.
Printed by Jaipur Printers Pvt. Ltd., M. I. Road, Jaipur 302001, India