Redesigning the National Solar Mission for Rural India

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The success of the Jawaharlal Nehru National Solar Mission depends on certain critical features – the subsidy structure, the role of standardised systems and institutional models of delivery. As the actual costs of small systems are considerably higher, on a per watt basis, than the benchmark costs assumed for the subsidy, smaller systems that are within the reach of the rural poor receive lower subsidies than larger systems. Efforts to standardise solar lighting systems should not be driven by the government at the current stage of diffusion. Furthermore, if the dissemination of these technologies is to be inclusive and sustainable, multiple institutional models should be recognised.

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The Jawaharlal Nehru National Solar Mission (JNNSM), launched in 2009, took off formally in 2010. Government policy in different focus areas has since become clearer. Early responses from industry as well as supporting institutions like banks suggest a mixed report card. While there seems to have been significant enthusiasm from investors for utility-scale plants, on the off-grid side, the number of projects involving solar photovoltaic (SPV) based micro-grids or home lighting systems have been too few.[1]

Rural regional banks that have in the past, played an important role in the diffusion of solar home systems in the villages have apparently become less willing to finance SPV applications than before the JNNSM, according to Harish Hande, managing director of SELCO Solar Light, and K Subramanya, the chief executive officer (CEO) of Tata BP Solar.[2] In fact Subramanya says that while their monthly sales before the announcement of the off-grid guidelines of the JNNSM were of the order of 2,000 to 3,000 solar home lighting systems, without subsidies, sales have ironically plummeted since.[3] Clear guidelines have to be given to the banking sector if this segment of the solar sector is to be revitalised.

Rural electrification has remained an enduring challenge in the country. Over the last few years, the Ministry of Power (MOP) has pursued an aggressive ramp-up on this front through the Rajeev Gandhi Grameen Vidyutikaran Yojana (RGGVY). The electrification route is occurring mainly through the extension of the central grid and distributed generation for more remote regions. It is perhaps too early to judge how successful this programme has been. Given the already prevalent demand-supply gap though, it would not be surprising if we continue to witness frequent brownouts and blackouts in these newly connected villages. As of August 2010, about 15% of villages in the country remained unelectrified.[4] Further, as per the MOP, 28 million rural households will remain unelectrified at the end of RGGVY, in March 2012.[5]

The promotion of solar energy at the utility scale is based on environmental benefits and expectations of costs coming down with increased deployment. On the other hand, investment in SPV off-grid rural applications makes sense from the standpoint of conventional economics and institutional efficiency. Solar energy provides lighting and power that is clean and reliable. As a source of distributed energy, solar can be used to electrify individual homes or communities, schools, hospitals, street lights, and even agricultural pumps.

The JNNSM thus is a great chance to push the already existing and, in many ways proven, solar energy services industry into

newer regions and markets. Government backing is required especially to provide access to poorer households for whom affordability is a major barrier; even the down-payment requirements for loans, after factoring in capital subsidies, were found to be out of reach for many rural homes (Wong forthcoming). Further, quality and maintenance have been major issues with many donor-based programmes, where systems were given away for free or with very high subsidies, and this has also been the case in India (Chaurey et al 2004; van der Vleuten et al 2007). There was a need to redress problems from the previous extremely centralised, capital subsidy-based programmes and catalyse the dissemination of solar solutions in a sustainable, multi-pronged manner.

While some of the steps taken to decentralise are very encouraging, we believe that the Ministry of New and Renewable Energy (MNRE) could lose a great opportunity unless it amends a couple of key measures. This paper focuses on solar home lighting systems for rural electrification and the implications of JNNSM strategy in this area. For example, the benchmark costs assumed by the JNNSM to base its subsidies on seem to be based on prices of larger systems. Simple analysis reveals that this leads to a lopsided subsidy mechanism that penalises smaller systems and sizes that are affordable to poorer households. In fact, the majority of the sales of some of the major solar players are below 40 watts.

Based on experience in India and other parts of the world documented in the literature, and on our interactions with some leading service providers in the country, we have attempted to assess how the off-grid policy fares in providing the framework for a large-scale sustainable programme. In particular, we analyse the current subsidy mechanism and the cost assumptions that dictate the subsidy. There are two other aspects of the policy that we will focus on – first, the expressed objective and subsequent steps taken towards commoditising solar lighting systems, and second, the support provided to different institutional models of dissemination.

SPV Applications for Villages

At the moment, rural energy and distributed generation is the best space for solar energy in India. A large part of the country receives good insolation for over 300 days. One of the chief advantages of solar energy is its ability to be customised for individual household needs – generation can be tailored to closely match the demand and financial constraints of the household. Installation does not require much time and maintenance, requirements are minimal. As aspirations and affordability rise, modules can be added, allowing greater loads and consumption. The range of applications, and the institutional mechanisms that have evolved to disseminate them, have made solar-based applications flexible as well as affordable.

As a stop-gap measure, solar lanterns are perfect substitutes for kerosene lanterns. If we consider the negative implications on health, the poor quality of light and the cost of subsidised kerosene over the lifetime of a solar lantern, we can very easily see how it fares better on a head-to-head basis. For the 28 million households that will remain unelectrified at the end of RGGVY, the total kerosene subsidy for lighting requirements is estimated

to be about Rs 170 billion over 15 years (less than the lifetime of a typical solar lantern). For the sake of comparison, providing solar lanterns with a 2.5W LED bulb and costing around Rs 1,600 (Chaurey and Kandpal 2009), with a 90% subsidy, would cost the government Rs 40 billion.[6]

Solar home systems can come in multiple sizes and are amenable to configuration customisation in terms of panel wattage, battery capacity and number of lights and applications that can be supported. Leasing models have been attempted, where a customer pays a daily or monthly charge for using the system while ownership is retained by a service provider. Further, as the PV panels constitute the most expensive component of the overall system, there have been central charging models for batteries of solar home lighting systems. Users can drop off the batteries at these centres for charging during the day and collect them later in the evening. Such an arrangement divides the costs over multiple users and makes solar lighting systems even more affordable.

A small note of caution: solar energy may not be ideal for electrifying rural households, irrespective of context. Other distributed sources could, indeed, have better cost competitiveness and be equally or more reliable in some locations. Still, solar lighting systems do have an advantage over most other distributed sources in their adaptability and ease of installation and maintenance. As the installation can be done in individual homes, solar energy trumps other distributed sources in being able to cater to even sparsely distributed hamlets. A disadvantage is that the time of generation does not coincide with the demand for lighting. Also, supply is bound to be limited during the rainy season or even during cloudy weather. These factors necessitate the need for storage. Battery sizing should accordingly be carefully planned.

MNRE's Solar Policies

It is worthwhile to briefly review the context in which JNNSM guidelines have been framed. Rural electrification comes primarily under the ambit of the MOP. As per Bhattacharyya (2006), immediately after Independence, the focus of rural electrification was on promoting irrigation and not domestic uses. In the ensuing decades, the MOP followed the route of extensive electrification, in terms of the number of villages, rather than an intensive approach to ensure all households were electrified. The focus on household electrification came only after the passing of the Electricity Act in 2003. There were some exceptions that preceded this Act, like the Kutir Jyoti Programme of 1989, which targeted a single-point connection to below poverty line (BPL) households.

With the RGGVY, launched in 2005, the MOP sought to achieve 100% intensive electrification by the year 2012, primarily by extending the grid. The mandate for the RGGVY was to provide at least 1 kilowatt hour (kWh) a day of electricity to every household.[7] Under the distributed generation component of the RGGVY, solar is the source of electrification of last resort – that is, when extension of grid is unviable (even by MOP's rather generous standards) and when other distributed sources of power are not available.[8]

What needs to be highlighted here before we study JNNSM's off-grid guidelines is that rural electrification does not come directly under MNRE's mandate and hence need not be the prime area of focus for the JNNSM either. The MNRE's role in rural electrification has been to fill the gap left by the MOP. The Remote Village Electrification Programme is the largest such exercise and basically targets 18,000 villages that were too far from the grid.[9] The MNRE's primary role is to increase the use of renewable energy in the country. What we are arguing, however, is where solar energy fits best. We believe, as discussed earlier, that rural electrification is the best-fit at this moment. Hence, the JNNSM strategy towards off-grid rural electrification merits close examination.

For solar energy, MNRE's two most relevant programmes were the Solar Lantern Programme and the Solar Photovoltaic or SPV Programme launched in 2009.[10] Both lapsed with the implementation of JNNSM's off-grid guidelines.

Overall, the JNNSM has incorporated several welcome changes over earlier programmes. For example, while the SPV Programme was restricted to five models eligible for government support, under JNNSM, the number of models has been increased to 11. The basic objective of the former was to substitute the use of kerosene lanterns in these beneficiaries' homes. Its mandate was to provide one solar lantern to homes in unelectrified villages and to BPL families with a school-going girl child. Moreover, procurement and dissemination were restricted to state nodal agencies and *Akshaya Urja* shops.[11] The new guidelines have relaxed this restriction.

The Role of Regional Rural Banks

We will slightly digress here to quickly review the role of financing institutions in promoting PV applications. The solar services industry in India is perhaps unique in leveraging the formal financial infrastructure. Sri Lanka and Bangladesh have relied on microfinance (World Bank 2008). In Latin America (Rogers 2006) and in certain regions in Africa (Gustavsson and Ellegard 2004), the leasing approach or micro-leasing, as it is called, has been prominent. Under this approach, the service provider has an energy service contract with the customer over the period of a few years. The customer pays a monthly fee while the service provider provides maintenance and continues to own the system. All our respondents were sceptical of such a model working in India and stressed the importance of end-user ownership. The main issue is one of the end-user's incentive in maintaining the system and hence the associated risks for the service provider.

A United Nations Environment Programme (UNEP) solar loan programme in 2003 was one of the first instances of the Indian mainstream banks financing solar lighting systems.[12] The UNEP support essentially worked as an interest subsidy. Syndicate Bank and Canara Bank in Karnataka were partners in the first phase of this programme. Since then, many other banks have taken up this initiative. A specific case in point is that of Aryavart Gramin Bank which worked with Tata BP Solar in financing solar home systems for a few villages in Uttar Pradesh (UP).[13] The success of essentially market-based dissemination models, with occasional interest subsidies, orchestrated by the rural banking sector has prompted policymakers to make this an integral part of the JNNSM.

The target for off-grid applications is 200 megawatt (MW) by 2013 and eventually, 2,000 MW by 2022.[14] This target includes solar lighting systems for rural electrification as well as community buildings, hospitals, etc, PV agricultural pumps, power plants for village-level micro-grids and street lights. Applications for commercial establishments like standby systems for diesel abatement and off-grid power plants for telecom towers also fall under this category. The target for rural lighting systems alone is 20 million units by 2022.[15]

Overview of the JNNSM

The most important feature of the JNNSM (and the SPV Programme) is decentralisation in project approval and subsidy disbursement. The off-grid policy envisages the creation of a range of different channel partners such as system integrators, banks and microfinance institutions, financial intermediaries, renewable energy service companies and state nodal agencies, who will create off-grid solar projects and submit them to the MNRE's Project Appraisal Committee for approval and financing. These channel partners will have to get themselves rated or accredited through an agency appointed for the purpose; based upon their rating they can put in project proposals. Each project proposal can aggregate different off-grid initiatives totalling 1 MW at a time.

One of the most positive steps in the new regime is the envisaged involvement of rural regional banks and non-commercial banking corporations as channel partners who can initiate projects and be given incentives to be proactive. Tied to this is the strategy of providing interest subsidy as opposed to high capital subsidies alone. While there is still a capital subsidy component to the tune of 30% of benchmark costs of the systems, this is much lower than in previous programmes. In addition, under the JNNSM (and in contrast to the previous SPV Programme, where a choice had to be made between the two), the beneficiary can access the interest subsidy as well. While there is always a concern about whether banks will be selective in choosing the customers or prefer to avoid the risk of financing low-income households, interest subsidies are likely to be less market distorting.

To ensure efficiency in implementation, the financing is to be back-ended. Banks get 50% of the subsidy payment upfront and the rest on completion of the project. Currently, payments are channelled by MNRE through the National Bank for Agriculture and Rural Development (NABARD). Damian Miller, chief executive officer of Orb Energy, suggests that banks are a little wary of this clause at the moment as there is uncertainty on the route of disbursement.[16] Possibly these are just teething problems and may get sorted out in the future. Anil Patni, deputy general manager of Tata BP Solar, feels that the critical success factors will be the speed and ease with which the channel partners and consumers can receive the subsidy from the government.[17]

All said and done, it is possible that banks have other issues with the government policy. Harish Hande, for instance, claims that SELCO has never had as much difficulty in getting loans as it has had since JNNSM.[18] In the next section, we will study the problems which threaten to negate the positive steps outlined above. We will also discuss other issues with the JNNSM approach, as a result of which it falls short of its intended objective of supporting a sustainable programme to reach poorer households.

Table 1: Benchmark Costs and Support Structure Per Watt Peak (in Rs)

Benchmark costs	300
Capital subsidy (at 30%)	90
Margin payment (at 20%)	60
Loan amount at subsidised rate	150

Issues with the Off-grid Policy

As per the off-grid guidelines for the JNNSM, Rs 300 per watt peak (W_p) is considered the benchmark costs for systems with battery storage, irrespective of size. The MNRE will provide 30% of the benchmark costs as capital subsidy and 50% of the benchmark costs (i e, Rs 150/W_p) will be eligible for a loan at 5% per annum.[19] The user must pay a down-payment to the tune of 20% of the benchmark costs. By having the current regime in place, the intention is to be open to solar lighting systems in multiple sizes and to provide clear guidelines for banks.

However, on a per watt basis, the smaller systems are priced significantly higher than the benchmark costs of Rs 300 per watt. The price does go down with an increase in size of the PV system. In the case of smaller systems, other systems will account for a higher proportion, such as the costs of internal wiring of homes, compact fluorescent lamp (CFL) bulbs, labour for installation and servicing in remote areas.

Further, in direct current (DC) systems that are better suited in the rural context, the product includes loads for lights and fans. These small systems, of less than 40W_p, form the bulk of the systems purchased by rural households, and constitute over 50% of the unit sales for SELCO and Orb Energy. In fact for Orb Energy, they constitute almost 80 to 90% of the units sold.

In this context, the government's prescribed benchmark costs seemed to be unfavourable to the very section of the population that could have greatly benefited from this programme. While all our respondents agreed that Rs 300/W_p is reasonable for alternating current (AC) systems at the kW level,[20] the costs for rural systems on a per watt basis are higher. As per our respondents, the costs of smaller systems, of under 40 watt peak, is over Rs 600/W_p, while for 40 W_p to 100 W_p, this goes down to about Rs 500/W_p. We can surmise that this perhaps asymptotically decreases to the assumed benchmark costs of Rs 300/W_p for larger systems, on the kW scale, for either rooftop models for larger buildings or for village-level power plants.

With the subsidised loan capped at Rs 150/W_p, to procure a low wattage system, the user either has to pay the rest from his pocket or take an additional loan at market rate. We have plotted below the estimated costs for different size systems, based on feedback from SELCO and Orb Energy. We have also presented what these costs imply in terms of down-payment and monthly instalments for rural households. Here it is assumed that the customer has to avail of two loans – one for Rs 150/W_p at the subsidised interest rate and the other for the difference between the actual cost and the subsidised loan. We have assumed that the loan term is five years and while the subsidised rate of interest is 5%, the market rate is 12% to the customer. The down-payment is assumed to be equivalent to 20% of the actual costs.

For the most basic 10 W_p system, while an equal monthly instalment (EMI) of about Rs 117 (from Table 2) is reasonable, the margin money required would be Rs 1,600. This amount would be beyond the reach of the poorest households that would stand to gain from such a system. We must also take into consideration the fact that the bank would have to provide two loans for rather small amounts, increasing the paperwork. One can thus begin to understand why banks are hesitant at this point, and are perhaps likely to remain so.

Table 2: Financial Implications of Low Wattage Systems

Module (W_p)	Estimated Cost (in Rs)	Capital Subsidy (in Rs)	Down-Payment (in Rs)	Monthly Instalments (in Rs)		
				Subsidised Loan (5%)	Additional Loan (12%)	Customer's Total Cash Flow
10	8,000	900	1,600	28	89	117
20	13,000	1,800	2,600	56	126	182
40	21,500	3,600	4,300	85	145	230

We have estimated the effective rates of subsidy given that the actual cost and benchmark costs differ and hence assuming that the customers have to take two loans. This was done by considering the present value of all the cash flow from the customer. (A 10% discount rate was used.) It was assumed that in the base case, the total costs of the system are borne upfront.

As the benchmark costs are close to the cost of an AC system that can be installed in an urban area, more affluent city-dwellers can install an off-grid system on their rooftops, and potentially access a subsidy of about 36%.[21] As service providers have been operating under market conditions already, the primary justification for a subsidy would be to support the lowest income bracket access solar lighting services. With the current subsidy regime, the highest subsidies appear to be beneficial to larger systems. If we can assume that poorer households will go for more modest sizes, of less than 40W, as has been observed, they will be getting the least subsidy, undermining the basic objective of the capital subsidy provided by the MNRE.

Recently, the MNRE has announced that the benchmark costs for the year 2011-12 will be reduced to Rs 270/W_p with effect from April 2011.[22] Given the arguments cited above, this will only further exacerbate the issue.

Figure 1: Costs of Small DC-Based PV Systems

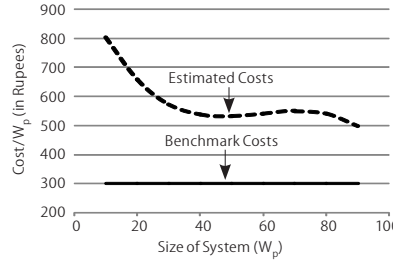
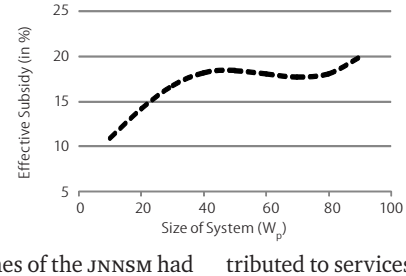


Figure 2: Variation of Effective Rate of Subsidy with Size



Commoditisation of Systems

One of the announced objectives of the off-grid guidelines of the JNNSM is the commoditisation of solar PV applications, i e, facilitating the availability of a range of products with certain specifications that can be purchased off the shelf. While the initial guidelines of the JNNSM had no specific system specifications, although they did cite commoditisation as an objective, the later guidelines of the refinancing scheme and the NABARD circular identify 11 models for which the banks can extend loans. Other systems have to pass through the Project Approval Committee of the MNRE.

SELCO and Orb Energy are among the service providers who believe that these stipulations are unnecessary. Ashis Sahu, chief operating officer of SELCO Solar, extends a fundamental argument. Solar lighting at the end of the day is an alternative to grid electricity.[23] Just as grid power is construed as a utility or a service, solar lighting should also be. Advocating a fixed set of commodities in the MNRE's terminology misunderstands the primary advantage of solar lighting systems – its flexibility to be tailored to users' needs. As different users have different requirements for lighting and related needs, the systems that they purchase must be customised. As Sahu argues, commoditisation is already present as far as the components are concerned – the panel size or wattage, the battery capacity and the lights.[24] The work of the service provider is to combine these elements so as to fit the user's requirements and affordability.

A counter-argument could be that models like those of SELCO are highly integrated – from marketing, assembly and installation, to maintenance. Commoditisation could lead to disaggregation among these functions, thereby leading to a faster dissemination and perhaps lower prices. For example, Krauter and Ochs (2003:153) describe the design of an "integrated solar home system" – where the manufacturer assembles the entire system as well – and suggest that the advantages could be lower system costs and increased reliability. The Aryavart Gramin Bank and Tata BP Solar partnership in UP, that has installed 80,000 of systems in three years,[25] offered only two models – 35 W_p and 70 W_p systems that could support two and four lights respectively and a power socket.[26] The scale of the dissemination, that too at market rates of interest, could make a compelling argument for commoditisation.

This is however a chicken or the egg problem. The availability of local service infrastructure is key to sustained adoption and this potential reduction in prices. Such infrastructure does not exist widely at present, however, and service providers typically train locals in taking care of the system. Local service enterprises may develop with an increase in and with high densities of adoption. Given this context, the government must not at this point try to enforce such commoditisation or modularity in the product and service. Rather, the choice should be allowed to be driven by the market.

What are the implications of this product versus service debate? The notion that a set of models must be identified originates from the belief that solar applications are products. The effect is on the quality of service extended to the customer. Sahu estimates that 20-25% of the system costs can be attributed to services – identification of potential users, installation and maintenance. One of the consequences of the Rs 300/W_p benchmark would be to support a lower quality of service, as service providers may try to cut costs as much as possible.

The treatment of maintenance as additional or the absence of any maintenance requirement at all is another manifestation of the notion of the solar application as a product. Maintenance contracts are conspicuously absent in the off-grid guidelines. The

only requirement currently explicitly stated is a warranty of five years against manufacturing or installation defects for all components and at least five years for overall structure. Maintenance of installed systems has been repeatedly stressed as a critical requirement for the success of SPV dissemination (Nieuwenhaut et al 2001; van der Vleuten et al 2003). In fact, Wong (forthcoming) suggests that one of the main obstacles for dissemination programmes is the absence of "robust monitoring and efficient technical support".[27]

One of the most often cited advantages of the SPV systems is its low overhead and maintenance costs. While this is true, simple issues like dust accumulation or the solar modules moving into the shade could adversely affect performance. Further, the battery is perhaps the most expensive component of the system; during its lifetime, it has to be replaced on average once every three to five years. There is reason to be worried that by overlooking requirements for maintenance and stipulating unnaturally low benchmark costs, this programme will con-tinue to support what has been described as "solar rubbish" (Schutzeichel 2010).

Alternative Institutional Models

As was pointed out earlier, despite loans, the costs of systems can still be prohibitively expensive. Different institutional models have been developed to help soften the financial burden of an SPV application. One alternative is a central charging station, where households can drop off lanterns (Chaurey and Kandpal 2009) or batteries to be charged. An entrepreneur trained by the service provider takes care of the central station and also maintains the batteries and systems. There have also been other experiments with the ownership of the system. The Energy and Resources Institute (TERI) model, for instance, involves a rental approach wherein households can rent the lantern on a daily basis for a small fee on the order of Rs two to five (Chaurey and Kandpal 2009).

The central charging station is a promising option. Despite prior experience with this option in the country (Chaurey and Kandpal 2009, 2010; Rao et al 2009), the guidelines do not explicitly mention this model. While the government may presumably be willing to consider such alternatives on a case-by-case basis, the absence of support for non-credit based institutional models could limit dissemination through smaller entrepreneurs.

One model that could potentially work would have a local intermediary non-governmental organisation (NGO) or a government body absorb the financing risks, instead of the service provider. Such an intermediary could bear the upfront costs and the loan advanced by the regional rural banks, in return for a monthly payment over a fixed period of time, say seven years or more. If at the end of this period, the user gets ownership of the system, it is essentially a credit model. Rao et al (2009) described a similar mechanism that was applied in an urban setting and with a central battery charging station. On the other hand, if the intermediary continues to own the system, it works like the leasing model. The advantages of such a scheme is that the burden of margin money can be avoided, making the system much more affordable for the

rural poor. Further, if the intermediary is a self-help group or an NGO, such a model may help in the overall sustainability of the project in terms of maintenance, and training of users.

One can foresee how the above model could be misused. But the point is that innovative institutional models such as this could play a critical role in dealing with issues of affordability and maintenance. Relying on one delivery model to work across the country would be ill-advised. The off-grid guidelines did suggest that the self-help groups and NGOs could be implementing agencies or the route for disbursing the subsidy. The only details that have been provided so far though have been for the refinancing scheme through mainstream banks. The MNRE must work on alternative routes of disbursement.

A Few Recommendations

Financing Requirements: There are a couple of specific requirements to avail of the loans that we believe are likely to become obstacles. One, there is a lock-in period of three years, that is, the user must avail the loan for a minimum period of three years (and a maximum of five years). While this stipulation is perhaps to ensure that banks do not demand repayment early, denying users the flexibility to pay when they can seems rather unhelpful. Second, down-payment requirements are known to be barriers for low-income households who may not be able to afford Rs 1,500, for the most basic 10 watt system, in a single payment. Perhaps this requirement can be removed for systems less than 40 W_p.

Interest Subsidy and Removal of Benchmark Costs: The case for the removal of the benchmark costs should be clear from an earlier section. An alternative option could be to increase the benchmark costs, but it is not obvious what the representative costs should be. The rationale for the current flat costs per watt is to avoid the complexity of defining different costs and subsidies for systems of different sizes, and hence allowing a relatively larger number of sizes. Mandating product specifications and then suggesting costs would be a backward step. An option could be to treat systems smaller than, say, 40 W_p differently from larger ones and hence, stipulate two sets of benchmark costs.

If the above issues with financing requirements are dealt with, an interest subsidy alone should be sufficient to make the systems more affordable. Again, this would not be able to cater to all sections of the rural community. The poorest sections should be targeted separately.

Maintenance and Local Presence Requirements: Going back to the discussion on solar energy as a service, and not a product, the government must mandate an annual maintenance contract (AMC) of five years or so. While this is bound to increase the cost, the presence of a good servicing infrastructure is vital for good battery life and system performance. As a cost-cutting measure, service providers may continue to prefer developing local competence in servicing; this would be a very positive development for diffusion of the technology. Further, the hope is that with increased dissemination, auxiliary industries may develop around solar systems, thus building the requisite infrastructure. The government must, therefore, require an AMC and a local presence before extending support.

Specific Targeting?

As we mentioned previously, while the Solar Lantern Programme lapsed with the implementation of the off-grid guidelines, the current approach does not target BPL households separately anymore. Even the 10 W_p systems may be out of reach of these households, despite the capital and interest subsidies. The government can even look to distribute solar lanterns with a capital subsidy of 90% or so to these families in order to replace kerosene lanterns. Such a subsidy does exist for special category states, viz, the north-east, Jammu and Kashmir and Uttarakhand. States like Bihar, Jharkhand, Orissa and Chhattisgarh have poor electrification levels and hence, may warrant special targeting. Another approach could be to have different rates of subsidies for systems of different sizes. Systems smaller than 20 W_p or maybe even 40 W_p can get higher rates of interest subsidy relative to larger sizes.

Conclusions

While solar power may often prove to be expensive relative to other alternatives for electrification, it stands out for its ability to cater to the diverse needs and circumstances of users. In designing support mechanisms, the government must keep in mind the flexibility SPV offers, and its associated technical and institutional merits. Despite positive measures in decentralising the disbursement of subsidy through the rural banking sector, the structure of this subsidy requires a review. The benchmark costs are considerably lower than the actual costs, leading to a distorted subsidy structure. In light of this, the recently announced decision to lower benchmark costs further to Rs 270/W_p seems ill advised. As the capital subsidy is bound to be tied to a benchmark cost, the financial assistance must be restructured to involve an interest subsidy alone. Furthermore, attempts to enforce standardisation and an over-reliance on certain delivery routes, though well-intentioned, may do more harm than good to the goal of large-scale dissemination.

NOTES

1 Off-grid projects sanctioned as of 31 August 2010 are given on the MNRE website. MNRE, SPV Division (2010): "Details of Projects Sanctioned under Off Grid Solar Applications of JNNSM", 31 August, accessed on 13 May 2011: http://www.mnre.gov.in/pdf/jnnsm-offgrid-project-sanctioned-as-on-31082010.pdf

2 Personal communication with Raghavan, January 2011.

3 Ibid.

4 Out of 5,93,732 census villages, 89,808 villages remain unelectrified as per the MoP website. "Progress Report of Village Electrification as on 31 August 2010", accessed on 19 February 2011: http://www.powermin.nic.in/rural_electrification/village_electrification.htm

5 According to RGGVY data, about 42 million households, out of the total 69 million households without electricity, will be electrified by 2012; hence 28 million households will remain unelectrified. RGGVY data accessed on 15 May 2011: http://rggvy.gov.in/rggvy/rggvyportal/plgsheet_frame1.jsp
Households without electricity have been estimated using NSSO (2008): "Household Consumer Expenditure in India, 2006-07", Ministry of Statistics and Programme Implementation, New Delhi. Accessed on 9 November 2010: http://mospi.gov.in/press_note_527_english.pdf

6 These figures assume a consumption of 50 litre of kerosene per year for each household and a government subsidy of Rs 15.67 per litre of kerosene for 2009-10, accessed on 15 May 2011 (This includes both government subsidy and under-recoveries borne by oil companies) (p 26): http://www.pib.nic.in/archieve/eec/2010/PetrobackEEC2010.pdf

7 Ministry of Power (2006): "Rural Electrification

Policy", *Gazette of India*, August, accessed on 13 May 2011: http://www.powermin.nic.in/whats_new/pdf/RE%20Policy.pdf

8 The Decentralised Distributed Generation (DDG) guidelines have a "Technology Decision Tool" in Annexure 2 which suggests the hierarchy of preferable sources of electrification. Further, as per the latest rural electrification policy of the MOP, i e, the RGGVY, when all other options are unviable for isolated houses, solar home systems are to be used. However, lighting with these home systems will not translate into the village being declared electrified. For the DDG guidelines, accessed on 15 May 2011, see: http://recindia.nic.in/download/DDG_guidelines.pdf

9 MNRE (2010): "Remote Village Electrification Programme", Government of India, April, accessed on 13 May 2011: http://mnre.gov.in/adm-approvals/rve-adm-2010-11.pdf

10 MNRE (2010): "Solar Lantern Programme", No 32/37/2009-10/PVSE, Government of India, April. MNRE (2010): "Solar Photovoltaic Programme", No 32/1/2009-10PVSE (Part I), Government of India, April.

11 *Akshaya Urja* shops are distribution outlets for solar appliances, operated by private entrepreneurs and NGOs and supported by MNRE since 1995. There are 297 of these shops in the country, accessed on April 17, 2011: http://www.mnre.gov.in/akshayshop.htm

12 UNEP Risoe Center (2008): "Financing Indian Solar Home Systems", August. Accessed on 13 February 2011: http://uneprisoe.org/indiasolar/index.htm

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14 MNRE (2010): "Guidelines for Off-grid and Decentralised Solar Application", Government of India, June, accessed on 22 January 2011: http://www.mnre.gov.in/pdf/jnnsm-g170610.pdf

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16 Personal communication with Raghavan, January 2011.

17 Personal communication with Raghavan, February 2011.

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19 MNRE (2010): "Capital Subsidy-cum-Refinance Scheme for Installation of Solar Off-Grid and Decentralised Applications under the JNNSM", Government of India, November, accessed on 23 January 2011: http://nabard.org/pdf/Eng%201%20solar%20circular-01-11-10%20with%20encl.pdf

20 SELCO, Tata BP Solar and Orb Energy sources estimated that Rs 300/ Wp would be reasonable for AC systems in the kW range.

21 Since the costs are similar to benchmark costs, there will be no requirement for an additional loan. The EMI of the subsidised loan comes to be about Rs 2,830/ kW. The present value, inclusive of the subsidy and the financing costs, is estimated to be Rs 1,93,200/ kW; hence the effective subsidy is found to be 36%.

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27 The quote is from the first page of Wong (forthcoming).

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