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Viewpoint

Renewable energies and the poor: niche or nexus?

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Abstract

Renewable energies are considered as an essential element of any strategy for sustainable energy development. The poor in the developing world without access to modern energies are regarded as a major market for renewable energies. This short paper attempts to analyse whether such a niche is backed by any economic logic and whether renewable energy and the poor nexus could be a strategy for success. The paper suggests that contrary to the common belief, the economic logic behind the niche is unsound and that the nexus is not a recipe for success.

Keywords: Renewable energies; Poor; Energy access

1. Introduction

Renewable energy sources attracted attention of energy policy analysts and researchers just after the oil price shocks of the 1970s. Availability of easy petro-dollars facilitated funding of renewable energy research and the field flourished during the periods of high oil prices in the international market. The global concern for climate change and sustainable development and the pivotal role enjoyed by energy in these issues provided further impetus to renewable energies. Now renewable energies occupy an important place in any strategy for sustainable development in general and sustainable energy development in particular.

The search for sustainable development has, in recent years, highlighted the critical role of energy access or lack of it. The most commonly cited figures on lack of access to energy indicate that there are about 2 billion people without adequate access to clean cooking energy and about 1.7 billion people are without access to electricity (WEA, 2000).[1] Providing access to energy has been identified as a major challenge and there appears to be a consensus that 'provision of affordable, reliable, and socially acceptable energy services' is a prerequisite for achieving the Millennium Development Goals (WEHAB, 2002).

Renewable energies, like any other form of energies, would vie for a share of this potential market. Even the standard prescription for providing energy access revolves around 3 Rs—reform of energy markets, renewable energies and right prices for energies. Many countries with energy access problems have undertaken renewable energy programmes with donor and lending agency support, especially for the poor. Yet, despite generous funding, research efforts, and policy interventions, renewable energies do not seem to enjoy any consumer patronage.

This paper attempts to analyse whether renewable energies are particularly suitable for the poor (i.e. whether there is a niche market) and whether renewable energy-poor nexus could succeed.

The paper is organised as follows: first a diagnostic analysis of the energy demand by the poor is presented. This is followed by an analysis of the relationship between the poor and the renewable energies. The last section provides some concluding remarks.

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[1]Similar figures are quoted in WEHAB (2002), IEA (2002a) and DfID (2002).

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2. Diagnostic analysis of energy demand by the poor

Energy demand in poor households normally arises from two major end-uses: lighting and cooking (including preparation of hot water).[2] Cooking energy demand is predominant in most cases and often accounts for about 90% of the energy demand by the poor. Such a high share of cooking energy demand arises partly from the low-energy efficiency and partly due to limited scope of other end-uses.

Any energy use involves costs and resource allocation problems. Both traditional energies (TE),[3] which play a crucial role in the energy profile of the poor, and modern energies impose private and social costs. The private cost may be in monetary terms or in terms of time spent by the family members to collect the TEs. For collected TEs, the problem of valuation of the cost arises and the collected fuel is considered as free fuel by many, even perhaps by the poor themselves, as no monetary transactions are involved. However, depending on the quantity of collected fuel, its source and the type of labour used in the collection process, the private cost and social cost can be substantial. The social cost arises due to externalities arising from pollution and other socio-economic problems related to particular forms of energy use.

The entire decision-making process for use of any modern energy form (electricity, kerosene or LPG, or renewable energies) as opposed to any other form of traditional energies revolves around monetary transactions. Any commercial energy requires monetary exchanges and the decision to switch to commercial energies can be considered as a three-stage decision-making process. First, the household has to decide whether to switch or not (i.e. switching decision). Second, it decides about the types of appliances to be used (i.e. appliance selection decision). In the third stage, consumption decision is made by deciding the usage pattern of each appliance (i.e. consumption decision).

While the costs do not always lend themselves to monetary-based accounting, the switching decision is largely determined by monetary factors: the amount and regularity of money income, alternative uses of money and willingness to spend part of the income to consume commercial energies as opposed to allocating the money to other competing needs. Appliance selection is affected by similar factors: cost of appliance, the monetary income variables described above and the availability of financing for appliance purchases through formal and informal credit markets. Finally, the consumption decision depends on, among others, family size, activities of the family members, availability of appliances and family income.

This framework of three-stage decision-making helps in analysing the problem in a logical manner. The poor normally lack regular money income flows due to unemployment or part-employment, both of which sometimes produce in-kind payments as compensation. Moreover, they often participate in informal sector activities, where barter rather than monetised transactions prevail. It is rational for any household or individual to focus on private monetary costs rather than social and/or non-monetised costs due to the inherent subjectivity and complexity of the valuation problem. Moreover, any modern energy has to compete with other goods and services (including saving for the future) procured by the household for an allocation of monetary resources. Given above characteristics and constraints, it is quite logical for the poor to have a natural preference for the fuel that involves no or minimum money transactions. Reliance on firewood and other traditional energies used for cooking, which constitute the major source of energy demand by the poor, can be explained using this logic.

For any commercial energy to successfully penetrate the energy demand of the poor would then require satisfaction of the following economic factors:

(a) The energy should be suitable and perhaps versatile for satisfying the needs.
(b) It should have a competitive advantage that would place no or little demand for money transactions (in other words, the low cost supplies) in the present circumstances.
(c) The use of modern energy should result in supply of adequate money flows to the poor so that they become willing to spend some part of the money on purchasing commercial energies.

Other supply and demand-related issues and social factors (such as availability of fuel, social acceptance, ease of use, pollution, etc.) will also affect fuel choice and its use, but they are secondary to economic factors.

The second stage (i.e. appliance selection decision) has a deciding influence on energy demand. Often energy appliance has a relatively long life (5–10 years) and its initial costs are highly relative to the income level of the poor. In order to, in a sense, amortise the costs, the appliances will likely have to be used for sometime, thereby introducing strong path dependence in energy demand. Strong path dependence affects fuel switching

[2] In some climatic conditions space heating may also be an important source of energy demand. However, for this discussion space heating demand is not considered.

[3] I have preferred to use the term traditional energies to non-commercial energies to avoid any confusion arising out of monetisation or commercialisation of some of such fuels.

possibility and responsiveness of the consumers to external changes. Fuel switching option will be limited by the appliance choice decision and will involve potentially sizeable capital expenditure. The rigidity or strong path dependence leaves limited options to consumers in the event of sudden changes in prices or supply conditions in the short run, who have to depend on their existing stock of appliances in any case.

The appliance selection decision has important bearings for the poor as well. First, high initial cost of appliances for using modern energy is a major deterrent. Consumers naturally prefer low cost appliances, although they are often energy inefficient. This also results from the difficulty of mental calculations for an economic appliance selection that involve factors such as operating costs, discount rates and appliance life. Second, appliances which the poor consider as essential and affordable will be selected, thereby restricting the choice to a bare minimum. Third, the poor are inherently adverse to experimentation and are unlikely to commit themselves to uncertain and unproven technologies on their own. Fourth, strong path dependence of modern energies is likely to add to the reluctance of the poor to invest in modern energies.

Once a decision is made to switch to a modern fuel and the appliance is purchased, the only variable left in the hand of the user is its utilisation. The short-term response of consumers to demand arises from this factor, which is quite limited.

3. Renewable energies and the poor

Consider now the case of renewable energies to analyse whether they meet the above requirements. As cooking and lighting constitute two major energy demands of poor households (excluding space heating), we consider these two separately. As there are different types of renewable energies (solar, wind, hydro and even sustainable biomass), we focus on solar energy here. Similar arguments can perhaps be advanced for other energies as well.[4]

Solar energy is available abundantly and from time immemorial, mankind has been using this form of energy for various purposes. The poor economies are major direct users of such energy, especially for drying purposes, although such information does not enter the official statistics. So long as the use of this energy remains traditional, the poor find its use helpful. However, modern ways of using this energy move it away from the poor. The more sophisticated the conversion process and higher the degree of usability, the further removed it becomes from the poor.

Consider solar home systems (SHS)—a technology on which great hope rests. SHS is available for one or two lights and a few small electrical or electronic appliances like TV or radio. This allows multiple use of solar energy and could make poor homes a better living place. The system size is typically between 10 to 100 W and involves an initial cost of a few hundred dollars and the replacement of batteries and lamps also involves some costs at regular intervals. Does this technology satisfy the factors we identified in the previous section?

First, let us verify the versatility of the SHS. It essentially competes with the lighting energy demand of the poor and is not suitable for cooking purposes. Therefore, it is not capable of meeting the most important energy need of the poor. Moreover, lack of alternative lighting fuels forces the poor to use some form of commercial energies in any way, mostly in the form of kerosene or electricity. Environmental benefits of SHS are thus limited compared to a solution that satisfies cooking energy needs of the poor. Second, the cost of SHS is significantly higher than the income level of the poor (IEA, 2002b). Therefore, it does not offer any competitive advantage in terms of costs. Third, the system cannot be used in any direct production process, although households may utilise manual labour over an extended period of time with these facilities, thereby indirectly benefiting from extra income. Given this indirect nature of income support, the impact of SHS in poverty alleviation is limited.[5] Hence, SHS does not appear to satisfy any of the criteria mentioned above in general and is not an attractive option for the poor.

As the versatility of and the income generation prospect from SHS can hardly be changed, only its cost aspect can be reworked to promote such a technology amongst the poor. From the perspective of the poor, a gift would be an ideal or most preferable financing option, as it imposes no monetary cost on the poor for using a renewable energy in a modern way. However, the cost of such a 'solar gift' could easily run into a few hundred billion dollars if SHS has to be provided to the two billion poor.[6] Had SHS been a substitute for cooking energy demand, the environmental benefit could have compensated a significant part, if not all, of the cost of the gift. In the absence of a sizeable environmental benefit, SHS appears to be a costly gift.

Admittedly, innovative financing schemes are being used to promote SHS successfully around the world. However, according to IEA (2002b), all such projects, promoted nationally or internationally, are supported by direct and indirect subsidies. Subsidies go against the principle of getting prices right and the experience of

[4]The specific arguments may have to be adjusted in some cases but the generic argument remains valid.

[5]See IEA (2002b).

[6]Assuming $500 on average for a SHS and a family of five members sharing an SHS (i.e. 400 million poor households, according to IEA (2002b)), the cost comes to $200 billion.

liquid petroleum gas (LPG) suggests that the removal of subsidies becomes a politically challenging task. If a technology or energy has to depend on subsidies and favourable incentives for its financial viability, we are going to make the same mistakes made in promoting some other energy forms (such as LPG subsidies, kerosene subsidies, etc.). The culture of subsidies would not lead to a sustainable development.

Let us now turn to the application of solar energy for cooking purposes. Solar cooking is a safe and simple way of cooking food using solar energy. Solar cookers of various types are available at relatively cheaper costs (as low as $25).[7] Solar cooking is smoke-free and fire-risk free. It also eliminates the need for fuel gathering, an activity that consumes a significant amount of time of the women in poor families. By addressing cooking demand—the major energy demand of the poor—solar cooking has the potential of satisfying the first criteria set out in the previous section. Moreover, in countries where the poor rely mainly on biomass, solar energy is available abundantly and can be easily harnessed. It is comparatively cheap, much cheaper than the SHS and thus imposes a relatively low monetary burden on the poor. It comes close to satisfying the second criteria as well. Finally, the time saved by eliminating fuel collection could be used productively to generate income for the family. The cooking system can also be used for food preservation, which may save some expenses as well. Although it does not lead to direct income generation, it provides indirect avenues of income generation and hence satisfies to some extent the third criteria as well. Despite such advantages solar cooking has not yet taken off and is perhaps least popular, except for drying food grains in a traditional way. It has not succeeded in enticing the poor households.

This failure stems, in my view, mainly from two factors.[8] The first relates to our very poor knowledge about how to manage small energy systems and how to organise the activities around them. Managing such decentralised systems is different from the traditional approach of providing energy through centralised supply systems. The skill set required for such new types of activities may not be available locally and there is a need to focus on such capacity development. Second, there appears to be a market failure here as low marginal cost of supply does not attract private investors to provide the good. The commercial profitability of such ventures being low, promotion of solar cooking is unlikely to be taken up by private investors having profit motives. Some alternative form supply is required, which has not yet emerged.

Should governments intervene and undertake supply of solar cooking appliances? Traditional economics would suggest yes but as mentioned earlier, governments do not have any special skills for managing the activities of decentralised energy supply systems. Most governments work in a centralised manner and tend to impose its decision at all levels. There can however be a case for governments providing capacity building facilities and opportunities for undertaking such activities, at least initially.

Financing options can also improve acceptance of solar cooking. Providing solar cooking facilities as a gift to 2 billion poor would cost 20 times less than providing SHS.[9] It could be vastly effective in reducing global climate change problems and environmental benefits of such a system could even justify the gift.

4. Conclusion

The arguments presented above provide a plausible explanation of the difficult situation in which the poor and the renewable energies find them. Renewable and modern energies compete with energies that involve no money transactions. Providing modern energies almost freely does not make commercial sense and does not motivate private entrepreneurs. Skills for alternative form of market organisation do not exist. There appears to be no niche market for renewable energies for meeting energy demand of the poor and the poor-renewable energy nexus is not a recipe for success.

Additionally, the issue of path dependence is of great importance for the poor. Choice of one option automatically removes alternative options, more so for the poor because of limited affordability. Extra care should be taken in introducing strong path dependence in poor countries through deceptive and distorted incentive mechanisms that could prove costly in the long run and lead to stranded cost problems. Many renewable technologies have not yet reached maturity and cost reductions, innovative applications and other changes cannot be ruled out. The poor being the most vulnerable segment of the society should not be made targets of such technological experimentation, unless of course such trials involve no money outgoes for the poor individually or as a nation. However, the present experience shows that the poor are the main targets and perhaps they are not economically better off with these technologies unless they get such technologies free of charge.

[7]Solar Cookers International website http://solarcookers.org/order/cookers.html.

[8]As expected, there is a large volume of literature on this issue, which identifies hundreds of barriers. While many of those barriers may be valid, the factors mentioned here are in my opinion most important.

[9]Based on a $25 kit for solar cooker, the cost for 400 million households comes to $10 billion, which is 20 times less than $200 billion required for providing SHS to the same number of households.

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