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SOME REFLECTIONS ON RURAL ENERGY ISSUES

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1. BACKGROUND

These reflections are based on

(a) 15 years of research, development, design, planning and implementation in the field of rural energy,

(b) a decade of experimentation on the community biogas plant at Pura village

(c) a long association with ASTRA, the Center for the Application of Science and Technology to Rural Areas of the Indian Institute of Science, for 9 years as Convener and then as a Project Convener,

(d) an equally long association with the Karnataka State Council for Science and Technology, first as Secretary and then as Vice Chairman, and finally

(e) analysis of energy problems at the village, city, state, country and global levels.

2. THE PREVAILING PARADIGM FOR RURAL ENERGY

This work led to a number of papers including the ones on the importance of rural energy (1), the nature of rural energy consumption patterns (2), the design of rural energy centres (3), the feasibility of community biogas plants (4), and the understanding of village ecosystems (5,6). These papers may have initiated the field and set trends, but they also established a ”paradigm for rural energy work” that is unfortunately turning out be hindering genuine rural development. The main thrust of these reflections is to describe the prevailing paradigm for rural energy work, to critique this paradigm and to suggest an alternative paradigm designed to advance rural energy centres that are consistent with rural development.

The almost universally accepted paradigm for rural energy work was supposed to be as follows (3):

STUDY OF RURAL ENERGY DEVELOPMENT OF BANK
CONSUMPTION PATTERNS OF ENERGY TECHNOLOGIES

DESIGN OF RURAL ENERGY CENTRES

ESTABLISHMENT OF RURAL ENERGY CENTRES

SUSTAINABLE RURAL DEVELOPMENT

The justification for the paradigm was obvious. The study of rural energy consumption patterns was intended (cf. the 1974 proposal to the Indian Council for Social Science Research) to reveal the basic energy utilizing activities and end uses of energy in a village and suggest in what priority these basic energy needs should be met. The satisfaction of these energy needs required it was believed the development of a set of decentralized technologies for the generation and utilization of energy. Given, on the one hand, the basic energy needs and therefore the energy utilizing tasks, and on the other hand, the energy technologies for performing these tasks, the next step would be the design of an integrated rural energy centre in which a mix of sources would be integrated through a set of energy devices to achieve the required set of endues. This design was viewed as an optimization problem:

Once a design was available, the problem would become one of implementation, which would consist essentially of establishing the set of technologies with all the component hardware and software.

Finally, with the provision of energy, a major advance in rural development would have been achieved.

3. EXPERIENCES WITH THE PREVAILING PARADIGM FOR RURAL ENERGY WORK

The paradigm was intended (3) to guide a set of inter connected tasks and a network of interrelated activities that would together promote rural development. In fact, what has happened is that the interlink ages have been mostly ignored and quite often the separate tasks have become ends in themselves.

Nowhere is this most common than in the case of the study of rural energy consumption patterns. Studies after studies have been carried out, and workshops and conferences have been held on the subject, without the results leading to the design and implementation of rural energy centres. Whereas the first studies of rural energy consumption patterns revealed a number of hitherto unknown features such as the overwhelming dependence on fuel wood, agricultural residues and animal wastes and the central importance of cooking energy needs, it is not even clear whether the proliferation of studies has led to significant new knowledge. If the result of a study is that cooking utilizes 92% of the fuel wood in village A instead of 87% in village B and that the ratio of fuel wood: agro wastes: animal wastes is 85:10:5 in village C instead of 90:10:0 in village D, what is the practical outcome of this knowledge. Even a typology of villages has not emerged so that for instance a small number of types of villages (say 20) have been identified (each with its characteristic and distinct type of energy consumption pattern) and if this small number are understood, the country's 586,000 villages can be deemed to be understood. The time has come to ask: what practical use are these rural energy consumption studies particularly when the populations and resource bases of the villages are changing? and are not studies of rural energy consumption patterns pointless unless they lead immediately to the process of establishing rural energy centres?

The development of rural energy technologies also has invariably taken place without

regard to the village setting in which these technologies are supposed to find a place. In particular, little thought has been given to the socioeconomic and environmental impacts that these technologies are sure to have. And the impacts on women are almost never considered.

Nevertheless, in view of the long gestation time for the development of technologies, it is fortunate that work has been carried out on a number of rural energy technologies woodstoves (chulas), biogas plants, wood gasifiers, windmills, solar ponds, minihydel plants, photovoltaics, etc. This work has in fact shown the well known learning curve that characterizes technology dissemination. The first generation of devices tends to fail in the field because enthusiasts with inadequate expertise prematurely introduce technologies that are not yet ready for dissemination. The second generation of technologies is the result of far more competent technical work, but the dissemination process may not be sufficiently enlightened. Finally the third generation of technologies is the result of both technical and managerial competence. But, the research and development on rural energy technologies must not stop.

The design of rural energy centres has attracted the attention of experts in optimization techniques. Unfortunately, in the few cases where optimization studies have been carried out, the results are so obvious for instance, that electric illumination is better than kerosene lamps that one begins to wonder whether villagers themselves could not have reached the same conclusion without a knowledge of linear programming. Even more important is the fact that the optimized design ignores crucial questions such as

(1) the sequence in which the different energy technologies should be deployed,

(2) whether the mathematical optimization captures the villagers criteria for optimization,

(3) who should pronounce the optimization as acceptable the designers of the rural energy centre or the villagers?

(4) the compatibility between the technical design and the management system.

It is in the matter of implementation that the most serious lapses have occurred. For all practical purposes, implementation has been viewed particularly by the central government agencies involved with rural energy centres as a matter of installing a set of one or more devices on the village. And if the number of devices is more than one, it is designated an ”integrated rural energy centre (even though there is no integration either in the thermodynamic or socioeconomic sense) or an energy village or ”Urja Gram (as if there is any village without energy).

What is most serious is that the mass replication of integrated rural energy centres and Urja Grams is taking place without virtually no consideration of the sustainability of these centres. In the first place, what is the economics of these centres? Do they generate any revenues from the village? or must they be completely subsidized? If there are subsidies, how do they compare with those extended to urban services? In short, what is the economic sustainability of these rural energy centres?

Then, there is the question of the sustainability of these centers from the standpoint of their management? Who will manage them the local community or an agency like the state electricity board?

If it is the local community, have the appropriate village organizations evolved? and how are they functioning? Since this is a nontraditional activity, has the appropriate management training been given?

These questions lead to the last, and most important, question, viz., whether the rural energy centres are advancing rural development. Viewing rural development as a sustainable socioeconomic process directed to

(1)the satisfaction of basic needs, starting from the needs of the neediest,

(2)a selfreliance that grows from within so that the community takes control over its future,and

(3)harmony with the environment to ensure sustainability over the long run, the basic paper

(4) on the design of rural energy centres now a decade old issued the following warning:

However technically perfect the design of a rural energy centre may be, there is no guarantee that the system is consistent with development objectives. To ensure this consistency, additional criteria must be used, e.g., whether the rural energy center fulfils the desire for local self-reliance. The problem of assessing designs for rural energy systems from the standpoint of a wider social perspective is far more complex, and the methodologies are in an embryonic stage

(6)... "Nevertheless, one conclusion is clear: for a `technological solution' to be accepted into the matrix of society, it has to satisfy vital nontechnical social criteria. Rural energy systems, therefore, must be society specific and culture specific. There cannot be standard designs and packages for universal application.

Rural energy centres cannot be mass-produced.

Thus, it is obvious that rural energy centres must satisfy several criteria. Firstly, the demand for the rural energy centers may be initiated by external change agents, but this demand must rapidly become that of the community. Secondly, the centres must be no less economically sustainable than urban services. Thirdly, the villagers must assume control over the centres and take responsibility for their management. This implies the formation and continuation of appropriate organizations/institutions, and the skills to run them. Fourthly, in the matter of technology, it is necessary that operational know-how is generated in the village to handle the new technologies. In addition, the elementary levels of maintenance know-how should be created in the village, and higher-level maintenance know-how must be available at mandal, taluk or district levels. All this implies that the major challenges of training must be successfully tackled.

By and large none of these criteria are satisfied by the two major rural energy programmes in the country. They must, therefore, be adjudged to have little to do with rural development however much energy they may provide.

The root of the problem lies in the fundamental paradigm that motivates current programmes on rural energy. Its major shortcomings stem from the fact that it assumes that the establishment of rural energy centres is

(1)a purely device based technological affair that can be carried through with energy generation and consumption hardware and optimization software,

(2)an exercise in ”overnight installation of devices and gadgets,

(3)a top down strategy emanating from the national capital instead of the result of the collaboration between villages and higher-level organizations,

(4)a to the people flow technologies and training to the people.

4. A NEW PARADIGM FOR RURAL ENERGY

Clearly, a new paradigm for rural energy work is vital. This new paradigm must evolve but the following may be some of its features.

(1)Satisfying rural energy needs is crucial to rural development, but even more important may be the issue of ”how these needs are satisfied.

(2)Building up a rural energy centre has to be a ”dynamic process involving the choice, adoption and absorption of technology by a community. Ideally, the technology absorption process must involve one technology at a time.

(3)Since the broad features of rural energy consumption patterns are known and since the rural energy center must in any case ”grow, it is not necessary to have an exact idea of needs and resources before starting the growth process. It is sufficient to have a rough idea of needs and resources and to build in safety factors so that resources can meet needs.

(4)At every stage in the development of a rural energy centre, there should be a set of internal factors preserving and maintaining the rural energy centre and another set of factors transforming the centre into the next stage in its evolution.

(5)The major factors of preservation and maintenance should be :

(i) the ”level of satisfaction of energy needs and

(ii) the ”control over its energy future that the community acquires and retains. If, at every stage of a rural energy centre, the need satisfaction level is higher and the community's self reliance is strengthened compared to the previous stage, then the community has a vested interest in keeping the rural energy center going.

(6)Whereas some energy technologies (for example, energy efficient woodstoves) do not offer possibilities of direct revenue generation, there are other technologies (for example, decentralized electricity generation for domestic electric illumination) that enable revenue surpluses. If therefore the surplus revenue generation is enhanced by the operation of a technology, then there is further vested interest in keeping it going.

(7)There are two extreme positions with regard to the economics of rural energy centres. One extreme view expects the rural energy centre to run like any commercial enterprise (raising its own capital at commercial interest rates, financing all developments through internally generated surpluses, etc.). This viewpoint ignores the fact that urban utilities (for instance, the water supply of a large metropolis) do not satisfy commercial criteria, and there are major subsidies (explicit and hidden) for centralized energy technologies nuclear, coal and

hydroelectric power generation. The other extreme view is make not only the capital costs but also the operating and maintenance costs of a rural energy centre a grant with no revenue collection from the village and its individual beneficiaries. Obviously, such rural energy centres are not economically sustainable and will collapse after the external funding agency withdraws as it is bound to do after getting its publicity. It is crucial to avoid both the zero subsidy and the cent percent subsidy viewpoints. It is of fundamental importance to determine what should be the grant as an investment in rural development and to what extent the operating and maintenance costs should be subsidized. Should, for instance, the salaries of the village level technical personnel be borne by a state level energy board just as the state electricity board pays the salaries of its rural personnel. The main point is that rural energy centres must be compared ”on the same terms as urban services/utilities and centralized technologies.

(8)The problem of individual gain vs. community interests has been discussed in terms of the famous "Tragedy of the Commons" described by Hardin (7). In that description, the personal benefits that each individual/household derives from promoting the further destruction of the commons (i.e., community resource) are larger and more immediate than the personal loss from the marginal, slow and long-term destruction of the commons -- hence, each individual/household chooses to derive the immediate personal benefit rather that forgo it and save the commons. Experience with the Pura Community Biogas Plant system appears however to illustrate a converse principle that may be termed the "Blessing of the Commons"

According to this principle, the price for not preserving the commons far outweighs whatever benefits there might be in ignoring the collective interest. In other words, ”the "Blessing of the Commons" is based on the coincidence of self interest and collective interest. In the case of Pura, non-cooperation with the community biogas plant results in access to water and light being cut off by the village, and this is too great a personal loss to compensate for minor advantage of being a loner.

There must have been many examples of "Blessing of the Commons" that contributed to the survival of villages for centuries in spite of the centripetal forces tearing them apart. Among those examples must have been the maintenance of village tanks, common lands, woodlots, etc. It is important to discover and utilize such examples for the design of rural development projects in general, and rural energy centres in particular. It is important to use the principle of the "Blessing of the Commons" as a heuristic (i.e., a device for discovering) for designing scenarios for the evolution of rural energy centres.

(9)The "Blessing of the Commons" approach should be utilized for the evolution of rural energy centres. Involving as it does individual initiative subject to ”local community control, it is a distinct alternative to the privatization (deregulation) option being offered as a solution to the defects of state control, operation and maintenance (regulation) of the commons.

(10)There are many possible factors of transformation: (i) the aspiration to increase the level of satisfaction of basic energy needs, (2) the desire to increase community control over its future, (3) the realization that the adoption of a new technology will lead to still greater needs satisfaction, self-reliance and surplus revenue, i.e., more private gains coinciding with more public benefits.

(11)The dialectical process of building up a rural energy centre must be driven forward by an internal dynamic based on the conflict between the factors of preservation and the factors of transformation of the rural energy centre. Of course what makes possible is the availability of a bank of relevant rural energy technologies whereby the adoption of each new technology carries the rural energy centre to a higher stage.

(12)Thus, a rural energy centre is not a destination but a ”path in which the milestones are the successful adoption of individual technologies. Rural energy centres cannot be installed according to Delhi determined time schedules; they have to evolve according to the learning curves and time constants for technology adoption.

Thus, the stages of the evolution of a rural energy centre correspond to the periods during which different technologies are adopted.

(13)There is no unique path or unique sequence of technologies. Each village has to choose its own technology sequence taking into account its prioritizing of needs, its availability of resources and its organizational, institutional and management constraints and strengths. In one village, it may be improved woodstoves (chulas) > wood gasifierbased electricity generation > domestic lighting > pumped drinking water > biogas plant > electricity for irrigation pump sets and industries ..... , but in another village, it may be biogas plant based electricity generation > pumped drinking water > domestic lighting > energy forest > wood gasifier >electricity for IP sets and industries > improved cattle > biogas cooking > .....

(14)The approach described above does not deny a role for external change agents who have to participate with technology generation and introduction as well as with training in technology operation, maintenance and management. Thus, there has to be an interaction between the external change agents and the local community with a two-way flow of demands, choices and priorities from the people and a flow of technologies, management and training to the people.

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