Towards a Framework

The basic concept of an energy planning process is fairly straightforward. As shown in Figure 4, an energy plan consists of three components, namely, supply-demand management, financial planning, and impact analyses. These are derived from an analysis of the supply - demand balance based upon demand projections and economic growth scenarios on the one hand, and resource assessment and technology evaluation on the other.

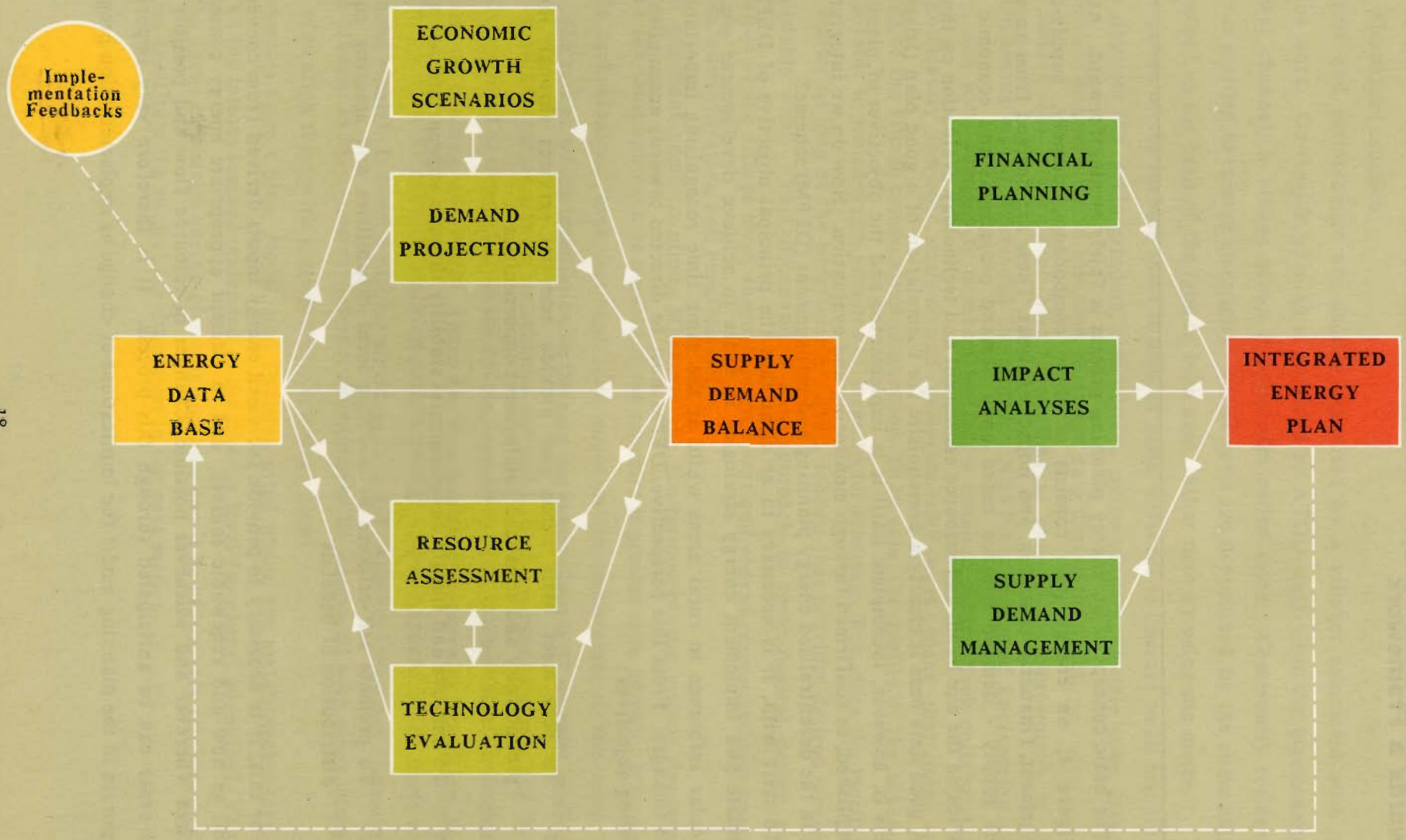
A good data base is clearly a prerequisite for formulation of a good plan (Islam). The process is, however, incomplete until it is implemented and the objectives of planning are accomplished, as confirmed through monitoring and evaluation. How do we integrate these ideas in the decentralised energy planning and management (DEPM) scheme?

To start with, it is necessary to be clear that the principal objective of DEPM is to formulate and implement energy strategies in order to achieve development goals with particular reference to rural areas while at the same time recognising important rural-urban linkages. From this perspective, DEPM must be directed towards accomplishing the following objectives :

- To help meet basic needs and provide essential services through increased productivity and enhanced employment opportunities
- To improve and sustain environmental stability through appropriate measures
- To promote self-reliance by building local capabilities and assuring equitable distribution of benefits

For this, it is necessary to provide increased energy inputs derived from conventional as well as new and renewable sources, and to attempt appropriate energy conservation practices wherever and whenever possible. Changes in resource flow and possibly in the social order can be anticipated through this process. It is therefore very important to incorporate in the planning model the implications of change as implementation progresses.

Figure 4. Integrated Energy Planning Process



Source : Codoni, Park and Ramani 1985, Quoted by Islam.

CHARACTERISTICS OF THE MOUNTAIN REGION

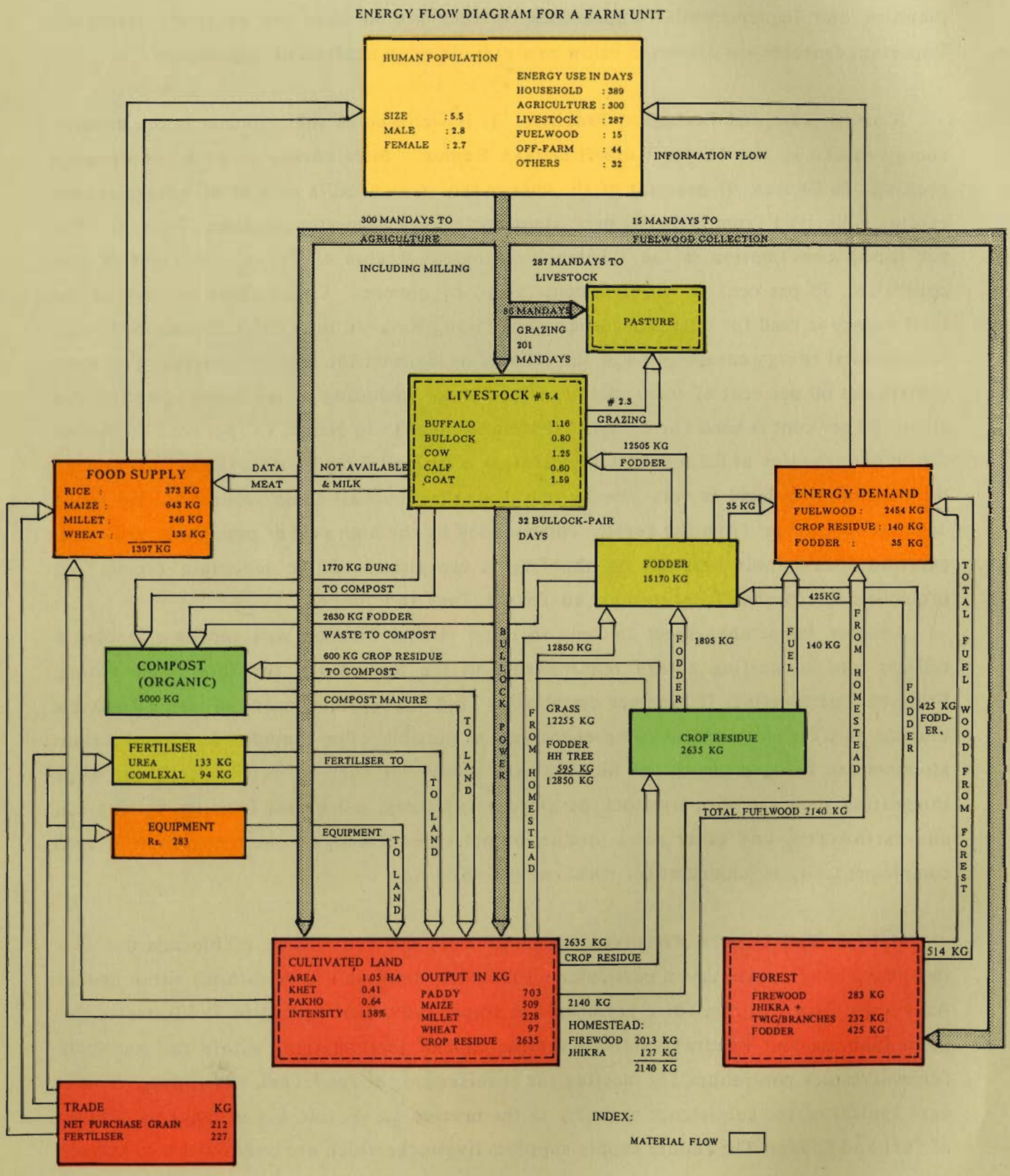
The characteristics of the mountain villages clearly have to be reflected in both planning and implementation approaches, if they are to have the necessary relevance. Important features are discussed below as a prelude to an analysis of approaches.

Biomass Base and Ecological Fragility. It is well-known that biomass is the primary energy source in the Hindu Kush-Himalaya Region. Most energy is used for domestic cooking. In Bhutan, 97 per cent of the energy requirement (0.78 tons of oil equivalent per capita) is derived from biomass, used almost solely for domestic purposes (Tsering). The per capita consumption in the Tibetan Autonomous Region of China is 0.7 tons of coal equivalent, 75 per cent of which is contributed by biomass. Eighty-three per cent of the total energy is used for domestic consumption (Wang Hai). In the Central Indian Himalaya, "almost total energy consumption of the villages depends on the forest resources. Fuelwood contributes 60 per cent of total energy in rural areas including plains districts, and of this about 85 per cent is used for cooking" (Pant and Singh). In Nepal, 93 per cent of the per capita consumption at 0.2 tons of oil equivalent is derived from biomass (Mahat). Although the consumption level is very low by world standards in all these countries, the heavy demand on biomass from the forest, compounded by the high rate of population growth, is exerting considerable pressure on the fragile ecosystems of the mountain region. A protective role is, therefore, strongly advocated (Pant and Singh).

Another important aspect to bear in mind is that biomass will continue to play a critical role in meeting energy requirements in the Region for the foreseeable future. From this perspective, it becomes essential to find appropriate means of using available biomass as efficiently and as comprehensively as possible. For example, in China, serious attempts are being made to use biomass as a source for fuel, as well as fertiliser, while integrating such use with livestock development, fishery, mushroom farming, raising eels and earthworms, and other rural production activities (Huang). The recognition of such complementarity is important for rural energy planning.

Multiple End Uses of Resources. Together with the significance of biomass use, it is important to recognise that a particular resource has multiple uses within the rural system. An energy flow diagram for a farm unit in Nepal (as shown in Figure 5) illustrates this point (Sharma and Bhadra). Here is a clear case of interrelations within the man-land-forest-livestock continuum, for meeting the requirements of food, fuel, and fodder. This is very typical of the subsistence economy in the mountains. Forest, for instance, is a source of fuel and fodder. The fodder supply supports livestock, which are essential for providing

Figure 5. Energy Flow in a Farm Unit in Nepal



Source : Sharma and Bhadra

draught power and compost for crop production. This in turn is crucial for supplying food for human use and fodder for animal use. Human contribution in this system is in terms of labour supply, for example, in crop production, livestock rearing, fuel collection, and post-harvest processing.

In other villages, it is possible to find evidence concerning additional linkages to employment opportunities. Although data from the mountain region is as yet unavailable, it is realistic to assume that the male as well as female labour force find employment both in primary and secondary activities within the forestry sector. A case study from Karnataka suggests that 5.9 per cent of the male and 4.0 per cent of the female labour force were engaged in primary forest sector activities in North Canara. More importantly, the secondary forest sector contributes to employment of 67.7 per cent of the work force (Nadkarni and Samuel 1985, quoted by Pachauri). The relevant question here concerns the fate of the labour force due to deforestation. Clearly the issue goes much beyond that of fuel scarcity alone.

The importance of human labour flow into different sectors has already been noted (e.g. in crop cultivation, post-harvest processing including milling, grazing, and fodder collection from forest). The tremendous labour intensity within the subsistence economy is evident if labour use in other activities (such as water collection, cooking, child rearing, and other occasional domestic activities) is also considered. It would be an understatement to say that most people in the mountains, especially women and the poorer section of the population, are overworked. The condition is worsened by inadequate nutrition among these groups. Such problems have serious implications for labour-saving devices and also for creation of employment opportunities (Pachauri).

The characteristic of multiple end use indicates, on one hand, the interdependency in the utilisation of resources for meeting basic requirements, and on the other hand, the competition for the same resources when physical limitation or scarcity is experienced. How is the household decision-making process affected when such competition is apparent? This is crucial for consideration in energy planning and implementation, particularly when additional interventions are being contemplated. A holistic outlook in energy interrelations is clearly essential.

Many examples show that such a holistic outlook is not yet pervasive. One case is the scant attention given to energy input-output interrelations of the ruminant animal population in the Nepal Himalaya. According to Panday, negative impacts of ruminant animals on the country's fragile environment are overemphasised; at the same time, their positive contributions to the economy in relation to the supply of dung and draught power are undervalued. Moreover, what is often ignored is the important dimension related to the impact on deforestation due to establishment of dairy industries. Although localised in

nature, increased stress on the surrounding forests due to cheese and butter factories in high mountain areas has not received necessary attention from planners and policy makers.

The 25-year history of the Thodung Cheese Factory in Nepal shows, for instance, that cheese production capability there has increased from two to three metric tons in 1960 to 18 metric tons in 1985 (Panday). Fuelwood consumption has correspondingly increased from ten metric tons to 58 metric tons annually. Whereas in 1960, deadwood was collected from the forest at a distance of 100 metres within five minutes' walking distance, the situation in 1985 was that live trees were felled for fuel at a distance of 600 metres. The fuelwood is being used at a ridiculously low price of Rs. 0.05 per kg.

Subsistence Living Conditions. A special strategy in energy planning is required to address the fact that people living in the mountains survive on a minimum subsistence base with almost total reliance on traditional systems. Various forms of barter system still exist with minimal commercial economy; usually, there is little contact with the outside world.

The *jhum* (shifting) agricultural system, practised extensively in the northeastern Indian Himalaya provides a good example (Ramakrishnan). Because of the high accumulation of biomass in relation to actual economic yield, a ten-year *jhum* cycle is proven to be self-sustaining and highly efficient. Furthermore, the system meets diverse needs of the tribal farmer, namely, cereals, vegetables, tubers, and even fibres. Multiple cropping is also practised as an insurance against crop failure due to uncontrollable factors.

Traditional systems of this kind are, however, under tremendous pressure. Population increase and dispersion have, for example, been instrumental in reducing *jhum* cycles to four or five years. The ecological balance is consequently distorted. Serious and urgent attempts are needed to bring appropriate transformation, such as economic diversification, perhaps by promotion of horticulture and plantation crops, intensification of animal husbandry practices, and improvement of agroforestry systems. For these purposes, Ramakrishnan recommends public intervention schemes in which government agencies act as catalysts and local people participate in design and implementation.

Other important dimensions are the existence of noncommercialised economies and hesitation on the part of local people in taking risks. Village economic activities can, to a large extent, be explained by the underdevelopment of markets in small isolated communities in which the gains from the division of labour based on the market are severely limited. The village community governs these activities by coordinating the use of scarce resources through customary rules and institutions. Decentralised planning and management at the village or community level can play a great role in strengthening these rural institutions and making them more productive. Conviction and internal capability will have to be built within the communities.

Heterogeneity. Whereas the general principles of rural energy problems are similar, it is necessary to recognise that heterogeneity exists in the mountain region. Altitudinal and climatic differences, for example, have obvious influence on agricultural and ecological patterns. Whereas rice production predominates at lower elevations, the higher elevations are characterised by production of maize, millet, and potatoes. Similarly, *Shorea robusta* and other tropical species are prevalent in the lower reaches; subtropical species such as *Schima wallichii*, and *Castanopsis spp* are dominant at higher elevations; and others like *Quercus*, *Rhododendron* and *Pinus* become more prevalent at still higher altitudes.

Economic patterns surrounding pastoral and transhumance activities are important at high elevations, but sedentary agriculture constitutes the base of economic activities at lower elevations. These conditions are further influenced by heterogeneity in human settlement patterns, indigenous institutions, organisational behaviours, and other socio-cultural patterns. The flexibility required in energy planning to respond effectively to all these diversities cannot be overemphasised.

ELEMENTS OF AN APPROACH

Given the objectives and characteristics described above, the principles involved in the decentralised energy planning process may be summarised as follows:

- Energy planning has to be consistent with both mountain development and national development objectives.

- Intersectoral relationships of the resource base, in general, and the biomass base, in particular, have to be recognised. This requires a holistic outlook and multisectoral integration in plan formulation, as well as implementation of action programmes.

- Transformation of subsistence living conditions is essential, but the process must include the principle of partnership between the beneficiaries and outside resource people.

- Considering the agro-ecological variation, sociocultural heterogeneity, and economic diversity, there cannot be a uniform master plan. Rather, the approach should be to maintain a great deal of flexibility within a framework of appropriate principles and guidelines.

- The urgency of problems within the mountain region suggests that the planning process cannot wait for a good data base. Action programmes have to start as soon as possible and a systematic data base can be developed as part of the process.

Within this general framework, essential components of an approach can be identified.

Planning Unit. A " district " is considered here as the basic planning unit. The district connotes the smallest politico-administrative boundary that has the presence of elected representatives from several smaller political divisions, as well as officers from government line ministries, who are authorised to decide on policies and formulate programmes on behalf of the people and the administration. The actual size and nomenclature of such a unit varies from one country to another. The essential principle is to have a mechanism for integrating local people's priorities with those of the administrative machinery in as small a unit as practicable. It is understood that decisions on formulation and implementation of specific activities would also take place as appropriate at smaller units, such as villages or clusters of communities.

The advantage of the district is that it is small enough to encourage local participation in decision making, yet large enough to provide a mechanism of exchange (of goods and services) among villages and market centres and maintain effective liaison with national planning and policy making bodies. It is important to note that not all energy plans can be decentralised. Some large-scale energy projects will have to remain directly within the jurisdiction of national agencies (e.g. the Electricity Board, the Coal Board, and the Petroleum Corporation). What is required is the linkage of district energy plans with these national agencies so that supply-demand management reflects realities in the districts while preparing national plans for large-scale projects. This signifies the necessity to distinguish between different levels of planning and to devolve responsibilities as required.

Integration with Development Activities. Energy planning is not an independent exercise, but has to be linked with ongoing and planned development activities. It needs to be oriented towards removing energy constraints by providing more efficient ways of utilising energy, or, when necessary, by providing alternative sources of energy. The advantage in a separate emphasis on energy planning is complementarity in the use of energy in many sectors. For example, use of electricity from a hydropower plant can be integrated with replacement of diesel in milling and lift irrigation, and of kerosene in domestic lighting. At the same time, it can be used in promoting additional activities such as power looms, poultry raising, production of fertilisers, and other small-scale activities.

When integrated in this fashion, electricity generation becomes economically viable. However, the potential of electric use for multiple activities will not materialise unless necessary commitments and material support from all related sectors are forthcoming.

Three points are particularly noteworthy in this regard. The first is that lessons can be learned from the history of development activities at the district level. By applying these to energy planning, mistakes could be avoided. This can be done by careful perusal of all available documents on such activities and also through discussions with government officers and community people. Second, an assessment of energy end use patterns in development activities from all sectors would give a comprehensive view of energy constraints. Energy strategies can thus be formulated to overcome those constraints. Also, an assessment of energy resources by district could suggest favourable sources of inputs to be used in development activities. Consultation with concerned authorities would be required to examine whether additional plans could be made within the various sectors to absorb the extra energy. Related to the above two points, the third point concerns the mechanism of coordination. Those involved in decentralised energy planning will have to think at the outset about an acceptable approach to proper coordination both in generating additional energy supply and meeting projected demands.

Typologies. Even a unit as small as a district is characterised by diversity within the mountain region. In view of this, it is important for decentralised planning to establish a basis for formulating energy strategies in correspondence with the opportunities and constraints presented by different types of resource base. Typologies can, for example, be formulated using the following parameters :

- Physical characteristics, i.e., elevation, climatic conditions, soil characteristics, land use, water resources, etc.
- Agricultural patterns including types and intensity of crop cultivation, seasonal variations, and land holding and tenure practices
- State of the forest and patterns of its utilisation, both for meeting basic requirements and providing employment opportunities
- Patterns of livestock holding and contribution to the village economy
- Annual labour use patterns with special emphasis on peak and slack seasons

- Forms of local institutions and organisations including human settlement patterns, indigenous skills, and knowledge systems

- Types of economic activities such as the extent of subsistence, interaction with the market, levels of economic disparity

- Extent of infrastructural supports including access to government services (extension opportunities, credit schemes, etc.) as well as market and urban centres

- Experiences in recent innovative efforts including the propensity of the people to take risks, try new ideas, and mobilise local resources

The list above is neither exhaustive nor necessarily appropriate under all circumstances for the specific district being considered. There may also be data limitations that prevent the inclusion of all desired parameters. The important thing, however, is that an understanding of even broad classifications (though the finer, the better) is necessary to help identify various rural development priorities and the corresponding energy implications in relation to a variety of conditions within the district. A combination of several activities, as illustrated below, can be selected based upon resource availability and limitations, harmony with national priorities, and other factors.

- Intensification of crop cultivation through increased energy inputs such as pumping for irrigation and provision of fertilisers

- Encouragement of horticulture and agroforestry schemes for diversifying traditional agriculture

- Development schemes for utilisation of under-exploited resources such as hydropower and forest

- Promotion of alternatives for protection of critically degraded forests

- Introduction of labour-saving devices for domestic activities and promotion of income-generating activities

- Market development for large-scale dissemination of new technologies and alternate schemes

- Establishment of demonstration units and development of indigenous capability for their production and dissemination

Responses to specific typologies, if classified systematically, can provide opportunity for comparison with other districts. Lessons can thus be derived in a systematic manner for national policy formulation or plan extension and other relevant activities.

Multilevel Spatial Planning. Emphasis has been placed on the idea that decentralised efforts in the village and the district need to reflect national development priorities. A harmonious working relationship at different levels of the planning mechanism, from the village to the central planning body, is thus a prerequisite for achieving development goals. A multilevel spatial planning approach provides an opportunity for this process to take place. With particular reference to the administrative structure in India, Figure 6a furnishes an example of the potential extension structure and possible extension functions at different administrative levels (Kumar). Modified versions of a similar structure can be designed to suit particular conditions in other countries.

Experiments and innovations in rural energy are envisioned as taking place in the village through the participation of the farmers for their own benefit. Efforts in the village are directed towards bringing changes in the internal resource flows through the application of additional sources of energy. Such a change is deemed necessary for better access to basic needs, more employment opportunities, and equitable income distribution. Positive change in the existing social order is also anticipated during this process.

Different types of support services are provided, depending upon the mandate and capability of various personnel at the service centre, block, district, state, and national planning level. Various components of the iterative process are shown in Figure 6b.

A Process for Partnership. Rural energy planning and development presume external inputs for mobilising internal resources and capabilities. From this perspective, it is important that all involved parties interact with one another so as to make each feel like a winner in a positive-sum process. In the process, the principal parties are : (1) policy makers, planners, extension officers, agents, and others representing government and international donor agencies ; (2) scientists, technologists, and researchers representing the research and development community, including those from private voluntary organisations, as well as manufacturing and consulting firms ; and (3) residents of the village who are, in the final analysis, the primary beneficiaries. At present, these parties operate in disparate ways and their interactions are minimal. This accounts for many obstructions to effective diffusion. A fundamental concept in decentralised rural energy

Figure 6 (a). A Multilevel Spatial Approach for Rural Energy Planning and Development

PLANNING LEVEL	EXTENSION FUNCTION	EXTENSION STRUCTURE
NATIONAL	To develop policies, educational programmes, training programme materials, and publications in all languages	National rural energy extension agency
REGIONAL (STATES)	Expert group to advise and train according to regional characteristics and needs ; preparation of training and extension aids	Regional rural energy extension agency
DISTRICT	Relates extension to the needs of the district according to five year plans; monitoring and evaluation	District rural energy extension agent
BLOCK	Achieve annual plan target for rural energy extension, identify and service village leaders on rural energy ; monitoring and evaluation	Block energy extension assistant
SERVICE CENTRE	Establish rural energy service and extension centres, record keeping ; supervision of field activities ; research and extension supply of inputs	Energy services centres managed by voluntary agencies / panchayat
VILLAGE	Village experiments and innovations in rural energy	Farmers

Figure 6 (b). A Planning Process at the Village Level

COMPONENT	PLANNING PROCESS
Land use, demography, livestock, resource use, and capacity including energy potentials, policies, constraints, opportunities	Identification of components of village system
Change of resource use, labour use, income	Extrapolation for change and alternate scenarios
Time budgets, life cycle, benefit-cost, financial analysis, environmental impact	Impact assessment
	Organisational requirements
Short, middle, and long range physical plans, financing plans, cash flow	Action planning

Source : Kumar

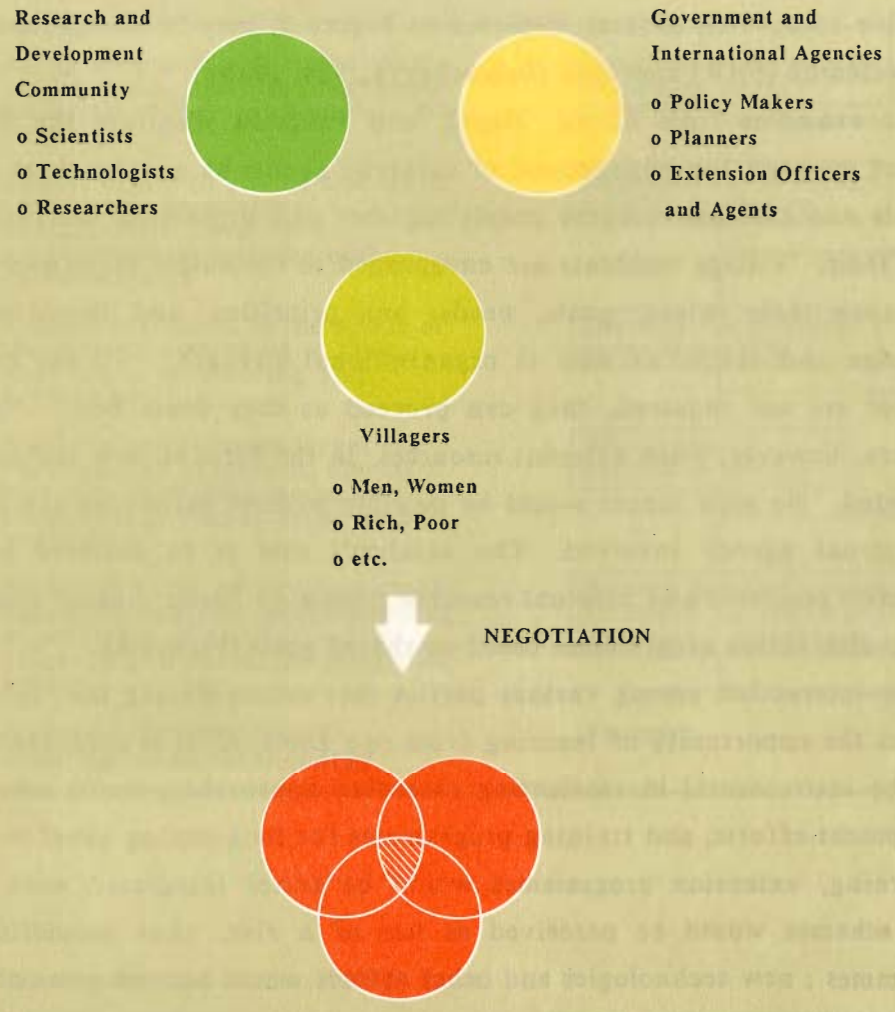
planning and development is therefore a transformation process in which the three parties negotiate as partners for a common goal. The action that follows is thus the consequence of this shared goal and the understanding of the parties' interdependence and their respective roles. This process, depicted in Figure 7, may be designated as a participatory action research (PAR) approach (Bajracharya 1984, 1985).

The examples from China, Nepal, and Pakistan illustrate the PAR process. The approach suggests the engagement of catalytic agents as matchmakers in bringing village residents and external resource people together and promoting the process of negotiation among them. Village residents are encouraged to formulate plans and action programmes based upon their values, goals, needs, and priorities, and their indigenous technical knowledge and skills, as well as organisational strength. To the extent that external resources are not required, they can proceed as they deem best. Negotiation becomes necessary, however, when external resources in the form of new technology and/or credit are needed. No such inputs would be possible without satisfying the process required by the external agency involved. The catalyst's role is to promote interaction between community residents and external resource people, to foster mutual understanding, and to help develop action programmes based on shared goals (Figure 8).

The interaction among various parties that ensues during the process of negotiation provides the opportunity of learning from one another. It is conceivable that the process could be instrumental in reorienting extension approaches, credit schemes, research and development efforts, and training programmes for long-lasting benefits. As a consequence of learning, extension programmes would be better integrated with people's priorities; credit schemes would be perceived as less of a risk, thus promoting new investment programmes ; new technologies and other efforts would become more acceptable to people; and research and development programmes would be oriented towards adaptive research based on specifications and designs from field experiences. The potential is enormous.

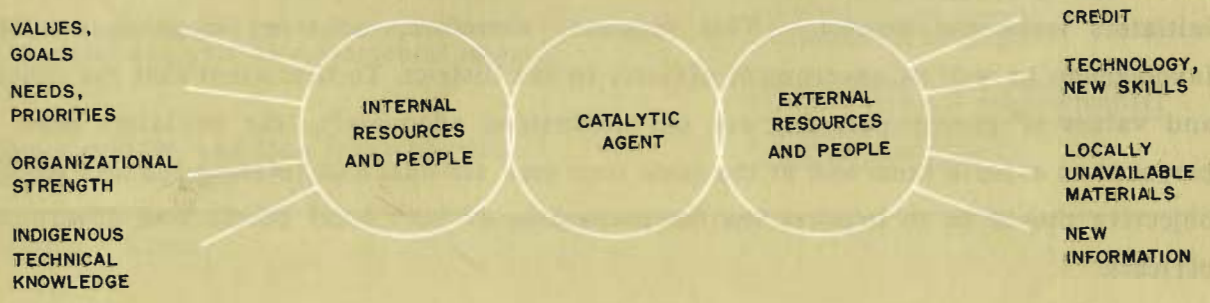
Increasing Local Capability and Building a Data Base. Decentralised energy planning and management must not be perceived as a project with a fixed timeframe for achieving limited goals. It must be developed as a self-sustaining process that will continue after the initiators leave the district. This requires, therefore, a strong emphasis on local involvement as well as government officers in the district. To thee xtent that the concept and values of energy planning are not understood adequately, the initiators must be prepared to explain them and at the same time seek assistance in refining the DEPM. The objective should be to improve the comprehension of both local people and government officers.

Figure 7. The Transformation Process



Source : Bajracharya

Figure 8. Role of the Catalytic Agent



Source : Bajracharya

As already mentioned, DEPM must be integrated with ongoing development programmes so that an action orientation prevails. For that, training programmes of various kinds would be necessary to mobilise local resources and increase local capability. Similarly, in support of action programmes, follow-up services including regular supervision visits, repair, and maintenance must be incorporated as part of the planning and management scheme.

All the elements described above include collection of data already available, and also generation of new data where gaps exist. An attempt is necessary to keep the data on a systematic basis for decision making, not only for the present but also the future. The data base should be in a form which facilitates rapid retrieval and encourages continuous supplements. Lack of a good data base is often mentioned as one of the main constraints in energy planning. Whereas limitations may be felt in this regard, a mechanism must exist to improve the quality and quantity of data as more experiences and new insights are gained. This must be a deliberate effort from initial stages of the DEPM exercise.