Chapter 4

Emerging Issues in Energy Use Patterns, Policies and Programmes

Technical Session 3 on 'Emerging Issues in Energy Use Patterns, Policies and Programmes' was chaired by Dr. T. S. Papola, with **Dr. S. Z. Sadeque** acting as the resource person. Dr. Rijal summarised the emerging energy issues based on the output of the studies commissioned in four countries of the HKH Region as well as on discussions held during the earlier sessions.

Energy Systems' Characteristics

Dr. Rijal began by putting forward the general characteristics of mountain energy systems, classifying them into two sub-systems such as energy resources and energy demand. He pointed out, however, that the objective conditions prevailing in mountain areas, such as inaccessibility, marginality, and fragility, had implications for the energy sector. Energy resources available in the mountains were generally high in bulk density, low in calorific value, low in energy density, and low in conversion efficiency, resulting in reduced suitability, flexibility, and diversity in use, high cost of extraction, high cost of conversion, and high cost of collection. Also, energy demand characteristics depicted the major requirements for energy to be in the form of heat; a minimal amount of energy was required for motive power application; the opportunity cost of collection and conversion of energy was very low; and the energy demand density was very low because of the dispersed settlement pattern. These led to the overall characterisation of the energy system in mountain areas.

- Biomass fuels dominated the energy consumption scene
- The domestic sector was the main consumer of energy
- Fuelwood was a major supplier due to lack of access to commercial energy resources
- There was less demand for energy by the productive sector
- Energy resources available in the mountains, though dispersed in nature, were renewable.

The presentation also outlined why and how the energy needs of mountain communities were different from those in the plains. It was believed that mountain specificities, such as diversity and niche, were the main causes of distinct energy-use behaviour in the mountains. Also, the objective conditions of the mountains provided a niche for certain types of energy forms, technologies, institutions, and financing mechanisms. What was important was to identify suitable energy forms, technologies, institutions, and financing mechanisms to fulfill the economic, social, and environmental objectives.

Emerging Issues in Energy Use Patterns

Given these general characteristics of the mountain energy system, Dr. Rijal presented a summary of the major emerging issues in energy-use patterns in the mountains.

Unsustainable Trends of Energy Supply and Demand

In most of the HKH Region, the demand for fuelwood exceeded sustainable supply, not only due to rapid thinning of forests closer to settlements as a result of appropriate management practices, but also due to a lack of suitable technologies to meet cooking and heating demands, increasing demands for fuelwood to meet the needs of incoming tourists and emerging cottage industry activities, and the increasing demand for high-grade energy. (Selected examples are provided in Box 1.)

Inharmonious Energy Transitions

There were two distinct phenomena in mountain areas. First, there was a movement towards non-monetised, low-quality energy forms. This was due to the fact that the purchasing power of the mountain population and their willingness to pay were low, and therefore, if fuelwood was scarce, most of the population started consuming 'other' biomass fuels for which the cost associated was only that of labour for collection. Second, there was a movement towards non-renewable fossil fuels. This was because the mountain population that could afford to pay for energy services tended to buy commercial fuels such as kerosene and LPG as reliable renewable energy technologies were unavailable. The main factors aggravating these movements were as follow.

- Existing price distortions, as the price of fuelwood, even when marketed, did not reflect the real resource cost. The cost reflected was the collection cost and varied widely from location to location, depending on the opportunity cost of labour.

- Subsidies on commercial fuels, such as kerosene, diesel, and electricity, not only in the mountains but also in the plains, led to a wrong choice of energy mix.

Box 1
Examples of Unsustainable Trends in Energy Supply and Demand

- In Nepal, only about two-thirds of the fuelwood demands are met by a sustainable supply of fuelwood at the national level. The fuelwood balance at the district level shows varying patterns. Fuelwood is in surplus in some of the districts in Western Nepal and in short supply in the central hills.
- In Pakistan, the total sustainable supply of fuelwood is less than 40 per cent of the total demand, of which more than 90 per cent is available in the Northern Mountains (i.e., NWFP, FATA, AJK, Northern Areas). In the fuelwood supply and demand balance for the Northern Mountains, supply exceeds demand 1.6 times. However, fuelwood is extracted to meet the demands of the plains as it fetches a good price.
- Traditional stoves, though effective as heating devices, are less efficient for cooking. The direct smoke emission causes health hazards. The improved stoves disseminated in Nepal, though efficient with regard to pot utilisation efficiency, are not suitable for the room heating requirements of mountain households.
- There are several locations in Nepal, India, and Pakistan where tourism is being promoted. The energy demand of the tourist is high compared to that of local residents. Most of these demands are in the form of heat energy which is being met by fuelwood in the absence of appropriate information and due to the prohibitive cost of RETs.
- Increased agricultural and cottage industry activities demand higher quantities of heat energy. These increased activities not only demand heat energy but also motive power for which high-grade energy in the form of mechanical and electrical energy is required. The energy options available for the provision of high-grade energy are limited.

- No technological innovations occurred as choices were made on an *ad hoc* basis, as illustrated in Box 2.

Lack of Energy Quality and Quantity Perspective

The lack of understanding of the quality and quantity of energy required not only led to a wrong choice of energy resources and technologies but also to a wrong scale of energy technologies and institutions. Generally, no distinction was made between the availability of fuelwood and hydropower, forgetting the quality of energy supply, and it was considered that one could substitute for the other in all circumstances, primarily on the basis of their fiscal cost. In most

Box 2
Making the Wrong Choice

The decreasing availability of fuelwood is being felt in many mountain areas, and this is demonstrated by the uprooting of vegetative cover, increasing time for the collection of fuelwood, increasing use of 'other' biomass fuels, etc. There is no visible impact of technological innovation even though the crisis is being felt. This is primarily due to three reasons: a) women are responsible for cooking as well as managing the fuel supply but are not involved in household decision-making; b) resource cost of fuelwood is not reflected in making choices of fuel; and c) the opportunity cost of collecting fuelwood is never realised and thus fuelwood is treated as a 'free' gift of nature.

cases, commercial fuels were subsidised and no appropriate incentives were available for renewable energy resources and technologies. In such circumstances, the use of commercial fuels increased even though they were environmentally unsustainable.

No initiative was being taken by the demand-side institutions regarding the choice of energy mix. Planning the provision of energy was seen as the responsibility of energy institutions and thus lacked a demand-side perspective in most cases. The comparative advantages of energy synergism were not at all understood. Energy resources and technologies were selected without a proper understanding of the social and cultural implications, as very little was known about these factors which might affect the level and type of energy services demanded. The social and cultural factors that would have implications on energy demand were not given adequate attention in designing the energy supply infrastructure.

Ignorance of the Biophysical Aspects of Mountain Areas

The ignorance of biophysical aspects led to the application of inappropriate energy technologies and also of institutional and financing mechanisms. For example, the quantity of energy services required in the mountains was quite low due to the scattered settlement pattern and lack of infrastructural development. Also, no distinction was made between centralised and decentralised energy systems. For example, the extension of grid electricity into the mountains was given priority instead of promoting decentralised energy systems. Further, the suitability of decentralised energy systems entailed that community-based participatory institutions were more sustainable.

Methodological Dilemma to Internalising Environmental Costs

Several valid environmental concerns were raised by the experts with regard to mountain areas. The most prominent of these were: a) increasing rate of deforestation; b) indoor air pollution caused by inefficient burning of biomass fuels, causing significant health hazards-particularly to women and children; c) increasing outdoor air pollution in specific urban areas in the mountains due to inefficient burning of biomass, coal, and petroleum fuels in brick kilns and bakeries as well as in the transportation sector; d) decreasing soil fertility due to an increasing diversion of agricultural residue and animal dung from the farm to stoves as well as increasing soil erosion; and e) increasing concern over global warming, even if the mountains are not a significant contributor currently, they could become so if unchecked. There was a lack of methodology to internalise environmental costs imposed as a result of production and use of different energy resources. At best, a mitigative approach to project development was being adopted, and this was inadequate for capturing the environmental concerns in a holistic manner.

Energy Policy and Programme Options

In conclusion, Dr. Rijal summarised the issues related to energy policies, programmes, and institutions, as well as the options in promoting sustainable development of mountain energy systems emerging from the presentations and discussions as follow.

- Develop a mountain perspective that integrates not only energy development but also other sectors such as agriculture and tourism
- Develop a long-term vision for the promotion of renewable energy systems in the mountains;
- Identify the role that the energy sector plays in fulfilling economic, social, and environmental goals of mountain communities
- Develop energy policies and programmes that are mountain-biased
- Adopt an integrated approach to planning to ensure greater sectoral linkages
- Remove cost, financing, and investment barriers typical to mountain areas
- Remove institutional bottlenecks
- Reduce the prominence of supply-side institutions, for example, by transferring the ownership of the forest from the government to the communities, etc

- Arrive at a better understanding of the demand-side issues of the energy sector so as to increase use efficiency

- Integrate gender concerns in implementing and planning energy systems in the mountains as women are the stakeholders in terms of household energy demands

- Develop a methodological framework for evaluating energy systems, integrating environmental issues, choosing the appropriate energy mix, and identifying mechanisms for technology adoption; this should include appropriateness of financing and institutional mechanisms

Suggestions Made

Vigorous discussions were held following Dr. Rijal's presentation. The suggestions made are presented under four broad themes below.

Gender, Participation, and Sociocultural Issues

The role of every stakeholder involved in the development and use of energy must be recognised, with more emphasis given to ensure the active participation of women in the design and implementation of energy programmes. Energy technologies being promoted should have sociocultural relevance and acceptance in the mountains. Priority must be given to the specific needs of users and communities through the development of small-scale decentralised systems, whereby indigenous knowledge and local institutions are used in the management and mobilisation of local resources to reduce dependency on outside knowledge and resources. The development of energy technologies should not be based on needs as perceived by experts and planners but on needs identified by local residents, the direct beneficiaries. Special care must be taken to ensure that women are not left out as they are the managers of household energy systems.

Technology Choice and Technical Issues

One major concern in the mountains is to make the production of fuelwood renewable rather than to restrict its use, as the energy substitution is limited by mountain-specific conditions. In this context, suitable modes of afforestation, such as community forestry, social forestry, leasehold, and private forestry, should be promoted by designing appropriate institutional mechanisms that suit local conditions by addressing ownership issues as well. There was a general tendency of users to shift towards employing high-grade energy forms as their living conditions improved. It was thus desirable that the development of technologies which could improve the quality of biomass fuels receive high priority besides augmenting fuelwood supplies and increasing the efficiency of energy conversion devices. The possibility of developing and producing green energy, such as the extraction of oil (Jatropa, 'Chiuri' butter) and alcohol fuels should receive the prior attention of research and development. There were other options which might be more suitable, given the resources available in the mountains. For example, hydropower, solar, wind, and geothermal energy possessed comparative advantages in the mountains but their selection should be based on area-specific factors. The development of micro-hydropower needed to be linked to the productive sector to improve the plant utilisation factor, thereby ameliorating the economics of power production. Some traditional technologies, for example, Ladakh space heating devices, were efficient and could be popularised in similar mountain conditions.

Energy technologies should be perfected before their dissemination as mountain people had limited access to capital resources and could not afford to take risks. The role of the government was crucial in minimising the risk to consumers and to developers.

Economic and Financial Issues

Energy development should be viewed in relation to development and poverty alleviation. It should be seen as an input to improving productivity, incomes and the diversification of the economy. There was much to suggest that energy transition was closely linked to economic development. Therefore, the economic linkages of energy transition should be clearly worked out and planned.

Economic and financial assessments and calculations were needed in making technology choices, linkages, and sustainability. Economic costs of alternative energy options should be rigorously examined. A mix of private and public sector was preferable for creating energy demand in mountain areas, whereas private sector and NGO involvement might be suitable for perfecting and disseminating energy technologies.

Environmental Issues

There was a need to estimate the environmental costs of energy development and to internalise them while evaluating the energy mix suitable for mountain areas. At the same time, development of one form of energy might not create environmental hazards at the users' level but might have implications at the production level. For example, the installation of solar photovoltaics in the mountains might not pollute the air but could generate pollution at the production level.

Some energy resources, such as micro-hydropower, solar, wind, and specific biogas options, were more environmentally friendly than others, e.g., the combustion of fossil and biomass fuels. But the increase in forest area and crown density through afforestation and forest enrichment had carbon sink advantage to offset global warming.

Chairperson's Remarks

In his concluding remarks, Dr. T. S. Papola highlighted the points of the discussion. First, there were gaps in our knowledge and information on mountain-specific energy options. It was important to identify data gaps and efforts should be geared to filling these gaps rather than to starting afresh. Second, it was also clear that fuelwood would remain the main source of energy at the household level as a primary requirement was heat energy. Among the options discussed by Dr. Rijal, the augmentation of fuelwood supply through afforestation and upgrading the quality of biomass fuels deserved special emphasis. Third, the energy needs of the productive sector were in the form of motive power. Thus, renewable energy technologies, such as hydropower and solar, would be of more use as imported non-renewable fossil fuels were costly. Fourth, it was important to understand why certain types of energy systems were not sustainable in the mountains and why certain emerging energy transitions were not harmonious and whether policies could be evolved so that these transitions become harmonious. The need for measures to check certain trends emerging in the energy situation of the mountains was obvious. But before that, it was essential to capture these trends and to identify appropriate interventions in technology, policy, institutions, and financial mechanisms on an area-specific basis, keeping the specific mountain context in mind.