# Chapter 5

# Future Priorities for Energy Development

Technical Session 4 on 'Identification of Key Areas for Further Studies' was chaired by Dr. M. Banskota, Deputy Director General, ICIMOD, with Dr. A. A. Junejo acting as a resource person. Dr. K. Rijal made a brief presentation of the areas for further study in relation to the energy sector in mountain areas. This was based on suggestions made by the country review studies and also on the discussions held in earlier sessions.

Prior to suggesting further studies in the energy sector that would be relevant to ICIMOD, Dr. Rijal discussed the need for a shift in the energy development paradigm in the context of mountain areas, as the energy development approaches that were suitable in the developed and plains' areas were not viable in mountain areas. Further, the issue of environmental sustainability was also gaining impetus in current-day development thinking.

**Shift in the Energy Development Paradigm**

Traditionally, energy had been treated as a constraint to development, with the approach for planning energy development always from the supply side. Gradually, the development of energy in the mountains was not only seen as fulfilling social and economic objectives but as also having environmental impacts. Dr. Rijal suggested that the social objectives should include: a) providing the minimum level of energy to sustain the basic needs of the population; and b) reducing human drudgery, particularly that of women and children. The economic objectives that needed to be considered were: a) sustaining and supporting economic growth; b) increasing economic productivity; and c) treating energy as an economic commodity to increase incomes. Environmental considerations were required to ensure that: a) the natural resource base was used for the betterment of the present generation without compromising its availability for the needs of the future generation; and b) the exploitation of particular resources did not result in general discomfort to the society. The suitability and relevance of a particular energy form needed to be examined not only from the perspective of energy demand structures and their associated environmental impacts but also from the perspective of their implications for income redistribution and for the income from producing energy.

The development process in the mountains should thus be accompanied by energy technology interventions that included but were not limited to: i) increased availability of renewable energy and energy-technology supply infrastructures; ii) introduction and/or increased use of energy conversion devices to alleviate human drudgery and boost productivity; iii) productivity increases that facilitated off-farm employment; iv) improved efficiency of use; v) better value use of energy forms; and vi) increased use of efficient devices.

At the same time, the development of energy systems should be based on financial and institutional sustainability, meaning that the choice of energy mix and scale of energy technologies and institutions were important in the mountains. In this context, choices had to be made in terms of; a) types of energy and their availability (renewable and non-renewable); b) types of energy institutions (decentralised and centralised); and c) types of financing mechanism. The choice or mix of energy resources and technologies and institutions should be based on prevailing mountain-specific conditions (such as inaccessibility, fragility, marginality, diversity, and niche) as these led to opportunities and constraints in the development of energy.

Renewable energy resources (including biomass) had to play a dominant role in the mountains as the energy services required were primarily of low quality, i.e., heat energy. It was also important to realise that biomass energy was not a non-renewable fuel if used and exploited judiciously. This meant the rate of extraction of biomass fuel should not exceed the rate of replenishment, so that a sustainable yield of biomass fuel was consumed rather than exploited rampantly.

Further, the quantity of energy services required in the mountains was also quite low due to the scattered settlement pattern and lack of infrastructural development. This, together with the fact that mountains were extremely scale-sensitive due to their fragile nature, made decentralised energy systems more viable in the mountains. Small-scale interventions in mountain communities were also less risky than large-scale interventions. Decentralised renewable energy systems also had implications for the choice of institutions in terms of both scale and operations. Community-based participatory institutions were more suitable for the promotion and development of forestry and decentralised renewable energy systems.

**Energy Programme Objectives and Components**

Given the desired shift in the energy development paradigm, the objectives of an energy programme in the mountains should be as follow.

- Develop economically and environmentally sustainable energy strategies that emphasise the intervention of a broad range of technology packages (institutions/ prices/ products/ suitability) to meet the economic needs of the mountain people

- Identify a policy package to reduce the emission of greenhouse gases and various other environmental hazards (physical, biological, social, and economic) caused by energy technology interventions
- Relieve energy constraints by promoting the use of efficient energy technologies
- Establish a dynamic database linkage among economies, the environment, and energy sectors that will be instrumental in formulating sustainable energy options
- Develop a better understanding of the existing energy use variability and explore the possibilities of energy synergism
- Establish a framework for information sharing and programme advocacy

The various components of an energy programme that will meet these objectives are given below.

*Decentralised Energy Planning Activities*

Energy planning activities should include the following: i) centralised planning for bulk energy supplies must be accompanied by indicative planning for decentralised energy supplies; ii) energy demand-side agencies must adopt an energy perspective of their sectoral plans and programmes; iii) at the intermediate and lower levels, participation of the private sector, NGOs, and local institutions should be seen as essential for developing and implementing programmes and projects; iv) planning should be viewed as a continuing process which need not always lead to a 'Master Plan'; and v) integrated planning must be accompanied by the integration of implementation efforts.

Decentralised energy planning activities should result in the identification of technology packages (inclusive of resource, technology, and institutional framework) suitable for a specific area because of the decentralised nature of energy supply and demand.

*Identification of Technology Packages for Intervention*

The programme needed to be designed to ensure the improvement of energy system efficiency and supply levels by a reduction in the emission of greenhouse gases and an increase in the rate of carbon sequestration. Inclusion of management and maintenance aspects in technology dissemination would increase the rate of technology adoption which, in turn, would help to make energy transformation systems sustainable. For example, the people of the HKH Region relying on the forests for their susbistence needed an alternative

livelihood for themselves and for their children. It was becoming clear that the destruction of the HKH region's forest resources would be eased by technology interventions.

The most effective approach was to identify different sets of technology packages for intervention in selected, diverse rural communities having diverse socio-cultural and economic statuses. These packages should be efficient, acceptable to private sectors, environmentally attractive, and should reduce the drudgery of women. This would help to promote economical and environmentally-sound development of energy resources, particularly biomass. For example, the efficient burning of wood and combustible residues would reduce the emission of greenhouse gases and energy requirements which, in turn, would alleviate mounting pressure on energy, agriculture, and the environment.

*Implementation of Action Research Programmes*

The implementation of action programmes meant intervention of identified technology packages in local communities. For example, these interventions might involve planting trees integrated with other agricultural activities; adoption of cooking stoves that reduce fuelwood consumption while not compromising the household need for light and heat; improvement of the 'F-5 System' of food, fuel, fodder, fertilizer, and fibre to identify shrub and tree species that maximise a household's utility from the same biomass source while reducing pressure on forest resources; solar dryers to reduce post-harvest agricultural losses as well as to create opportunities to add value to cash crops such as fruits and vegetables; and technologies to make traditional brick kilns more efficient and less polluting by introducing models with improved combustion which have been pioneered in one area of the region and transferred to other areas.

*Improving the Knowledge-base on Sectoral Linkages*

Conventional energy strategies invariably tended to treat the various energy-using sectors as independent of each other, since little was understood about the existing relationships between them. Thus, energy planning for each sector was usually carried out in isolation. Consequently, the interdependence of energy-consuming sectors was rarely exploited. In fact, proper understanding of the interdependence could become the basis of what had been termed 'synergism' whereby the combined and cooperative effects of approaches in two or more sectors were greater than the sum of the separate effects left uncoordinated.

*Developing a Methodological Framework for Energy Planning and Database Management*

Though energy planning activities had been carried out in the countries of the region for more than a decade, lack of comprehensive methodologies as well

as the scarcity of available information made the task complicated. In most cases, demand-side information was almost non-existent and issues relating to decentralised energy systems were not fully understood. Understanding in these areas was imperative, prior to formulating sustainable energy strategies.

The integrated approach of database management and the identification of a number of link parameters between sectors would help to arrive at a holistic approach to preparing guidelines for energy resource management. In this regard, extensive use of GIS, remote-sensing techniques for database management, and the establishment of a regional network needed to be initiated. Also, a database on energy, environment, and economy for the HKH Region should be developed.

*Programme Advocacy, Information Exchange, Sharing of Knowledge, and Improvement of Capabilities*

Workshops, seminars, study tours, and regional consultative meetings would be instrumental in meeting the multiple objectives of programme advocacy, information exchange, and sharing of information. The active involvement of national institutions in programme and research activities would improve capabilities as well as confidence in the application of research findings on the methodological approaches and processes involved.

Training packages were effective tools for improving capabilities and needed to be developed primarily for the following target groups: a) manufacturers; b) development workers; and c) semi-skilled labourers. These programmes should consider producing a training kit for trainers as well.

*Standardisation and Quality Control for Renewable Energy Technologies*

Currently, though a number of renewable technologies were being employed in the HKH Region, most of these were not functioning mainly due to their substandard quality. It cannot be denied, however, that there were other reasons for the malfunctioning. Quality control measures should be introduced and appropriate mechanisms designed to suit the local conditions of the countries.

**Key Areas for Energy Studies by ICIMOD**

Identification of key areas for energy studies would have to be based on the understanding developed so far about the role that the energy sector played in fulfilling the economic, social, and environmental objectives of mountain communities with an overall framework of the objectives and mandated activities of the centre. The objective of ICIMOD was *"to help promote the development of an economically sound mountain ecosystem and to improve the living standards of the mountain populations"* through documentation and information exchange, research, capacity-building, networking, demonstration and advisory services.

ICIMOD's energy programmes needed to be designed primarily to understand the energy-use pattern and behaviour, to develop sustainable energy policies and programmes, and to identify factors that promoted renewable energy technology adaptation. The centre's efforts, in most cases, should also focus on creating a knowledge-base and developing innovative approaches as well as their documentation. Continued efforts needed to be made in terms of programme advocacy, information exchange, sharing of knowledge, and improving capabilities. The following thematic areas were considered important for investigation and study.

*Understanding Energy Use Variability*

The major energy-consuming sectors in the mountains were households, agriculture, and cottage industries. Sufficient knowledge existed in terms of factors affecting the household energy sectors. However, very little knowledge was available with respect to energy-use patterns and the factors that affected energy-use levels in cottage industries and in agricultural activities in mountain areas. Thus, priority should be given to understanding the energy-use variability of various types of cottage industry activities and farming systems.

A series of case studies should to be carried out by identifying the major cottage industries and agricultural activities of the HKH Region in order to capture factors that influence the energy-use level and the choice of energy mix. Selection of the prevailing types of cottage industry activities and farming systems was essential prior to examining the energy-use variability of a particular activity. Detailed surveys of energy resource and technology mix should be carried out by classifying these activities a) in terms of product; b) in terms of fuel use and energy technology employed; c) in terms of location, etc. It was also important to understand the quality and quantity of energy demanded for these activities and the factors that affect the level and type of energy demanded. The following factors that might affect the level of energy consumption as well as the choice of a particular energy mix should to be examined.

- Energy resource availability patterns (type, nature, quantity, quality) and energy supply infrastructures and their scale (management, operation, institution)
- Access to various energy technologies
- Price of various forms for energy and technologies
- Affordability of users/consumers
- Quality and quantity of energy services demanded

- Climatic conditions
- Awareness of the application potential of various energy technologies and their associated environmental and social implications
- Level and type of economic activities
- Availability of physical and social infrastructures
- Homogeneity or heterogeneity of the communities
- Sociocultural norms and values

*Developing Sustainable Energy Policies and Programmes*

It was essential to examine the suitability of energy mix to support and sustain different types of agricultural activities and cottage industry in a sustainable manner. The findings of the study on energy use variability and the examination of various issues discussed below would eventually lead towards the identification of suitable energy policies and programmes for the mountain population.

The issue of sustainability should be examined not only from the perspective of resource and technology but also from that of environmental and social sustainability. At the same time, the financial sustainability of a particular energy mix should be examined along with the institutional sustainability of the supply infrastructure. The availability of and access to the energy supply infrastructure warranted careful examination. Questions as to the type of environmental impacts and the implications on gender as a result of selecting a particular energy mix should be examined. The examination of these issues would not only lead to the identification of an appropriate energy mix but also help to design suitable policies to support and sustain these activities in the mountains. (Some factors that might affect the promotion of energy policies and programmes in mountain communities are listed below.)

- Integration of different components of a mountain development perspective and energy development strategies at the operational level
- Integration of sectoral policies with the energy development programme
- Possibility of capturing energy synergism
- Consistency among various sectoral and intra-sectoral policies in relation to the economic, social, and environmental objectives

- Existence and suitability of institutional and organisational structures to ensure and establish linkages between policies and programmes

- Suitability of legislation and regulations to promote the desired energy mix in the mountains

- Existence and suitability of the financing mechanism

*Identifying Factors to Promote Renewable Energy Technology Adaptation*

The choice of energy technology and institutions depended on technical parameters such as the availability of energy resources, prices, and life and efficiency of the device, though the final basis for selection should be its social and cultural acceptability by mountain communities. Most of these factors were location-specific and required close scrutiny with regard to the mountain-specific situation. This meant location-specific analysis must be considered in identifying factors for the promotion of RETs. Factors, such as the stage of technology, policies and programmes, institutional and financing mechanisms with regard to a particular technology, and the possibility of ensuring social and environmental objectives, would be vital. Therefore, it was essential to examine the factors given below in relation to a particular technology prior to identifying strategic elements for their promotion.

- Suitability of a particular technology to meet the energy services demanded in terms of their quality and quantity

- Implications of national policies (fiscal, trade, import, energy pricing, etc) and sectoral policies (energy, forestry, industry, environment, etc) on the development of RETs

- Identification of gaps in the prevailing legislation and regulations relating to forestry, water, renewable energy resources, etc

- Review of economic incentives provided for the promotion of RETs, if any, and their economic, environmental, and social implications

- Review of direct public investment programmes with regard to rural electrification, afforestation programmes, and RETs and their impact on mountain communities

- Review of institutional arrangements with regard to RETs' development to identify institutional bottlenecks

- Analysis of the gender implications of RETs

- Review and analysis of the traditional skills and management practices with regard to energy resource use

*Suggestions Made*

Detailed discussions were held on Dr. Rijal's presentation and the following suggestions were made.

- Objectives should be translated into activities and appropriate indicators should also be identified and assigned to assist in developing suitable programmes.

- Studies should have specific objectives such as providing feed-back to decision-makers to improve the policies and programmes. A time-frame should also be formulated for such studies and suggested programmes.

- More successful and promising technologies should be studied for their dissemination in specific areas where they were considered to be an effective option. Otherwise, studies only were unlikely to bring about the intended objectives of poverty alleviation or economic growth.

- Many mountain areas differed from each other; suitable technologies should be specifically identified for different areas. Indigenous and local renewable sources should be given priority.

- Some specific in-depth studies should be undertaken to determine why some technologies were successful in one location/area while they failed in others.

- For international/regional organisations, carrying out studies, data gathering, or promoting favourable policies, it might be necessary to identify and designate a coordinator in each country. This coordinator would assist in data collection and the exchange of information, experts, and technicians.

- Due attention should also be given to identifying, evaluating, and promoting suitable energy-saving/energy-efficient technologies/devices.

- Some programme outlines or guidelines should also be put forward as a logical follow-up to studies and data gathering to address problems in the field, such as poverty alleviation and income/employment generation, and to avoid failures.

- Studies were a necessary prerequisite for everything, but they should be authentic and well-focussed. Studies should provide feedback to decision-makers and implementers to improve the programmes and their benefits/

impact. For example, this meeting had made it clear that current patterns of energy use were not sustainable and transitory changes were also not appropriate. Studies should be undertaken to suggest options and methodologies to correct this situation.

- Data gathering was problematic and the projections and assumptions that followed in terms of quantifying non-commercial energy were usually not accurate. It was, therefore, necessary to fill the data gaps and to develop/test/improve the quantifying assumptions and projections.

- It was important to determine which technologies/systems were suitable for a given area and how to disseminate them.

- Some other (non-energy) issues also affected the energy situation. The interest and anticipated gains of the stakeholders, such as investors, developers, and users, also needed to be studied and understood to bring about a harmonious balance and desired results.

- Other factors such as the dynamics of economy, urbanisation, and changing attitudes and expectations must also be given due consideration in the studies.

*Chairperson's Remarks*

The chairman, **Dr. Mahesh Banskota**, Deputy Director General, ICIMOD, observed that discussions primarily focussed on energy issues but in many instances non-energy issues influenced the energy sector and, at times, dictated the choice of energy mix. These might not be considered sustainable by energy experts but might be optimal from the point of view of resource allocation. For example, in some mountainous areas, the availability of LPG, which is a non-renewable and imported energy source, could reduce pressure on the forests significantly, even though this choice might be considered unsustainable. There was a need to devise a mechanism to share benefits, with some associated costs, that would accrue to the population outside the mountains due to activities initiated in the mountains.

In the past, a number of issues had been examined with regard to the environmental, social, and economic implications of energy production and usage. *"Are there other issues that should receive greater attention in the context of the mountains?"* Dr. Banskota asked.

Given that societal development was a dynamic process and the rate of urbanisation was increasing rapidly, it was possible the suitability of energy mix might differ significantly. Similarly, the commercialisation of farming systems and newly-emerging service sectors in the mountains might demand different

forms of energy of which little or nothing was known. So there was a need to tackle these issues not only by looking at the energy sector in isolation but also in relation to other sectors.

It was vital to identify the most appropriate forms of energy resources and technologies that were sustainable and that supported and augmented the present global trend of economic liberalisation and growth. What was more important, however, was to have the right policy in place and to provide more information to the mountain people with regard to choices available in the energy sector.

It was also important to analyse and understand the role of stakeholders involved in developing energy systems. The role of stakeholders became pronounced in the context of mountain areas. The decision-making process was more complex because of a larger number of interest groups, and the risk associated with decisions taken was high because of the fact that there were less options available to the stakeholders.

Given that a number of plans and master plans had failed in the past, it might be appropriate to consider developing an indicative plan in the energy sector and to allow the players involved to take their own initiative to make the programme successful. Instead of the government playing the lead role, it should act as a facilitator, and it might be appropriate to quickly move into developing projects aimed at creating options in the mountains.