Annex 1.

Workshop Programme

DAY ONE

Opening Session

Welcome Dr. Colin Rosser
Director
ICIMOD

Opening Dr. Ratna S. J. B. Rana
Chairman, ICIMOD
Board of Governors

Introduction to the Workshop

T. M. Vinod Kumar

Session I

District Energy Planning Framework : Problems and Issues

Chairman Wang Hai

District Energy Planning and Management for the Indian Himalaya
T. M. Vinod Kumar

Users' Perspectives for District Energy Planning
Dr. Deepak Bajracharya

Session 2

Fuelwood Crisis and Solutions

Chairman Dr. K. L. Shrestha

Energy Use Pattern and Environmental Conservation : The Central Himalaya Case
Dr. D. D. Pant and Dr. S. P. Singh

Survey of Rural Energy Studies in the Academia Sinica
Wang Shizhong

Fuelwood and Fodder in Nepal : Problems and Prospects
Dr. Kk. Panday

Rural Energy from Forest Biomass in Nepal
Dr. Tej B. Mahat

DAY TWO	DAY THREE
Session 3	**Session 5**
Non - Wood Energy Options Chairman Dr. M. A. Hossain *Potentials for Mini and Microhydel Projects in the Himalaya* Prof. D. P. Sen Gupta *Small Decentralised Hydropower for Rural Development* Dr. M. Abdullah *Geothermal Energy Resources in the Himalaya - Hengduan Region* Zhang Mingtao and Tong Wei	**Planning and Policy Issues** Chairman Prabhir Sengupta *Role of Private Sector in Decentralised Energy Planning :* *Alternate Energy Technology Options* G. R. Shrestha *Plans and Policies for Energy Development in the Autonomous Region of Tibet* Wang Hai
Session 4	**Concluding Session**
Energy Intersectoral Relations Chairman Dr. M. Abdullah *Energy, Employment and Rural Development in the Mountain Areas of India* Dr. R. K. Pachauri *Food - Energy Relations in Nepal* Dr. S. Sharma and Dr. B. Bhadra *Energy and Rural Production System* Dr. Huang Zhijie *Energy Flows and Shifting Cultivation* Dr. P. S. Ramakrishnan	Chairman Dr. Colin Rosser Panelists Wang Hai Dr. K. L. Shrestha Dr. M. A. Hossain Dr. M. Abdullah Prabhir Sengupta

Annex 2.

ICIMOD Rural Energy Planning Programme

Working Papers

Samuel P. Mauch	Destruction of the Margin Process : Dynamics of Interaction between Rural Production, Energy Related Resource, and Rural Development
Ji Xiao Yun	Issues of Mountain Development in China
Binayak Bhadra	Food and Energy Interrelations in Nepal : Policy Issues and Research Objectives
T. M. Vinod Kumar	Micro-Experiments and Macro-Applications for Rural Energy Planning and Implementation in the Mountains
T. M. Vinod Kumar	Methodological Notes on Multilevel Rural Energy Planning for Mountainous Regions
D. Bajracharya	District Energy Planning Policy Issues and Planning Framework

Annex 3.

Background Papers :

Country State - of - the Art Reviews

CHINA

Energy Institute of the State Economic Commission and the Chinese Academy of Sciences

- The Status and Future Prospects on Rural Energy in the Southwestern Region of China
- Report on the Tibetan Autonomous Region in China
- The Survey Report of Rural Energy Resources in Yunnan Province, China

Feng Yao-Zong	An Effective Way to Resolve Energy Resource Problem in Mountain Regions
Huang Jhijie and Han Yinghua	Survey of Rural Energy in Sichuan Province
Ji Xiao Yun	Application of Chinese Biogas Technology in Nepal: An Evaluation
Li Zhou Sesheng Dong Jianguo and Yang Guang	Research on Matching Mixture Patterns of Grasses/Shrubs/Trees of Fire Wood on the Loess Plateau of China
Liu Ke-Xin	Exploitation and Application of Biogas in the Transverse Mountain Region of Sichuan Province
Zhangm Song-Yun	The Study of Fast-Growing and Disease - Resisting Genetic Breeding of Larch

INDIA

Sushil C. Agrawal	Energy Technology for Himalayan Development: Prospects for Community Biogas Plants
S. Manzoor Alam and Mazid Hussain	Energy Scenario in the State of Jammu and Kashmir

L. S. Bhat	Sub - Regionalisation of the Himalaya
Ashok Gadgil	Energy Technologies for Mountain Development
Ramachandra Guha	The Himalayan Eco-Crisis : A Historical and Socio-Political Analysis
P. N. Gupta	Interpretation and Use of Landsat Imagery for Resource Planning in the Himalaya
Vinod Gupta and Ranjit Singh	Energy Conservation in Traditional Buildings in the Mountains
T. M. Vinod Kumar	Micro Experiments and Macro Applications for Rural Energy Planning and Implementation in the Indian Himalaya
T. Mathew	Status Paper: North - Eastern Region
J. P. Painuly	Energy Demand and Supply in the Indian Himalaya
Dharam Singh	Hydraulic - Ram and Its Uses in Hill Areas
Padma Vasudevan and Santosh	Role of Women in Energy Related Activities in the Mountains
Varun Vidyarthi	Local Participation in Rural Energy Development Programmes

NEPAL

Devendra B. Amatya	Forest Fuels
D. P. Joshi	Crop Residues (Agroforestry and Farm Biomass)
Khilendra N. Rana	Fossils Fuels
Hari Man Shrestha	Hydro Energy Sector
Ganesh Ram Shrestha	Rural Energy Development Institutions and Organisations in Nepal
Sidhartha Tuladhar	Biogas Energy

PAKISTAN

M. Jamil Mahara	Application of Biomass for Mountain Development
I.H. Shah	Solar Energy Applications for Mountain Communities

Annex 4.

Summaries of Papers Prepared for the Workshop*

SMALL DECENTRALISED HYDROPOWER FOR RURAL DEVELOPMENT

M. Abdullah

For socioeconomic development of rural areas, electrical energy must be made available. The conventional method of rural electrification by extending national grids has not benefited rural people due to limited funding and low prioritisation. Relative simplicity, absence of fuel purchase and low maintenance costs make hydropower attractive for mountain communities.

Development of small hydropower plants has two main purposes : improved quality of life and improved productivity. The supporting institutional arrangements vary from country to country, but two general approaches are centralised and decentralised. The main issue in the selection of development approaches is the trade - off between cost and performance. Planning and implementation of small hydropower projects as scaled - down models of large hydro projects may lead to excessive costs. Small decentralised hydropower matches the needs, resources, and capabilities of local communities, and thus is geared toward comprehensive rural development.

Small hydropower has the advantages of being a well - developed technology where mechanical power can operate all machinery, being based on renewable energy resources with no adverse effect on the environment, and being amenable to local implementation and management. While the capital investment for a conventional hydropower installation is high, small capacity power is sufficient for rural communities' needs. For example, with 20 kw capacity, agro - processing units can be operated by staggering loads, and lift irrigation can be undertaken by operating lift pumps at night.

Although social cost/benefit analysis must be considered in association with economic analysis, one of the main constraints is investment. Cost reduction can be achieved through civil engineering approaches (e. g. indigenous fabrication, use of pumps as turbines and electronic load controllers). As hydrological study is the basis for determining economic feasibility, methods need to be developed for obtaining reliable estimates of flow at ungauged sites. A simplified analysis is recommended in which estimation of the physical characteristics of the potential plant, including stream flow and available head, is the main focus.

The Appropriate Technology Development Organisation, started in 1975 by the Government of Pakistan, has a programme to develop and disseminate hydropower technology, relying on local resources. Benefits such as increased awareness of the need for development, and employment generation, have accrued from this approach, along with cost reduction. Experience suggests that small microhydro schemes, if implemented along unconventional lines, may offer the best solution for remote rural areas.

* Not all authors have had the opportunity to comment on the summaries presented here ; ICIMOD has tried to reflect as accurately as possible the major points raised by the authors.

USERS' PERSPECTIVE FOR DISTRICT ENERGY PLANNING

Deepak Bajracharya

The recognition that perspectives of beneficiaries and users must be considered in district energy planning represents a leading edge in "third generation" activities concerning rural energy research and development. Villagers' perceptions and priorities are influenced by their subsistence living conditions, existence of inequality, agro - ecological variations, and socio - cultural diversity.

The participatory action research approach is advocated for implementing innovative alternatives in harmony with indigenous knowledge systems and local organisational strength. This approach also presents opportunities for overcoming politico - administrative constraints as manifested by the existing top - down bias, technological determinism, and inflexible and uncoordinated bureaucratic structures. The role of the catalytic agent can effectively foster interactions between external resource people and village residents, and promote active negotiations for achieving transformation.

ENERGY AND RURAL PRODUCTION SYSTEMS IN CHINA

Huang Zhijie

Energy use in rural China is predominantly direct burning of biomass, which threatens ecological systems. Significant progress has been achieved through improved stoves, but biomass burning is incapable of satisfying the diversified demands of rural development and transformation.

Theoretically, biogas presents the most satisfactory energy utilisation for an efficient agricultural ecosystem. To improve the economic impacts of biogas, comprehensive systems of material - feed - fuel - fertiliser linkages are being developed. Further studies are needed.

Small hydropower resources are important for rural electrification programmes and have contributed to an increase of 11 per cent from 1979 to 1984 in rural household electricity. In areas with coal resources, cheap loans, appropriate services, marketing, favourable prices and tax privileges should be provided. On the Quingzhang Plateau in northwest China and Inner Mongolia, livestock manure is usually used for fuel, but abundant solar and wind energy resources await exploitation.

Rural energy policies have played a role in improving energy utilisation and reducing deforestation. However, longer term efforts are required. Different methods to reduce energy deficits will be required to suit local conditions.

APPROACH TO PLANNING AND IMPLEMENTATION OF ENERGY DEVELOPMENT IN MOUNTAIN COMMUNITIES

M. Nurul Islam

The main objective for mountain area development is to provide basic needs and essential services for mountain communities. Rational development of mountain area resources should contribute to national development, as well as meet local energy needs. In many areas today, however, overexploitation of forests, development of large hydro projects, and increasing agricultural production through energy intensive processes are resulting in social unrest.

Energy development should be considered an integral component of mountain development, which is in turn part of national development. Equity between mountain areas, and upland - lowland equity, are important considerations. An evaluation of past development strategies indicates that a decentralised approach best meets these criteria. Furthermore, energy technologies such as biomass fuel, biogas, minihydro and solar, have high potential for decentralised development.

Energy planning and management at the district level (meaning the bottom level development unit having local government and administrative line ministries) would encourage appropriate diversification of energy plans, localised budget allocation and integration of development efforts and institutions. Integrated energy planning means analysis of all energy issues within a unified policy framework for long - term national goals. Three areas of integration must be

considered : economic and energy plans, energy subsector plans, and various energy sources and technologies.

Integrated National Energy Planning has a series of steps: first and most importantly, establishing an energy data base with reference to districts ; building economic growth scenarios ; making energy demand projections ; assessing energy sources and supply technologies ; supply demand balancing ; financial planning ; and framing supply and demand management strategies. District Energy and Management project design should use a flexible, adaptive learning approach. Other factors necessary for effectiveness include : political commitment, human resource development, people's participation, participatory action research, compilation of innovative experiences, flexibility in project implementation, coordination of implementing institutions, and monitoring and evaluation.

DISTRICT ENERGY PLANNING AND MANAGEMENT FOR THE INDIAN HIMALAYA

T. M. Vinod Kumar

Past planning experience in the Indian Himalaya shows that programmes prepared at the national and state levels are not effective in bringing about integrated development in the mountains. Since June 1982, the National Planning Commission has promoted the establishment of district level planning bodies, which now exist in most states of the Himalaya. Systemic, decentralised management is necessary, with procedures for release and transfer of funds, coordination with state and sectorial plans, and monitoring, review, and evaluation.

District energy planning methodology is aimed at change in resource flows by the application of additional sources of energy, to improve access to basic needs and increase employment opportunities and equitable distribution of income. A spatial planning approach, with hierarchies of market service centres and dependent villages, is useful. The starting point is analysis of existing conditions based on supply - receipt relations of various components, such as market, land by type, household by type, and livestock.

Among the challenges to a district energy planning approach are the substantial investments and risks associated with renewable energy technologies. Success can only be achieved by developing field - tested methodologies including a rapid appraisal of natural and energy resources, by preparing case materials for training programmes and guidelines for district energy planning and management, and by establishing rural energy service and extension centres for the gradual institutionalisation of decentralisation.

RURAL ENERGY FROM FOREST BIOMASS IN NEPAL : PROBLEMS AND PROSPECTS

T. B. S. Mahat

A direct link exists between the welfare of local communities and the use of forest land for fuelwood, fodder, leaf litter, poles and small timber, and other materials mostly obtained as free goods. These linkages have only recently started to be appreciated by professionals. While fuelwood is usually assumed to be the principal contribution of forest to the rural population and hence, the cause of deforestation in the underdeveloped world, evidence from Nepal and India clearly indicates the overwhelming importance of forest - fodder for livestock. The rural household energy question in less developed countries, however, is very important and plant biomass from forest plays a significant role, though only scattered and isolated efforts have been made to assess the quantities and patterns of fuel biomass consumption by rural populations.

In predominantly rural Nepal, with a low per capita fuel consumption of about 200 kg of oil equivalent, by far the most important source of energy is plant biomass. The situation is unlikely to change in the foreseeable future. Traditional fuel from biomass supplies 93 per cent of the total utilised energy in the country and even in urban areas the share of biomass fuel is 83 per cent. In the Middle Hill Region, biomass from forest including shrubland supplies two - thirds of the total annual fuel supplies. However, great variability occurs

between estimates of fuel biomass use and hence, in conclusions regarding adequacy of forest to meet either fuelwood demand or consumption. Therefore, currently accepted per capita fuel consumption for Nepal is overestimated at 1 cu.m. (640 kg) per annum. Estimates show that for the current mixed farming system in Nepal, not less than 3 ha of forested land are required to support 1 ha of cultivated land, and a requirement of at least 0.3 ha is estimated for fuelwood alone.

On these criteria, most hill areas in Nepal are deficient in forest area, including shrubland. Similarly, with the assumed forest growth of not more than 2 cu.m / ha / annum, the net annual increment is estimated at about 12.5 million cu.m. / year growing in an estimated total forest area of 6.3 million ha. This cannot meet the fuelwood demand of an ever - increasing population which at present stands at 16 million. The problems in general, therefore, are related to a dwindling resource base and the deteriorating local environment.

This calls for special emphasis on forest development activities, such as protection and improved management of existing forest, and afforestation of large denuded areas in the hills. In the short run, these programmes have high potential for creating employment and income opportunities, particularly for the economically weaker section of the local population. In the long run, they provide effective cover for the conservation of soil and water. The need for local people's participation in such resource management activities cannot be over emphasised and should be encouraged through Community Forestry Programmes. These seem to be the only practical solution to the increasing rural energy problem in Nepal. Popularising improved energy efficient stoves capable of reducing fuelwood consumption could help conservation of energy in the rural areas.

Alternative sources of energy such as hydropower, solar radiation, and natural gas will involve much greater cost, prohibiting their widespread use in rural areas. Their development for domestic and other uses in urban areas, however, will also relieve the pressure on the forests, thus reducing competition for scarce forest resources between rural subsistence farming communities and urban societies.

ENERGY, EMPLOYMENT AND RURAL DEVELOPMENT IN THE MOUNTAIN AREAS OF INDIA

R. K. Pachauri

Energy scarcity is on the increase in several parts of the Third World. Nowhere is this problem more acute than in the Hindu Kush - Himalaya. Time needed for productive activities is being sapped by the incessant search for energy resources. Forests needed for raw materials and capital inputs for non - farm activities are being depleted.

Although modernisation of mountain agriculture may initially have a positive effect on labour demand, employment generation has to extend beyond agricultural activities. Looking at non-farm activities in the total perspective on rural households, it becomes evident that the allocation of women's time is central to the entire analysis. With more time spent collecting fuel, women's productive output declines in quantity and quality.

Development planning in mountain regions should bring about investment in new technologies to harness local energy resources, not only to ease the problem of fuel scarcity but to provide employment, and ultimately improve the economic and social well - being of mountain societies.

FODDER-FUELWOOD ENERGY PROBLEMS OF RUMINANT ANIMAL HUSBANDRY IN NEPAL

Kk. Panday

The issues of energy input / output of the ruminant animal population and their impact on the economy and environment have received scant consideration in the development planning of Nepal. Both in terms of land use planning and information acquisition, the field is almost neglected, while ironically the production of tobacco gets attention. Statistics on the ruminant population and milk and meat output are under - and overestimated.

The negative impact of the ruminant population on Nepal's fragile environment is overemphasised. At the same time, the contribution

of the ruminant population to the economy, from food to draught energy, is undervalued by economists and land use planners. Consequently, one of the basic points missing in the planning of ruminant animal economies is the mention of supply of fodder and fuelwood input/draught power output of this sector.

A review of statistical documents (population and products) and dairy strategies (supply and pricing mechanisms) of Nepal reflects the current opinion of experts that fodder collection is having serious impact on land erosion, in the widest sense, and soil erosion, in the narrowest sense.

The consequences of fuelwood use for, especially, commercial processing and supply schemes of milk and milk products do not receive mention. The approach and attitude towards supply and pricing mechanisms of milk and milk products are rudimentary as reflected in fuelwood collection and consumption in dairy factories.

Although localised, the dairy industries, especially cheese and butter factories located in the mountains, have become stress factors in already stressed ecological conditions. These cases will form the basis of arguments for ecologically sound planning for dairy development. Responses are needed from forestry on a long - term basis.

ENERGY USE PATTERNS AND ENVIRONMENTAL CONSERVATION : THE CENTRAL HIMALAYA CASE

D. D. Pant and S. P. Singh

In the context of a larger regional ecosystem, we assign mainly a protective role to mountain ecosystems and a productive role to adjacent plains ecosystems. In view of this, only low - energy sources are discussed. The principal problem in the Central Himalaya is how to develop an energy use pattern which also facilitates the revival of forest cover, which is far less than generally thought. Of the total area, about 15 per cent is in agro - ecosystem, less than 2 per cent in urban - industrialised system, leaving about 83 per cent in natural system, most of which is being converted into ecologically non - sustainable ecosystems.

Productivity in terms of energy is greater for forest (relatively undisturbed) ecosystems than for either grasslands or croplands. A comparison of agronomic yield with commercial yield indicates that forests are more productive. The cropland productivity is inadequate ; consequently about half of the total food energy requirement is imported from the plains. However, each unit of agronomic (plus milk) energy produced consumes about 12 units of forest energy, mainly in terms of fodder and fuelwood exploitation. Since the forest area required to support the agricultural activity is inadequate, onslaughts on the remaining forests are great and abandonment of agriculture is not ruled out in some localities.

This situation calls for alternative models of development. Our model involves the replacement of the crop system with the tree farm system. The major prerequisite is to develop a mutualistic relationship between mountain and plains populations in which the latter would provide food energy and the former, by reviving forest cover, will protect the latter from hazards of peak floods and siltation of water bodies. Socio - political factors seem to be favourable for adopting this model.

In order to achieve the above goal, alternative energy sources need to be developed. The per capita energy consumption is so low it cannot be reduced further. Solar energy has not been technologically harnessed. Use of solar cookers or solar pumps is still non - existent. There is scope for extensive use of Chullahs (stoves) of improved efficiency and other energy saving devices, such as pressure cookers.

Potential for geothermal energy as an alternative source is low, however, it can be made available in remote areas where fuelwood and hydroelectricity are difficult to obtain. Though available in plenty, technological breakthrough is still awaited in the use of wind energy. Thus the situation is similar to that of solar energy. The ecotechnological implications of pine needles as a source of biomass fuel need to be determined. The use of gobar gas is limited to areas below 1000 m. Instances of setting up microhydel systems by village communities exist, however, their use has been mostly for lighting purposes.

ENERGY FLOWS AND SHIFTING CULTIVATION

P. S. Ramakrishnan

In the interests of ecologically and economically efficient development, the traditional practice of jhum (shifting agriculture) deserves consideration. With five to fifty units of food energy harvested for every unit put into the system, it is a model of productive efficiency. However, population increase and dispersion have shortened the traditional jhum cycles. The distorted ecological balance in the northeastern hill region of India reflects these changes.

A characteristic feature of the jhum system is the high accumulation of biomass in relation to actual economic yield, which ensures the stability of the system. In studies carried out in Meghalaya, low and high elevation jhum system varieties were found to exist. The studies revealed : (1) a longer jhum cycle gives better yield than a short cycle, (2) a 10 - year jhum cycle is economically viable, (3) though terrace cultivation gives as much return as jhum under a 10 - year cycle, a major fraction of input for the former is through organic fertiliser, while labour is the chief input into jhum.

The main advantage of the jhum system is that it meets the diverse needs of the tribal farmer, such as cereals, vegetables and tubers, and even fibre. Mixed cropping is an insurance policy against crop failure.

Considering that the 4 to 5 year cycle, now prevalent in the northeastern hill region is inefficient, and that terracing is not a viable alternative, the only alternatives seem to be the 10 year cycle (restricted by population pressure on land) and confinement of cereal cultivation to valleys.

One way of taking pressure off the land to allow longer jhum cycles is to diversify economic activities. Encouraging horticulture and plantation crops, intensifying animal husbandry and improving agroforestry systems with better crop varieties, sound management techniques, and fast - growing native tree species are recommended.

Nowhere is the interlinkage between energy and environment so evident as in the tribal societies of the northeast. Public intervention for development should be given first priority, with people's participation in design and implementation of programmes. Apart from providing acceptable appropriate technology, government agencies can act as catalysts for providing the organisational base both for production and marketing.

POTENTIAL FOR MINI AND MICROHYDEL PROJECTS IN THE INDIAN HIMALAYA

D. P. Sen Gupta

The development of small, mini and microhydel power in India has been extremely inadequate. There are 84 units generating 168 MW, of which over 40 MW were installed by the British.

It is essential that this renewable source of energy be developed further, especially in hill regions. The states of the Indian Himalaya are Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim, Arunachal Pradesh, Nagaland; Manipur, Mizoram, Meghalaya and Tripura are also included.

The technology for SHP, particularly for high heads, is well established. However, it is necessary that technology suitable for the terrain, utilising local skill and manpower, is developed. This will bring down cost per kw and reduce costs of operation and maintenance. If standard CPWD norms are to be followed everywhere, the cost / kw can be as high as Rs. 40,000 / kw. On the other hand, a number of minihydel units were set up in Arunachal Pradesh at less than Rs. 8,000 / kw by deviating from rigid norms. Similarly, operation and maintenance costs may be prohibitively high if the standard rules of Electricity Boards are always adopted. It is, therefore, essential that standardisation of SHP technology should have built - in elements of adaptation to local needs and environment. Training of manpower for survey, implementation, and maintenance is essential.

The major objectives of electrification in the Himalaya region are to :

1. Provide lighting and save kerosene

2. Provide lift irrigation

3. Help the development of cottage industries
4. Help the setting up of industries such as poultry farming, fruit canning, tea and other agro - based and forest industries
5. Save diesel where diesel generation is being resorted to for strategic purposes

Recommendations include :

1. Setting up a Central Public Sector Corporation to deal with Small Hydel Projects
2. Carrying out extensive surveys at the sites Already identified for SHP
3. Training engineers for design and construction
4. Providing domestic connections free of charge for low income groups

FOOD - ENERGY INTERRELATIONS IN NEPAL

Shankar Sharma and Binayak Bhadra

The pattern of resource use in Nepalese agriculture reveals that inputs are increasing because of declining land per capita. More labour, energy, and fertiliser per unit of land than before is being used to raise productivity. Chemical fertilisers and commercial energy are heavily subsidised. However, forests, the major source of fuel and fodder, are also being destroyed for additional land for cultivation and rising fuelwood needs. Animal dung is increasingly used for fuel and a lower proportion of it is available for crop production. The present food - energy sector policies have high social, economic and environmental costs. The farming system is geared towards highly energy intensive technology.

Food - fuel - fodder - fertiliser linkages are vital to the sustenance of agricultural productivity. The solution to food and energy problems requires both direct and indirect methods of intervention and innovation in technology and institutions. Research, development and extension of local and new varieties suitable for rainfed and irrigated conditions, intercropping systems suitable for microclimatic zones, and nitrogen fixing legumes deserve high priority. In the present conditions, a low - energy, high - production food system should be the main strategy of agricultural policy. The investments in newer technologies should be concentrated so village communities generate a self-sustaining process of economic growth. In planning any food - energy programme, due consideration should be given to the rural institutions, rural resource endowments, and their interactions in light of the growing interest in decentralised, participatory planning concepts.

ROLE OF THE PRIVATE SECTOR IN DECENTRALISED ENERGY PLANNING IN NEPAL (ALTERNATIVE ENERGY TECHNOLOGY OPTIONS)

Ganesh Ram Shrestha

Energy is at present one of the major constraints to the economic development of Nepal. Lack of any commercially exploitable fossil fuels, increasing cost of imported fuels, and over - reliance on fuelwood supply are among the major problems the country faces today. In view of this situation, there is an urgent need to develop cheap and reliable sources of alternative energy that can substitute for the increasing fuelwood consumption and, at the same time, provide the additional energy required for meeting basic needs of the rural population. In the Nepalese context, water and biomass form major sources of renewable energy. Serious efforts, therefore, need to be taken towards careful planning and implementation of alternative energy development projects like installations of small - scale microhydro plants, biogas plants, improved stoves and other energy technologies which have good potential for widespread dissemination, particularly in rural areas.

The success of the energy development programme depends largely upon the effective mobilisation of users and local communities as partners in planning, as well as greater involvement of private sector organisations. For this, a decentralised energy planning approach

should be adopted to involve participation of the local population in energy development programmes and mobilise local skills and resources available in rural areas. On the other hand, greater emphasis should be given to the development and strengthening of private sector enterprises for developing alternate energy technologies.

ENERGY DEVELOPMENT IN BHUTAN

Lakpa Tsering

Bhutan's hydropower resources and vast forests, covering 70 per cent of the country, offer tremendous potential for energy development. Improvement of traditional stoves, development of methane digesters in Southern Bhutan, and installation of windmills in isolated areas are also important.

Non - commercial fuelwood energy accounts for 97.4 per cent of total energy consumed in Bhutan, most of which is domestic. Electricity supply is limited to major urban centres and, in Southern Bhutan, is supplied by Indian grids. Diesel consumption is primarily for trucks, buses,and electric generators ; demand for fossil fuels is expected to grow rapidly. Small turbine units and hydel development are promising, particularly in remote areas. Bhutan's coal resources will remain supplementary to hydropower.

The main institution dealing with the energy sector is the Department of Power. Major planning approaches have been: progressive augmentation of generation capacity through hydroelectric plants for use primarily in the country, but also for export ; building of a national grid of transmission and distribution lines from existing grid lines in Western Bhutan ; and installation of new systems using diesel generating sets for areas where energy is absolutely necessary.

Over 90 per cent of Bhutan's total demand is expected to be met by development of hydropower. Conflicts in interest between hydropower and irrigation schemes must be carefully avoided. Numerous hydroelectric projects are already underway with external assistance. Regional, international, bi - and multilateral cooperation will all be important for Bhutan's energy development.

TENTATIVE PLAN AND POLICIES FOR ENERGY DEVELOPMENT IN THE AUTONOMOUS REGION OF TIBET, CHINA

Wang Hai

The traditional fuels of animal dung, fuelwood and grass account for three - quarters of the energy consumption in Tibet, which poses a continuing threat to ecological balance. The stagnant economy retains 80 per cent of consumption in the domestic sector. Absence of coal, oil, and gas contributes to a 70 per cent dependence on energy from outside the region.

Energy development should parallel economic development. Policies for development of the region include : creation of a prosperous economy, reliance on private and collective enterprises according to market trends, open door policies and maintenance of autonomous status. Emphasis is on development of agriculture, animal husbandry, and animal products, as well as mining, tourism, and service industries. Low educational levels and difficulties in disseminating scientific and technical advances need to be overcome.

Priorities should be accorded to construction of electricity supplies, especially for domestic and light industry (handicrafts and tourism). The region has the highest hydropower potential in China -- which already supplies over 80 per cent of the electricity generated in Tibet -- along with abundant geothermal resources, and solar energy potential second only to the Sahara Desert. These resources along with wind energy should be exploited, however, energy construction should be small scale and suitable to local conditions. Along with improving technologies, the government should continue to provide financial assistance for energy development. The application and popularisation of fuelwood forests, improved stoves, and biogas generation should be stressed.

CHINA'S ENERGY VILLAGE EXPERIENCE

Wang Shizong

Rural energy shortages exist in much of China. Research and field testing of technical improvements for natural resource use are important. The guiding policy of the government is that rural energy problems should be solved with consideration of local conditions, using alternative energy supplies comprehensively, with great attention to practical results.

The Chinese Academy of Sciences has selected six villages for tests and demonstrations of single technical achievements (e.g. combination firewood - saving stoves and solar water heaters) and comprehensive studies of energy systems. Results are expected to be transferred to various products and equipment.

GEOTHERMAL ENERGY RESOURCES IN THE HIMALAYA - HENGDUAN REGION

Zhang Ming - Tao and Tong Wei

Approximately half of the national active hydrothermal zones, created by recent orogenic events, are in the Himalaya - Hengduan region in two geothermal belts : the Himalaya Geothermal Belt and the Hengduan Mountain Geothermal Belt. Surveys indicate a vast energy resource.

Apart from hydropower, which has made limited progress due to physical conditions and transportation difficulties, southern Tibet lacks conventional energy sources. The population presently cuts fuelwood and collects dung, straw, and turf for domestic use. The northern plateau of the Hengduan faces similar conditions. Shortage of conventional energy resources restricts progress towards diversified economies.

Geothermal resources have been exploited in Yangbajain field, northwest of Lhasa, since 1975, providing 60 - 70 per cent of Lhasa's energy needs during winter. Potential is high for geothermal development for Xigaze, Zetang, Shiquanhe, Naggu, and twenty other residential areas. Power for processing livestock products at Ganzi, wool products at Kangding Wool Mill, greenhouse heating in the Litang basin, and tea and rubber processing in south and west Yunnan, are further potential uses for geothermal energy in the region.

Annex 5.

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