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Implications of National Policies on RETs

The morning session was chaired by **Dr. M. Banskota**, Deputy Director General, ICIMOD. During this session, the first presentation was made by **Mr. V.B. Amatya**, Consultant, Centre for Rural Technology, Kathmandu. The presentation was based on a study commissioned by ICIMOD on 'Implications of National Policies on Renewable Energy and Energy Efficient Devices in Nepal'. This was followed by a presentation by **Ms. Soma Dutta** on a study on the same topic commissioned in India.

The afternoon session was chaired by **Dr. G.R. Bhatta**, Special Secretary and Advisor, National Planning Commission, Nepal. **Mr. Tajammul Hussain** presented a paper based on a study commissioned in Pakistan on 'Assessment of Implications of National Policies on Renewable Energy Technologies'. This was followed by the presentation of a study commissioned in China on the same topic. Dr. Kamal Rijal made the presentation on behalf of the Chinese expert. **Dr. S.S. Chandel**, Principal Scientific Officer, State Council for Science, Technology and Environment, Himachal Pradesh, India, made a presentation on 'Efforts and Expectations of Passive Solar Housing in the Mountains'. Discussions were held after the presentations.

Biogas Lamp Installed Inside the Kitchen of a Restaurant Owned by a Gurung Family along the Ghandruk Trekking Route, Nepal

3.1 Country Presentations: Nepal

The Nepal presentation briefly highlighted the current energy use pattern and supply potentials. Fuelwood represented 80 per cent of the energy consumption, mainly consumed in rural Nepal. Electricity supplies were limited to about 13 per cent of the total population. The rural population, which comprised about 90 per cent of the total population, had very limited access to elec-

Box 1: Status of Alternative Energy Development in Nepal

Alternative Energy/End Uses	Installed Units/ Capacity	Institutions Involved	Comments
Biogas Digester/ Cooking and Lighting	> 32,000	ADB/N - Financing Biogas Co – Construction, R&D Other Co – Construction – Donors' Promotion	Mostly of 6 and 10 cum. fixed dome type
Micro-hydro (<100kW) Mechanical and Electricity	10,000kW	Private Sec. - Manf., R&D ADB/N - Financing I/NGOs – Promotion	Including non-electricity uses
Small-hydro (100-1000kW) Electricity	9,913kW	NEA – Implementation	Includes 100kW sizes
SPV Heat and Electricity	700kW	Private Sec. - Manf., user I/NGOs - Promoter, user NTC/Aviation – user	Power and communication
Wind Mechanical and Electricity	20kW	NEA	Experimental and Promotion stage
Improved Cooking Stoves Heat for cooking	90,000	I/NGOs, Private sector, Government	Residential Cooking stoves
Briquettes Indus. and Comm. appl.	12 industries	Private sector - Manf.	

tricity (4%). Petroleum fuels and coal were imported from other countries. Rural energy consumption comprised about 87 per cent of the total consumption and was an important sector. It was also evident from the rural energy consumption characteristics that most of the people relied heavily upon animate and biomass energy to meet their energy requirements.

Alternative energy technologies in Nepal primarily included biogas plants, micro- and mini-hydro power plants, solar technologies, and improved cooking stoves (Box 1). Nepal had made significant progress in developing and using its water resources for producing power in the micro range (up to 100kW) over the past three decades. A good micro-hydro technology manufacturing base had already been developed in the country. Currently, there were over 900 micro-hydro installations in the private sector scattered throughout 59 of the 75 districts of the country. The total installed capacity was about 5MW.

The success of biogas development programmes in Nepal could be attributed to the availability of government subsidies as well as the interest and involvement of a number of INGOs and donor agencies. Currently, the number of biogas plants of different sizes exceeded 32,000. The biogas support programme (BSP) had been set up as a joint venture between ADB/N, recognised biogas companies, and the Netherlands' Development Organization (SNV-Nepal) to support the biogas programme through subsidy, quality control, training, and research. A third phase of the programme has been proposed for the period from 1996/97 to 1999/2000 with the target of installing 100,000 biogas plants.

Traditionally, in Nepal, solar energy had been and still was used for drying purposes, mainly for drying agricultural products. A significant modern use of solar energy was for heating. Another important use of solar energy was electricity generation from Solar Photovoltaic (SPV) systems. According to one estimate, more than 6,000 units of 50W module SPV systems were being used by the Nepal Telecommunications' Corporation. Similarly, the technical and economic viabilities of solar PV systems for pumping water for irrigation and drinking was also being tried out in Nepal. Private entrepreneurs and NGOs had shown an interest in the promotion and dissemination of SPV home-lighting systems. The government was providing 50 per cent subsidies through ADB/N for the installation of household SPV units. The estimated total installed capacity of solar energy was 700kW.

Wind power development in Nepal was still in the experimental stages and, so far, no contribution had been made by wind energy to meet energy requirements. Absence of reliable data for proper assessment of wind energy and lack of adaptive R&D efforts were the main setbacks to the proper assessment of wind energy.

The only large-scale ICS programme carried out in Nepal was through the Community Forestry Development Division (CFDD), which was suspended in 1991. So far about 88,000 to 90,000 ICS of various types had been promoted and distributed by the government, NGOs, and private sector agencies.

Rice husks were used to make briquettes for space heating and cooking in the domestic and commercial sectors. There were 12 briquette industries in operation. But, due to various technical and marketing problems, in spite of some initial success, the industry was on the verge of total failure.

The presentation primarily focussed on the various policies on RETs. Nepal had been following planned economic development models through five-year development plans. The specific policy in energy development started from the Fifth Plan (1975-80). Energy policy covered only hydropower and forestry sectors until the Sixth Plan (1980-85). The highlights of various policies related to the energy sector (economic policies, industrial policy, foreign investment and technology transfer policy, trade policy, credit policy, interest rate policy, and energy pricing policy), and policies that would have implications on the energy sector (natural resources' policy, energy policy, alternative energy subsidy policy, hydropower development policy, water resources' policy, and forestry policy) were presented.

The presentation also highlighted the role of financial intermediaries in promoting RETs. The Agricultural Development Bank, Nepal (ADB/N), was the main development finance institute with an active role in the rural energy programme. It also provided loans to local entrepreneurs and channellised a renewable energy subsidy programme of the government. Commercial banks (primarily, Nepal Bank Limited and Rastriya Banijya Bank) had also started to act as financing intermediaries for the development of alternative energy technologies, as commercial banks had to provide 12 per cent of their total loan portfolios to the agricultural and rural energy sector under the priority sectors' lending programme launched by Nepal Rastra Bank (NRB). Among the 3,500 registered NGOs, the Centre for Self-help Development (CSD) and *Nirdhan* are the only noteworthy NGOs involved in the promotion of the alternative energy programme.

The role of technical intermediaries was highlighted in the presentation. This was related to providing the necessary information, research and development, technical services, and training. Various reports pointed out the urgent need to produce a cadre of lower, middle, and higher level technicians and motivators for promotion and research and development in the field of RETs. Manufacturers were playing a key role in training end users and promoters. There was a lack of institutions to provide technical backstopping, but it was expected that the recently formed Alternative Energy Promotion Centre (AEPC) under the Ministry of Science and Technology would play a significant role in this respect. Donor agencies, such as the Swiss Association for Technical Assistance (SATA), which had helped to establish BYS; United Mission to Nepal (UMN), which had helped to establish DCS; and SNV, which had funded the Biogas Support Programme, had all played a vital role in promoting renewable energy technologies in Nepal, in addition to ITDG, USAID, ICIMOD, and other similar organizations.

The presentation also reviewed subsidy programmes and policies and concluded that these had failed to address concerns regarding social equity in terms of class, gender, and ethnic groups. This had been because of the inadequate planning and poor analysis; i.e., inadequate in terms of resource and development objectives. Subsidies were provided on an *ad hoc* basis and were not based upon proper design that addressed the necessary minimum concerns (e.g., financial, technical, resource, and market externalities).

On gender issues, the presentation pointed out that, although women accounted for more than 50 per cent of the population, they found it difficult to become active participants in development activities because of poverty; illiteracy; poor health; traditionally conservative attitudes towards women; and lack of access and control over productive resources, information, and technology. Women played key roles in the management and use of energy resources, but they faced several problems related to using fuelwood and other biomass residues in poorly ventilated kitchens, grinding grains during the late evening or early morning, increase in time needed to collect fuelwood and fodder, increasing responsibilities in household management because of out-migration of the male members of the family, besides carrying out all other household errands. Though participation of women was being encouraged in planning and implementation of rural infrastructure this seemed unfeasible because of the work burdens with which they were associated. Review of various energy-related policies with gender implications indicated that they were gender blind. Even those policies that referred to gender issues failed to assess and address the practical and strategic needs and constraints that women faced.

The presentation also summarised the main barriers to dissemination and promotion of RETs. These were: high front-end capital costs, inadequate rural credit systems, non-continuous nature of energy supplies, an insufficient institutional base, and sporadic availability of low-cost information and services.

Following the presentation of the main findings from the field case studies carried out, the conclusions and recommendations of the study were highlighted.

The study concluded that Nepal had made remarkable progress in the development and dissemination of RETs such as biogas, whereas this was not the case with microhydropower and some other technologies that were in the initial phases of dissemination, for example, SPV home systems and Peltric sets. The progress in the biogas sector was phenomenal and, thus, had been specifically due to the establishment of an institutional set-up to supervise the programme in an integrated manner so as to facilitate the proper delivery of subsidies, quality control and standardisation, warranty charges for operation and maintenance, and development of training packages to promote private sector activities. This was a not the case with other RETs. For example, micro-hydropower development was beset with problems such as low load factors, frequent needs for repair and maintenance of water channels, high up-front capital costs even after subsidies, poor quality control, poor back-up services in most areas, and unresolved water rights. The success achieved in disseminating SPV home systems was being questioned as the subsidies reached affluent members of the community and there were no or limited linkages to income-generating and development activities. The improved cooking stove programme had failed miserably because of failure to set proper targets and because it catered to cooking needs alone, forgetting space heating and drying. There was hardly any programme for wind energy. The presentation made recommendations (See Box 2 above) with regard to legislative and regulatory arrangements, financial and

Box 2: Recommendations on RETs in the Context of Nepal

Legislative and Regulatory Arrangements

- Protection of for the lower stream users' rights
- Private sector R&D and intellectual property rights
- Standardisation of equipment and safety guidelines for construction and operation
- RET and ESD product warranty
- Registration should be scrutinised for mills and turbines

Financial and Economic Aspects

- Framework for subsidies based on a level playing field concept for all RETs
- Simplified and uniform banking procedures
- Promotion of productive end use
- Development of entrepreneurship
- Special programme to enable the poor to have access to RETs

Direct Public Investments

- Social equity concerns must over-ride technical efficiency
- Incorporate social equity concerns in all government programmes
- Design location-specific target-driven programmes for marginalised communities

Institutional Arrangements

- Greater commitments for technology promotion and dissemination
- Coordination, monitoring, and evaluation need to be established
- Provision of follow-up and technical backstopping
- Need for a training and awareness programme
- Use of Traditional Skills
- Encourage practice of traditional management
- Promote traditional technical skills
- Integrate traditional technical and management skills with new technology interventions

economic aspects, public investments, institutional arrangements, and utilisation of traditional technical and management skills to promote the development of RETs in Nepal.

Himalayan Region of India

The presentation provided general information on the Himalayan region of India. The region occupies an area of roughly 500,000 sq.km., spanning 11 states in the northern and north-eastern parts of the country. The Himalayan region contained more than two-thirds of the total hydropower potential (84,000MW). Currently most electricity generated was through thermal power, followed by hydro-electricity and diesel based products. A recent macro-level estimation of the total energy consumption indicated that about 20,977 million GJ were consumed within the region in 1992. Of this, 53.2 per cent was met through biomass resources, 31.8 per cent by coal , 11.4 per cent by petroleum products, and the balance by natural gas, electricity, and renewables. All the different studies clearly demonstrated a heavy dependence on biomass and fuelwood in the domestic sector. The penetration of commercial fuels, such as electricity, coal, and cooking gas, had been insignificant. Data on the number of LPG users showed that the HKH states had less than five per cent of the LPG consumers in the country. The Himalayan region provided an ideal niche for the deployment of renewable energy technologies due to the availability of a renewable natural resource base (solar, wind, hydropower, and biomass) associated with features such as difficult terrain, inaccessibility, poor infrastructure, and low levels of income.

The presentation reviewed the status of renewable energy technologies in the context of the Indian Himalayas (Box 3). Improved cooking stoves and family-sized biogas plants were the most widely distributed technologies within the HKH Region of India. Various reports evaluating biogas plants and improved cooking stoves indicated that the percentage of functional apparatus varied between 65 to 90 per cent and 50 to 65 per cent, respectively, throughout the various states. Currently, 376kWe solar PV systems, primarily for lighting, were being used in the mountain areas of India, though it was not clear how many of them were fully functional. This technology seemed to be feasible in areas in which houses were scattered and where it was not economically feasible to extend the grid. The Western mountains showed significant potential for solar energy technologies, and several private and public institutions were promoting them. For example, Solar photovoltaic home systems and street lighting facilities were popular in Ladakh. The use of solar greenhouses was also on the rise in Ladakh.

The Indian mountains provided good sites for the installation of mini- and micro-hydropower, as a potential of almost 2000MW existed in these areas. Only about 52MW were exploited, however. Almost all mechanical factories had the capability of constructing mini- and micro hydropower plants, if appropriate designs were provided.

Manufacturing of various renewable energy systems had advanced in India as a result of the promotional efforts of the Government. There were 74 manufacturers of solar photovoltaic and wind power systems, and they were capable of providing services within the HKH Region as well but were located outside the region. Household biogas systems had been installed throughout India, primarily by the Khadi Village Industries. The local craftsmen produced improved cooking stoves. A number of gasifier designs were available and several mechanical factories were capable of producing these units.

Box 3: Status of RETs in the Indian Himalayas

Technology	Status
Biogas Plant	High subsidy; problems of dung availability, water shortages, ambient temperature etc.; has not performed well; lack of maintenance due to remoteness; need of R&D and appropriate technology
Improved Cooking stove	50 per cent subsidy; inability to design stoves that suits local con ditions; improper construction and short life of the device; metal portables better accepted in the north-eastern states
Micro- and Mini-Hydropower	Up to 3MW capacity; installed capacity is 93.21MW; potential of 10,000MW in the HKH region; MNES provides subsidy; MNES has been encouraging state governments to develop and announce incentive packages to attract private sector participation; IREDA provides soft loans; operating at sub-optimal capacity due to load factor problems, technical constraints, organizational set-up, lack of private sector participation and manufacturing base, peoples involvement, etc
SPV Technology -	Applications are for minor irrigation and drinking water supplies, street and domestic lights, solar lanterns, lighting for schools, hostels, etc.; heavily subsidised; SPV pumps installed on a demonstration basis; the only functional device is the solar lantern; problems of climatic constraints, lack of technicians for distribution of many technologies, lack of users training for discharging batteries, high rates of dysfunctionality, and difficult terrain and poor infrastructure.
Solar Thermal-	Subsidy withdrawn by MNES, but some of the states have continued – a 90 per cent device cost subsidy in Arunanchal Pradesh, mainly for community use such as hospitals, health centres, etc.; mixed performance; the functionality level, except in Arunanchal Pradesh, is less than 50 per cent; new management system introduced in Assam; problem of damage by rains, hailstorms, and floods in hilly regions.
Biomass Gasifier-	Not successful in the hilly regions; costly; unviable options for small industries; Thermal applications have worked well; detailed and scientific study has not been carried out.

The Ministry of Non-conventional Energy Sources (MNES) was mainly responsible for developing renewable energy plans and programmes. State nodal agencies, such as the Himachal Pradesh Energy Development Agency, Arunachal Pradesh Energy Development Agency, State Rural Works' Departments, and so on, were implementing renewable energy programmes at the state level. Besides these, other government and non-government agencies were implementing these programmes. The national programmes for biogas development and improved cooking stoves were looked after by the agricultural department or state Agro-industries' Corporation and by the Rural Development Departments, respectively. Solar thermal and PV programmes were looked after by the State Energy Development Agency and small hydropower by the Power Department or the State Electricity Board. The improved cooking stove programme was implemented through several academic and social institutions to design more efficient cooking stoves and to undertake training programmes. Renewable policies had contributed to the deployment of a large number of devices in the hilly regions, but they had not been entirely successful in terms of ensuring satisfactory performance. The experience with RETs in the hill states showed that there were several shortcomings in policy and planning, implementation procedures, and institutional frameworks. There were technology-specific barriers as well as those common to all programmes and technologies. Barriers to large-scale distribution of different technologies are summarised in Box 4.

Regarding policy and planning, there were various barriers such as mismatch between technologies and local needs and preferences; approaches to distribution; supply-side planning; failure to incorporate linkages between components of livelihood systems; absence of reliable databases; high cost of renewables; and pricing of commercial fuels. It was pointed out that institutional constraints arose from the multiplicity of agencies and duplication of efforts, lack of monitoring mechanisms, and low level of participation on the part of NGOs and local bodies. The technological barriers were identified as lack of local manufacturing capabilities and low R&D invest-

Box 4: Barriers to Dissemination of RETs

Technology	Barrier to large-scale dissemination in present form
Micro- and Mini-hydropower	Inadequate work on load developing strategy Basic field data not available Technical and operational problems not yet solved
Improved Cooking Stove	Existing models incompatible with region-specific traditional lifestyle Inadequate attention to R&D
Biogas Plant	Issues of low temperature and scarcity of dung not resolved
Solar Photovoltaic	High initial investment required
Solar Thermal System	Technology not yet suitable for the mountains
Biomass Gasifier	Uneconomical, because of subsidised electricity and diesel
Wind Energy	Wind monitoring and mapping data not available for many places

ments. The presentation highlighted the important issues (Box 5) and made various suggestions (Box 6). The presentation suggested the following measures at the National Policy Level.

Box 5: RET Issues

Technology	Issues
Improved Cooking stove	Stove design and cooking practice, inconvenience, alternative uses of cooking stoves; R&D in ICS; performance of portable ICS better; dissemination strategy
Micro- & Mini-Hydro	Low load factor; technical and operational; Institutional set-up; private sector participation and mode manufacturing base; people's involvement
Solar Thermal System	Flat plate collectors - unsuitable for hills; damages caused by rain, hailstorm, breakage of glass panel, etc.; high investment cost
Solar Photovoltaic	High cost of technology; accountability towards installed systems; lack of users' training in system maintenance
Biogas Programme	Dung availability; water shortages; ambient temperature; high costs Swastik models for the hills; unsatisfactory field programs; none of the existing models suitable

operated by government agencies. Mainly, two organizations, the Pakistan Council of Appropriate Technology (PCAT) and the Aga Khan Rural Support Development Programmes (AKRSDP) are engaged in the promotion of micro-hydropower plants up to 100kW in capacity. There were 200 micro- and mini-hydropower (MMHP) plants installed with a total capacity of three MW, out of these 160 plants were working with an 80 per cent success rate. The presentation identified the issues regarding the micro- and mini-hydropower plant as a mismatch between plant capacity and energy demand, inappropriate equipment, lack of trained personnel, tendering by the government, failure to identify local energy markets, and limited private sector involvement. PCAT had so far installed 750 biogas units throughout Pakistan. The government had recently given approval for the installation of 20,000 biogas plants. Solar thermal technology had been developed successfully in Pakistan for water heating and space heating and was being commercialised. About seven solar stations with a total capacity of 257 kW had been installed in various parts of the northern areas.

The HKH Region of Pakistan

The presentation highlighted the overall energy situation within the HKH Region of Pakistan. Biomass fuel (firewood, dung, crop residue, etc) accounts for about 80 per cent of the total energy. Natural gas is not in use, although Balochistan produces most of the natural gas for the country. LPG is used in the mountain areas of the Punjab and the NWFP. Kerosene is used in most of the mountain region, because it is affordable. Charcoal is also used in some parts of Pakistan. Firewood is used in all the regions of the HKH. The second fuel used is dung cake.

The presentation primarily dwelt on the status of renewable technology. In Pakistan, the recoverable potential of hydroelectric power has been estimated to be nearly 35,000MW out of which only 3,330MW, has so far been exploited. There are altogether 64 MMHP plants with a total capacity of seven MW

Box 6: The Main Technology Specific Suggestions were as follows

- Hilly areas needed specially designed cooking stoves to increase efficiency and the market should be selected suitably according to biomass scarce and peri-urban areas.
- Cheaper systems, such as the batch type Solar Water Heater, should be developed.
- To enhance solar PV technologies, only specific applications, such as electrification in remote areas, should be promoted.
- In the case of biogas, R&D are needed to focus on removing climatic bottlenecks.
- For the development of hydropower, basic data collection is needed for
  - policies on incentives, credit arrangements, etc,
  - baseline information on institution/manufacturers, etc,
  - region specific data, and
  - ready to use updated information for
    - load development strategies,
    - institutional requirements such as dedicated agencies, involvement of NGOs, and
    - regional manufacturing.

- To improve wind energy technologies, wind mapping and surveys in more locations, as well as extra emphasis on basic resource assessment, were required.
  - There should be a technology-specific requirement.
  - The approach to dissemination should be geographically focussed, prioritised in terms of available technologies, and NGOs and local institutions should be involved.
  - Interlinkages between sectors were very important. Two key areas that needed attention were: increasing biomass availability through local management of forests and the promotion of efficient and environmentally friendly, traditional water-harvesting methods.

Use of the improved design for traditional *chullah* had increased from 43 per cent to 50 per cent. This design saved about 50 per cent of fuelwood. So far, 6,800 stoves had been distributed in rural areas of the NWFP and Balochistan.

The Pakistan National Conservation Strategy document (1993) had outlined seven priority programme areas of activities for developing and deploying renewables in Pakistan (See Boxes 7 and 8). However, none of the projects identified in the NCS had been implemented except PCAT's MHP project and wood plantation initiatives taken by the Forest Department of the NWFP. The PCAT's MHP project had also not been

Box 7: National High Priority Renewable Energy Projects in Pakistan

- Installation of a 1MW solar thermal power plant in the desert area of Pakistan
- Energy self-sufficient model houses
- PV telecommunication system for rural areas
- Biomass plants using agricultural and municipal wastes
- Solar desalination pilot project
- Community solar dryers for drying grain, fruits, vegetables, etc
- Biogas plants for meeting the domestic fuel needs of rural areas

Box 8: RETs in Pakistan: Issues and Options

The following issues were identified at the national and provincial level with regard to RET policies.

- The nation lacked a clear cut and comprehensive national policy for the development of renewable technologies.
- The high initial cost of most renewables put them beyond the reach of most individual consumers or private enterprises.
- Market distortions and imperfections made energy from renewables appear more expensive than energy from conventional technologies.
- Suitable financial mechanisms and incentives were not devised to encourage adaptation of pre-competitive but highly promising renewable technologies.
- The country lacked the institutional capacity for indigenous planning and development of more challenging renewable technologies.
- Old planning tools and decision-making practices were not conducive to fair competition for renewables against conventional options.
- Development of human resources in RETs and training had not been effective.

The following measures were suggested for the development of RETs.

- The government should develop and integrate programmes for the development of RETs in the mountain region and set a target for each year in the five-year Development Plan.
- The Ministry of Planning (Energy Wing), and the Ministry of Science and Technology should assign specific projects to be implemented by each organization.
- Growing trees and development of forests by the private sector should be encouraged by supplying planting stock.
- Energy saving cooking stoves should be widely introduced. Local women should be trained and stove building should be undertaken by the local community.
- Local entrepreneurs should be given soft loans for manufacturing stoves.
- The government should formulate support programmes for the development of MMHP projects. Soft loan and financial incentives should be provided in order to attract the private sector. SHYDO, NAPWD, and PCAT could play a vital role in organizing the activity.
- Extension of the National Power Grid in the Northern areas could attract private investment. This would help to connect mini-hydel power plants to the grid line. Private entrepreneurs could sign agreements with WAPDA for the sale of power in accordance with the Private Board Power Policy.
- Import duties should be waived from all RET equipment to lessen the cost of application/production. (Currently this facility was available for solar energy technology equipment.)
- Tax holidays should be given to industry-based RETs in the region.
- Financing institutions/agencies should be issued instructions to facilitate soft loans to manufacturers of renewable energy application plants/products. Special allocations should be made in this respect.
- Solar water and space heaters should be installed in all the community and government buildings. Soft loans or subsidies should be provided by the government to make these appliances cost effective for low-income groups.

funded by NCS but initially by the Public Sector Development Programme and then from the Technology Development Action Plan (TDAP). These projects were also facing financial constraints, there being no fund allocations.

The presentation suggested measures such as explicit R&D planning, financial evaluation, survey and demonstration of RETs, identification of private sector participation, monitoring of performance, and training of local manpower in RETs for institutional development.

The Director General's Office for New and Renewable Energy Resources (DGNRER) had become non-functional and no policy on renewable energy existed in Pakistan. A proposal had been submitted by the Ministry of Science and Technology (MOST) recently to create a new Council for Renewable Energy Technologies (CRET) by merging PCAT, the National Institute for Silicon Technology (NIST), and the Solar Energy Centre of PCSIR.

The HKH Region of China

The presentation began with a review of the general situation of the HKH Region in China. The HKH region covers all of Tibet, 30 per cent of Yunnan Province, and 66 per cent of Sichuan Province. Traditional modes of energy consumption in the region were largely dependant on firewood, and this had caused a lot of problems, i.e., increasing rate of deforestation, soil erosion, flooding, environmental pollution, and landslides, which in turn had resulted in a decrease in agricultural production as a result of poor soil structure and quality. However, the region was rich in natural and energy resources. The presentation mainly provided information on Yunnan and Sichuan Provinces as examples.

The presentation reviewed the status of RETs within the region. The development of new and renewable energy technologies in the HKH Region was quite impressive in terms of the number of installations, though it was not clear what percentage of these were functional. For example, there were about 82,624 family-sized biogas plants, 1.5 million improved cooking stoves, 111,288 sq. m. of solar water heaters, 60,000 solar cookers, and 3,900 sq. m. of solar greenhouses (Table 3.1). Besides these, large-scale biogas plants to treat waste material products from townships, hospitals, and alcohol processing units were also operational. There were several small-scale coal-mine enterprises within the HKH Region of China, primarily in the Sichuan and Yunnan provinces.

The region was suitable for solar energy applications as solar radiation ranged between 335 - 921 kJ per cm^2 (equivalent to 2,800-

Table 3.1: Installation of Renewable Energy Technologies in China

Descriptions	Unit	HKH Region of China	Total in China
Family-size Biogas Plants	'000 Nos.	83	5,400
Improved Cooking Stoves	'000 Nos.	1,541	158,000
Solar Thermal Systems	Sq.m.	111	N.A.
Solar Cookers	'000 Nos.	60	N.A.
Solar Greenhouse	'000 sq.m.	15	N.A.
Solar Houses	'000 sq.m.	120	N.A.
Solar Lamp (7-9 Watts)	kW	800	N.A.
PV Systems	kWp	105	N.A.
Wind Turbine (100-200 Watts)	kWp	N.A.	234
Micro-hydropower	MW	< 2	600
Small Hydropower	MW	N.A.	15,760

3,000 hours of sunshine). It was a common feature in Tibet that most of the public sector residential houses had been retrofitted with sun spaces and trombe-walls. Solar water heaters of the flat-plate type were in operation, but, recently, vacuum tube solar water heaters had been developed and were being produced commercially. These systems were suitable for mountain areas as they did not suffer from extreme climatic conditions. There were seven factories to produce photovoltaic cells in China with a total production capacity of 4.5MW annually.

The pace of dissemination of new and renewable energy technologies in the HKH Region of China was slower than in the rest of the country. Manufacturing capabilities for these technologies were strong in China, but lack of institutions to promote them, the low rate of acceptability, and socioeconomic conditions in the HKH Region of China hampered large-scale diffusion of these technologies.

New and renewable energy technologies needed to be appraised and permission granted by assigned institutions. These institutions were identified in each province by the government body. A good manufacturing base existed within China. For example, 78 manufacturers were involved in the construction of small, mini-, and micro-hydropower in China, 17 of which were located in the Yunnan and Sichuan provinces — part of which fell within the HKH Region. The annual production of micro-hydro units in the capacity range of 0.1 - 15kW amounted to 26,000. Similarly, there were 9,867 institutions and 30,895 technicians involved in household-type biogas appliance distribution. There were eight technology service institutions that were capable of designing large-scale biogas plants for waste treatment and seven institutions with the capability to design solar buildings. There were about 300 manufacturers of solar water heaters, five service institutions for solar cookers, and four service institutions and eight manufacturers of solar photovoltaic systems.

The presentation highlighted that strong political commitment at the highest level and the establishment of decentralized institutions at village level were excellent examples with regard to the development of RETs (Box 9).

It was further pointed out that, in China, the national policy for developing rural energy is "making policies according to local conditions, compensating with various forms of energy comprehensive use, and seeking practical benefits". The different policies implemented by the government through the years were also elaborated.

The presentation highlighted the salient feature of existing policies with regard to RETs in China. These were as follow.

- Make policies according to local conditions
- Provinces, autonomous prefectures, and cities should design a development plan for rural electrification with the provision of financial support to minority regions, remote mountain areas, and poor regions
- Construction of medium and micro-hydropower stations should be given priority
- Encourage and support rural electrification activities using solar, wind, geothermal, and biomass energy resources to increase the rural power supply
- Electricity tariffs for the agricultural sector should be set on a non-profit basis
- Tax relaxation for producing new and efficient type building materials
- Strict rules to discourage conventional building materials

The main issues covered by the presentation with regards to RETs were lack of a re-

Box 9: Chronological Events of Biogas Development: An Example of Strong Political Commitment

Year	Policy statement made	Leader/Institutions
1958	Popularisation of biogas	Mao Tzedong
1959	Extension of the biogas programmme	Mao Tzedong
1970	Set up biogas offices at province, city, and county levels	Ministry of Agriculture
1980	Developed biogas as an example to the world Introduction of subsidies (IR - 0.21% loan) Provision of free land, subsidies for construction, free biogas appliances	Deng Xioaping
1981	Provision of 40 million *yuan* each year in soft loans	State Commission for Planning/China Agriculture Bank
1984	Tax exemption for biogas companies	Ministry of Finance
1986	Provision of 5 million *yuan* per year for soft loans for construction	Ministry of Finance
1989	Developed biogas in rural areas	Jiang Zeming
1991	Developed biogas to protect the ecological balance	Jiang Zeming
1993	Promulgation of the Law of Agriculture (promoting integrated approach)	

gional focus, of technical personnel, of local-level institutions and funds in mountain areas, of attention from the local government, and lack of public awareness.

Suggestions given were improvement in the existing policies, strengthening leadership and improving understanding, promoting various modes of ownership, providing technical knowledge to users, and strengthening scientific research, training, and propaganda.

3.2 *Clarifications, Issues Raised and Suggestions Made*

During the presentation, a question about the size of peltric sets was raised. It was stated that peltric sets usually come in one size with a capacity of 1-5kW. Clarification about the life of the battery used for SPV home systems was sought. The representative from Lotus Energy, Nepal, said that the battery they provided had a 10-year guarantee with 50 per cent discharge, and the price of the battery was Nepalese Rs 6,000.

Answering the queries about the Chinese presentation, Dr. K. Rijal, stated that the tariff rate for the agricultural sector was fixed on a no profit and loss basis. The tax rate applied to new and energy efficient types of building materials was lower than that for traditional building materials.

One of the participants was interested in the status of renewable energy technologies, particularly in Tibet. Dr. Rijal clarified the fact that the presentation on China covered the HKH Region within Yunnan and Sichuan provinces. He added that distribution of RETs was taking place, but almost all RETs manufactured in other parts of China were being distributed and marketed in Tibet. Manufacturers had appointed dealers in Tibet. It was pointed out that geothermal and SPVs were used for power generation, and distribution of solar cookers (mainly for boiling water), solar lanterns and passive solar building technologies was actively taking place in Tibet.

Mr. Kedia supplemented the presentation made by **Ms. Soma Dutta**. He pointed out that, in India, projects up to 100kW were categorised as micro-hydro, Up to 1,000kW, projects were categorized as mini-hydro and a capacity of 1MW to 15MW was categorized as small hydro (SHP). Earlier, the MNES had a mandate of up to 3MW, which they were trying to increase up to 15MW. The UNDP Project had planned to install 20 demonstration sites with a total capacity of 15MW and to install 100 water mills. In the seven eastern states of India,there were 29 installations with 26MW hydro-electricity generation capacity.

Profesor S.R. Chalise suggested that there should be a more integrated approach to the promotion of RETs in mountain areas. Opportunities in mountain areas were not isolated. In many cases, they were interrelated. The ability to use a particular resource might differ from area to area, and sometimes a mix, hybrids, or integrated implementation might be better. So, in terms of emphasis on policy, it might be better to emphasize renewable energy as a whole because that was the crux of the matter. No matter which technology was used, it had to be used appropriately.

Role of Energy in Reducing Drudgery

During the discussions, it was realised that energy technologies, such as improved stoves, biogas, and micro-hydro, might play a critical role in terms of reducing the drudgery of women in particular. There were issues of equity in total not settled by drudgery reduction alone. It was also acknowledged that, without reduction in drudgery, and as a result of the out-migration of men from the village, increasing the burden of mountain women in managing household and farm simultaneously, it would be difficult to bring about greater participation of women in decision-making to the extent needed in energy-related and other programmes. Some of the participants raised the issue of increased burdens on women in other activities, once they were relieved of one specific activity. For example, the availability of electricity in mountain communities had facilitated agro-processing activities, but the extension of working hours during the evening had substantially increased women's work in new productive activities. In this respect, however, most of the participants felt that, although the working hours of women had increased, households received more cash income from their extra work. As male householders make the financial decisions, women do not get the full benefit of their own income.

Linkage between Energy and Income Generation

Most of the participants recognized that the energy programme needed to be linked to income-generating activities so that increased income would provide people with the ability to pay for services. This in turn would attract private sector investment in energy infrastructure in mountain areas. There was a consensus among participants that an integrated and holistic approach was required for the promotion of RETs. For example, Chinese experts had tried to integrate biogas development while constructing buildings and infrastructure (roads, water supply), therefore biogas was a component of building. This was a good example of an integrated approach to energy development in China.

Compatibility of Technical Design: Technology for Whom?

Mr. K.C. Dhimole pointed out that, in the case of India, some models of cooking stove were designed according to the requirements of the people. He noted that some biogas models were working well in the mid-hills of the HKH region, but models with faulty designs needed to be improved. **Dr. S.S. Chandel** argued that *chulha* designs should be improved to suit local requirements. Though *chulha*(s) used at higher altitudes had taken roots in the mountains of India, in the lower hills the model really needed a more suitable design. Only about 20-30 per cent of the target was being met. An example was given of a solar thermal device, stating that this technology was not suitable for higher altitudes due to low temperatures.

Mr. Hussain emphasized the need for compatibility of technology, as cooking stoves failed in the context of adaptation. If a stove had been properly designed, it could have been one of the suitable technologies in the rural hills. He added further that properly designed ICS could save 50 per cent on fuel. Therefore, there was a need to look at the strategies and what had gone wrong in terms of adoption.

Participants agreed that renewable energy technologies should be developed to suit local needs and conditions. Most of the participants agreed that the concept of distribution was wrong, adoption and adaptation of RETs were required.

Dr. Chandel suggested that ICIMOD could play a key role in promoting adaptive research and development. One of the participants requested ICIMOD to introduce activities in cooking stove technology and to assess the problems related to its adoption.

Private Sector Participation versus Affordability

A question was raised regarding the performance and survival of the private sector in Pakistan Mr. Tajammul Hussain replied that the private sector was working on its own at present. He gave the example of solar water heaters that did not receive subsidies but which were still selling to communities and organizations such as hospitals, hotels, and offices.

Dr.G.R. Bhatta pointed out that, in Pakistan, there was a practice of tendering out the management aspect of maintenance for micro- and small plants. Unless there was some benefit to the private sector, it would not come forward. Therefore, the profits of the private sector increased the per unit energy cost. RETs were supplying energy to rural people where there were no grid connections and, moreover, where people's ability to pay was poor. How was the problem of affordability solved in such areas ?

Mr. Hussain replied that, up to the current time, about 80 per cent of the projects were working. Actually, the main contribution came from the government, and electricity was even distributed free of cost in some cases. There were also local management groups. The people were given training in maintenance and even to collect money from the households. He stressed that, judging by the different experiences from different countries, there might be a possibility of generating a joint venture among the private companies of the region which could increase the market size and even lower the per unit cost. There would be a tradeoff as one country might be good in a particular technology and another in another technology.

One of the participants cited the example of a tea plantation in West Bengal to emphasize the role of the private sector in increasing competitive behaviour which could reduce economic inefficiencies. In a tea project completed in West Bengal, the tea corporation owned the land and the people managed it. As the management was the most difficult part, giving it to the private sector reduced the cost and increased the financial sustainability of the programme. The state government was not capable of managing such activities and, even if the government had prepared the plan, it might have turned out to be expensive.

Some of the participants argued for a participatory approach for the sustainability of the energy programme. In this respect, most of the participants realised that there was a need to recognise the interests and objectives of each stakeholder (such as manufacturers, promoters, financiers, users, and government) in order to share the benefits of the programme based on the costs incurred by each of them on an equitable basis.

Creation of a Management Fund

Mr. Kiran M. Singh pointed out that a management fund needed to be created for pre-feasibility and feasibility studies for micro- and mini-hydropower in Nepal. However, participants queried the manner of managing of this fund. It was mentioned that studies carried out by the private sector did not help much to increase the number of installations, because the studies were conducted without realising the potential demand. There was also a discussion about manufacturers bearing the costs for such studies, which they might then add to the cost of the installation. Mr. Hussain cited an example from Pakistan in which a private investment fund had been created to promote the development of hydropower, but it had been very poorly managed and use of the fund was nominal. There could be different reasons for this, and nothing was known about it. There was a general consensus about establishing such a fund for the promotion of micro-hydropower development, but the issue of how to manage this fund needed further analysis.

3.3 Chairperson's Remarks

Dr. Mahesh Banskota, Chairperson for the Morning Session, commented on the widespread smoke-related problems, which were a hazard, especially in the kitchen. The problem of illiteracy could not be resolved because of time constraints during the day, therefore, illumination was justified as it could give the rural people a chance to study in the evening.

There were many problems related to subsidies, and many other factors should be incorporated into the calculations so that benefits would increase. There were a lot of discrepancies in the mainstream Cost Benefit Analyses for power projects presented by the organized sector. Projects could be feasible or unfeasible depending upon the person doing the analysis. Therefore, innovation was essential. He also pointed out that there should be a way of linking RETs as a systematic integrated system when issues of co-generation and coupling technology arose. He highlighted the Chinese experience in terms of energy villages, although, allowing that some of the experiences with energy villages had not been encouraging. Therefore, linkages between various components of different systems in specific mountain areas needed to be thought of in the development and promotion of RETs.

A lot of emphasis was given to intermediaries, especially in the presentation given by Nepal. Probably these intermediaries could be the problem. Every time an intermediary was added, the cost might go up, for example, by 10 per cent. So, this had to be looked at seriously. He stressed the subsidy issue as the main problem and identified the need to find real beneficiaries. The real beneficiaries, the poor, needed to benefit from the programmes. On the one hand, supply constraints and rationing, load shedding, etc continued, and, on the other hand, there were subsidies. This was bad economics and did not make any sense at all. Economics that did not benefit the poor and the worst sectors of the society must be discarded. If there were health and literacy benefits for poorer groups, then there might be a way of justifying subsidies. But, if they were only benefitting the well-off, then they really needed to be re-examined.

In the context of subsidies, the chairperson remarked that the actual beneficiaries needed to be identified in order to make them justifiable. He added that energy was not needed for its own sake but as an input into other sectoral economic activities and as a derived demand from other economic activities. A stagnant economic structure could not be changed overnight, therefore subsidies could be justified in such cases. However, real progress could only be judged if it was accrued without subsidies.

He stressed the need to investigate why and in what form energy was needed and how it should be linked to economic changes. Lastly, he stated that technical skills needed improving, for which basic literacy was absolutely necessary.

The Chairperson for the Afternoon Session, Dr. G.R. Bhatta, pointed out the increasing importance of rural energy that directly affected the rate of increase in the Gross Domestic Product (GDP). He added that large hydels and thermal or nuclear energy were required to provide energy for industrialisation and economic growth. But, due to environmental and health concerns, such large projects were discouraged because they caused displacement of people, submergence of cultural heritage, and danger from blasting, which affected the life and property of the people. This was also the case with thermal energy plants that created pollution. Therefore, new and renewable energy had great significance in the context of the hills and mountains, as it was the only alternative energy available.

Dr. Bhatta pointed out that not only the common people but also those who were involved in energy planning (planners, decision-makers, politicians) consumed energy but lacked the general awareness about what type of energy they were consuming and how sustainable these sources of energy were. The biggest hurdle in the way of promoting new and renewable energy resources and technologies while designing energy programmes was the lack of understanding about the nature and type of energy and its implications among planners, decision-makers, and politicians. Therefore, publicity at all levels could play a key role in promoting renewable energy technologies. ICIMOD could initiate this at the regional level. The development of renewable energy would not be possible until and unless the politicians were convinced of its importance. Dr. Bhatta added that there seemed to be a great potential for developing a hybrid energy system in the HKH Region (e.g., solar + micro hydro + wind). Such a development would not only mean increase in reliability but also improvement in the system load factor, thereby reducing the per unit cost of energy. He highlighted that the common issues brought out in all presentations were lack of national funds, lack of understanding at the highest level, lack of publicity, lack of human resources, and lack of incentives for the rural people.