Chapter 4
Review on Policies and Their Implications on Renewable Energy Technologies in Nepal

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4.1 Introduction

Ninety per cent of Nepal's population live in rural areas, and it is the agricultural sector that is the mainstay of the rural population. This sector contributes about 41 per cent (1995/96) to the real national GDP, even if the trend is downward (MOF, 1996). However, this sector still provides employment to more than 80 per cent of the economically active population. The industrial and service sectors (including tourism) are the next major contributors to the national economy, but their contribution to the rural economy is very small. Historically, as mentioned in the first chapter, Nepal's rural populations have been meeting their energy needs from traditional sources such as fuelwood and other biomass resources. The use of modern forms of energy – electricity, kerosene, and diesel – is comparatively new, and in many rural areas they have yet to be introduced.

Two major characteristics of energy systems in Nepal are excessive dependence on biomass energy and very low efficiency in its use. An excessive dependence on biomass energy involves a trade-off in agricultural productivity, the crop residues and animal wastes being diverted from farms, where they supplement soil nutrition, to stoves and hearths to provide heat energy needs. Diverse energy-consumption patterns, due to different geographic, cultural, and economic settings, and a very low level of energy consumption, as a result of widespread poverty, are some of the other important characteristics. Other aspects that have direct and/or indirect implications on the economic and financial viability of energy systems are people's inability to afford commercial forms of energy and a lack of resources for proper development.

The development and promotion of renewable energy technologies (RETs) so far have relied upon government and donor agency assistance in the form of subsidies and grants. This does not necessarily mean that these technologies are financially unattractive. Given a level playing-field, it can be demonstrated that RETs can rea-

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sonably compete with other conventional alternatives. Also, the proper design and implementation of these technologies can serve socioeconomic and environmental concerns. The contribution of these technologies to meeting overall energy needs has been, however, very small, and the success of these technologies in Nepal varies widely.

Failure or less than anticipated results may have been the outcome of a lack of comprehensive national policies to promote and develop RETs. This is assuming that problems and issues of a technical nature can be resolved in a straightforward manner, while problems and issues institutional, economic, and socioeconomic in scope need more rigorous policies.

At first, it is important to examine the linkages between various sectoral policies that have direct and indirect implications for the development of RETs. Further, linkages between broader national policies and sectoral policies are also important. Policies without appropriate programmes and projects can do more harm than good, and hence policies should always be analysed in tandem with programmes and projects. Often vagueness and generality in policy statements are encountered, sometimes intentionally, for political reasons, and sometimes due to incomplete information. This aspect has also been considered in reviewing and analysing the issue. At the same time, socioeconomic concerns, which include a whole range of institutional issues, such as financing the rural economy, culture and tradition, as well as the evolution of energy use behaviour, need to examined. The characteristics of renewable energy resource — for example, their heterogeneity, low energy density, and small-scale and dispersed nature —call for complex location-specific data for any meaningful analysis, but these are not always available.

The success of strategies to implement the policies depends not only upon the adequacy of institutions and institutional linkages and programmes, but also on budgetary allocations and legislative rules and regulations. Also, the implications of each policy vary widely for the parties concerned. For example, policies intended to ensure social equity will have different implications for entrepreneurs, financing institutions, and end users. Therefore, the perspective and opinions of each party need to be given due consideration.

4.2 Energy Consumption Pattern and Resource Availability

Nepal's per capita annual energy consumption, 0.3 toe (14.06 GJ), is one of the lowest in the world. Per capita commercial energy consumption, 30kg of oil equivalent, is also very low compared to other countries of the sub-region. However, the growth of commercial energy consumption has been high, about 8.4 per cent per annum. The electricity supply is limited to about 14 per cent of the total population. The rural population, which makes up about 90 per cent of the total, has very limited access to electricity (4%) (Amatya 1997).

The rural residential sector alone consumes about 84 per cent of the total energy. However, if only commercial energy (including new and renewable energy) is considered, then this figure falls to only 45 per cent. Table 4.1 depicts sectoral energy consumption by fuel type, with available rural-urban disaggregation (WECS 1997). In rural areas, in the absence of electricity, most of the lighting is done with kerosene lamp. In the urban areas too, due to declining fuelwood availability and the increasing electricity tariff, kerosene and LPG are increasingly used for cooking.

Table 4.1: Energy Consumption, 1995/96, by Sector and Fuel Type ('000 toe)

Energy\Sector	Residential			Commercial R/U	Industrial R/U	Agricultural R	Transport R/U	Total	Per cent
	Rural	Urban	Total						
Traditional									
Fuelwood	4,508	238	4,747	18	168	0	0	4,933	80.6
Agri residue	192	30	222	0	7	0	0	229	3.7
Animal dung	365	35	399	0	0	0	0	399	6.5
Conventional									
Coal/coke	0	0	0	7	59	0	0	67	1.1
Petroleum products	70	37	107	48	30	46	177	408	6.7
Grid dlectricity	7	22	29	10	30	2	0	71	1.2
Non-Conventional									
Decentralised electricity	1	0	0	0	0	0	0	1	0.0
Gaseous Fuel (biogas)	8	0	8	0	0	0	0	8	0.1
Total	5,151	362	5,512	84	296	48	178	6,117	100.0
Per cent	84.2	5.9	90.1	1.4	4.8	0.8	2.9	100.0	

Note: R=Rural, U=Urban

4.2.1 Energy Resources

The energy resources of Nepal consist of a combination of traditional and commercial sources of energy, including biomass, hydropower, and alternative forms of energy. Petroleum fuel and coal are imported from other countries. In spite of its large theoretical hydropower potential of 83,000MW, of which 42,000MW is established to be technically feasible, Nepal has developed only 250MW of hydropower to date, which supplies about one per cent of the total energy requirements (WECS 1994). Fuelwood accounts for 80 per cent of energy consumption, and it is mainly consumed in rural Nepal (Amatya and Kharel 1997). Public, community, and private forests and private land are the major sources of fuelwood. These resources are depleting rapidly as a result of overexploitation and lack of adequate management. Other biomass sources — agricultural residue and animal waste — provide for about 10 per cent of the energy requirement. Imported petroleum and coal together make up about eight per cent of the total consumption.

Biomass, as a source of energy, mainly consists of fuelwood, agricultural residue, and animal dung. The biomass available for energy purposes on a sustainable basis was estimated to be about 23 million tonnes in FY 1991/92, of which fuelwood

based upon accessible forest accounted for 33 per cent, agricultural residue 53 per cent, and animal dung 14 per cent (NPC 1995). Fuelwood is used in traditional stoves of various kinds or improved, more efficient stoves for cooking and space heating energy. There is a marked imbalance between the sustainable supply of fuelwood and consumption at present (Amatya and Kharal 1997). Agricultural residue, although it can be converted to briquettes for more efficient use, is used in an unprocessed form for energy purposes. Alternatively, it can be converted to biogas without losing nutrients. Dung and agricultural residue both have other important uses (fertilizer and fodder) which compete with their use as fuel.

4.2.2 Renewable Energy Resources and Technologies

Energy forms that are not conventionally used or which are new and renewable are considered alternative or renewable energy. They include resources like solar, wind, and geothermal power and newer technologies that improve use efficiency such as biogas, improved cooking stoves (ICS), micro-hydro, and biomass briquettes.

Micro-Hydro

The traditional water wheel (less than 1kW) has been in use in rural Nepal for centuries. Nepal has made significant progress in the private sector in developing and using its water resources for producing power, particularly in the micro range (up to 100kW), over the past three decades, and now has a total manufacturing capacity of more than 2MW per year (WECS 1994). Some of the manufacturers have capabilities of manufacturing turbine casing, penstock pipes, electro-mechanical equipment, and other accessories for hydropower plants of up to 15MW in capacity (Earth Consult 1995). The factors that have contributed to bringing the micro-hydro development programme to the present stage are, i) relatively low capital investment requirements, ii) short construction periods, iii) local geography that provides micro-hydro potential, iv) simple to operate, v) government incentives and, recently, vi) delicensing of plants.

The present subsidy on micro-hydro installation is limited to the cost of electrical equipment and transmission and distribution systems. The amount of subsidy is 75 per cent in remote mountainous districts and 50 per cent for the remaining districts. The present subsidy policy does not differentiate between stand-alone and add-on plants. The installation rate of micro-hydro projects has slowed down recently, and this can be substantiated by the investment trend of ADB/N. The progress over the past two years is shown in Table 4.2.

Biogas

The interest in biogas began only in 1975/76, an 'Agriculture Year' to boost agricultural production. The Gobar Gas *Tatha Krishi Yantra Vikas* Limited, popularly known as the Gobar Gas Company (GGC), was established in the year 1977 to promote

Table 4.2: Investment in Micro-hydro Power (in '000 Rs)

(1993/94)			(1994/95)		
Target	Achievement	Per Cent	Target	Achievement	Per Cent
12,152	7,265	60%	17,001	2,774	16%

Source: ADB/N

biogas technology. In 1992, the Biogas Support Programme (BSP) was 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 subsidies, quality control, and training (BSP 1994/95). As a result of the privatisation policy and implementation of the Biogas Support Programme, more than 41 new biogas companies have been established. Nonetheless, the success of biogas development programmes can mainly be attributed to the availability of subsidies and the involvement of a number of INGOs and donor agencies.

Solar Energy

Solar water heaters are produced and marketed locally. In the Kathmandu Valley alone, there are about 35 manufacturers involved in manufacturing and installation. Another use of solar water heaters is for preheating water in industries as part of process heating. Currently they are being used to preheat water in some carpet industries (WECS 1995a). Recently efforts have been made to develop solar driers for large-scale crop drying. They have yet to be commercialised. With effective R&D efforts and proper dissemination approaches, solar driers and cookers have a fair chance of replacing fuelwood and kerosene, especially in rural households.

Another important area of solar energy use has been electricity generation from solar photovoltaic (PV) systems. Private companies have started manufacturing, installing, promoting, and providing service for household- and community-sized PV system packages (CRE 1994). Although very capital-intensive, the household solar PV unit is emerging as an important alternative energy source for rural household lighting where options such as hydropower are technically not feasible.

Wind Power

Wind power development in Nepal is still in the experimental stages. So far, no contribution has been made by wind energy to meet the energy needs of the country. A 30kW wind power plant was installed by the Nepal Electricity Authority (NEA) in Kagbeni, Mustang, but was heavily damaged by high winds after only a few months of operation. At present, NEA is implementing a Wind Power Development Project, and a few private workshops are involved in the fabrication of windmills for pump irrigation purposes. The main obstacles to harnessing and using wind energy in Nepal are the absence of reliable wind data for proper assessment of wind energy and adequate adaptive R&D efforts (WECS 1995a).

Improved Cooking Stoves (ICS)

Since 1980, when the ICS programme began in earnest, HMG/N has played an important role in promoting and disseminating. The only large-scale ICS programme carried out in Nepal has been through the Community Forestry Development Division (CFDD). About 44,000 insert-type stoves were distributed, of which 35 per cent are believed to be in operation. At present, the ceramic insert-type design has been abandoned in favour of stoves built on site using locally available materials and skills. A number of NGOs and INGOs have included ICS as an integral part of their overall development objectives and programmes. Stressing user motivation and education, these organizations are beginning to show some success in their efforts to introduce improved stoves on a sustainable basis.

Briquetting Technology

The use of rice husk has been on the increase for industrial heating and process heating purposes. Several private manufacturers produce briquettes, many of them are located in the *Terai* region where there is plenty of rice husk available. Briquettes are also being produced using sawdust as the raw material. There is a possibility of briquettes replacing kerosene, fuelwood, and coal in the domestic and industrial sectors (WECS 1994).

4.3 A Review of Energy Policies and Programmes

A specific policy for energy development was not stated until the Fifth Five Year Plan (1975-80). This energy policy covered only hydropower and forestry sectors up through the Sixth Plan (1980-85). In the Seventh Plan, the government began to attach due importance to the development of alternative energy for socioeconomic development. It provided subsidies for the installation of biogas plants and micro-hydro turbines. Improved cooking stoves were distributed through various establishments in order to promote them (NPC 1981, 1995).

The Eighth Five Year Development Plan of Nepal was a turning point for Nepal which embraced a market-oriented, liberal economic policy for the development of the country. The Eighth Plan (1992-97) focussed on sustainable economic growth, poverty alleviation, and the reduction of regional imbalance as its principle objectives and devoted a comprehensive section to the energy sector; and this included alternative energy. In the planning history of Nepal, the effectiveness of the private and non-government sectors in development activities was emphasised for the first time. In order to facilitate the activities of the private sector and NGOs, the plan also recognised the need to simplify administrative procedures, speed up the decision-making process, and liberalise government policies and the implementation of these policies (NPC 1981, 1985, and 1992).

The Eighth Plan recognised that the sustainable economic growth through which economic prosperity can be achieved would require proper management of bio-physical resources so as not to deplete them. If properly translated into programmes, this would entail the development of renewable resources. In the energy sector, therefore, harnessing renewable energy resources is inevitable. The means to attain sustainable economic growth, as made clear in the plan document, are community participation and involvement of the private sector in economic activities. Implementing programmes that have higher comparative advantages and taking care to ensure social equity in development activities are also highlighted. Also mentioned was the fact that high population growth and the resulting excessive demand on biophysical resources needed to be controlled (NPC 1992). The plan document enumerated ten priority sectors, including energy and rural infrastructural development, but did not rank them. On the whole, the number of programmes outlined that achieved their objectives during the plan period was found to be disproportionately low. During FY 1996/97, of the total investment budget for hydropower and energy generation, only 0.3 per cent was allocated for the micro-hydropower sector and 1.7 per cent for the biogas programme, as depicted in Table 4.3.

Table 4.3: Budget Allocation for RET Subsidies and Total Energy (Rs in millions)

S.N	Description	Amount
a.	Total budget for energy sector	5,848
b.	Budget for alternate energy	119
c.	Budget for biogas	99
d.	Budget for micro-hydro subsidy	17.5
e.	Budget for solar and wind	2.5
	Per centage (d/a)	0.03

Source: Annual budget, Ministry of Finance

Energy pricing policies play a major role in the success of energy policy and the achievement of its objectives. Table 4.4 summarises the major energy pricing observations and their implications.

4.4 A Review of Sectoral Policies with Implications for RETs

4.4.1 Water Resources and Electricity

Policies on water resources and electricity are perhaps the most important sectors that influence the development of RETs. Tables 4.5 and 4.6 summarise water resources' development and electricity development policies and their implications for RETs.

4.4.2 Industrial Policy

The Industrial Enterprises Act 1992 was enacted in 1992 and followed by an industrial policy statement. Some of the policies defined in the act and their implications are highlighted in Table 4.7. There are some differences regarding industrial policies/acts and hydropower development policies/acts. These differences are summarised in Table 4.8.

Table 4.4: Energy Pricing and Its Implications

Policy Statement	Implication
Fuelwood prices in most urban areas are above their long-term marginal costs	The supply of fuelwood from the Timber Corporation of Nepal (TCN) depots used to be insufficient to have an impact on fuelwood prices. At present, TCN has discontinued supplying fuelwood to the market. Instead, fuelwood is auctioned by the TCN at the source to private sector suppliers for supply to urban areas. The price of fuelwood is, therefore, determined by market forces. However, the poor are not directly affected by the prices because they rarely purchase fuelwood.
LPG, kerosene, and diesel are subsidised and gasoline is heavily taxed	Energy pricing subsidies are a difficult tool with which to reach the poor because of their limited purchasing power and the difficulty of ensuring that intended benefits reach them. For example, whereas kerosene for lighting is an important fuel for some urban and rural poor, kerosene is mostly not used by these groups. The price difference between gasoline and kerosene has led to mixing kerosene in gasoline, with adverse urban environmental consequences, and possibly some additional engine wear.
Electricity is priced below its economic costs adjusted for financial requirements upon different customer classes, e.g., households, transport, irrigation	Petroleum products and electricity are only available to a minority of the population, mainly in the urban areas. The poor have limited access because of the prohibitive cost arising from the lack of supply infrastructure. High costs of end-use devices and connection also affect access to these modern forms of energy for the poor.

Source: deLucia 1994

Table 4.5: Water Resource Policy and Its Implications

Policy Statement	Implications
Licenses not required for running water mills or water grinders as a cottage industry	No fiscal or other facilities can be made available to the industry without industry registration.
The government can acquire and develop water resources for the purpose of extensive public use and turn them over to a users' association.	Industrialists/entrepreneurs may be hesitant to invest in and install micro-hydro units.
Hydroelectricity has been ranked fourth in priority for water resources' use.	High risks for entrepreneurs investing in micro-hydro - there have been cases of closure of micro-hydro projects due to diversion of water resources for irrigation purposes, e.g. micro-hydro projects in Dhading District.

Source: EDC 1996.

Table 4.6: Hydropower Development Policy and Its Implications

Policy Statement	Implications
Investment may be made in a national, foreign, or joint venture of national and/or foreign funds.	The private sector is taking the initiative to install micro-hydro power. The pace has been slow due to limited subsidies. The private sector is attracted to peltric sets. Foreign nationals are investing in technology transfer and small hydro projects.
Concessional loans to generate and distribute electricity	An interest rate of 16 per cent plus one per cent service charge and a loan period of from 5-7 years cannot be considered a concessional loan. Timely availability of loans is preferred.
Waiving license requirement for surveys, generation, transmission, and distribution	No fiscal or other facilities can be made available without registration as an industry.
Customs duty facility	Customs duty is levied on alternators imported for micro-hydro generators, whereas no customs' duty is levied on alternators for diesel/petrol generators. Since the cost of diesel engines is lower than that of micro-hydro projects, diesel engines are competing with micro-hydro plants.
Micro-hydro plants may be replaced by small hydropower plant/grids.	Lack of clarity over compensation has created a dispute between NEA and the micro-hydro plant in *Tamghas* (WECS 1994).
NEA will provide compensation if it extends its grid to existing private power in the form of micro-hydro, etc.	NEA is hesitant to extend its grid in areas where there are micro-hydro installations.

Source: EDC 1996

Table 4.7: Industrial Policies and Their Implications

Policy Statement	Implications
Removal of licensing and registration for industries.	No fiscal or other facilities can be made available without registration as an industry, which nullifies the facility.
Industries manufacturing fuel-saving devices and hydropower generation and distribution fall under national priority industries.	Industrialists/entrepreneurs are attracted to investing in such industries due to the increased facilities.
Rebate on duties and no levy of double sales' tax.	Local manufacturers who do not import bulk quantities of raw materials will have to depend on local supplies. The availability of supplies is of greater importance for industries than duty rebates. Industries are required to pay duties on supplies due to the vagueness of classification in the tariff structure.
No double sales' tax will be levied on the raw materials and products of any industry.	Industries either do not pay or pay only nominal duties on the import of material, whereas they have to pay 15 per cent sales' tax on purchases from local manufacturers or the local market.

Source: MOI 1992, 1992a.

Table 4.8: Differences in Facilities Accorded by the Electricity Act 1992 and by the Acts Pertaining to Industries

Electricity Act, Hydropower Development Policy	Industrial Enterprises Act
1. No income tax on generating, transmitting, and distributing hydroelectricity up to 1,000kW.	1. No cottage industry shall be subject to sales' tax, excise duty, or income tax.
2. License for the generation, transmission, and distribution of hydroelectricity lowered to 10 per cent below the prevailing rate.	2. Industries entitled to reduction in tax rate by five per cent.
3. License for hydroelectricity generation, transmission, and distribution exempted from income tax for 15 years from the date of generation, transmission, and distribution.	3. Energy-based industries exempted from income tax for five years from the date of commercial production.
4. License for hydroelectricity transmission for distribution exempted from income tax for 10 years.	4. National priority industries (hydropower generation and distribution) entitled to an additional two years of exemption.
5. License operators and managers or purchasers of hydro-electricity generation plants owned by HMG/N exempted from income tax for 5 years.	5. Cottage and small-scale industries are reserved for Nepalese citizens only. Foreign investment of up to 100 per cent is allowed in medium and large-scale industries only.
6. One hundred per cent investment by one or more foreign investors for power projects, including generation, transmission, and distribution, is allowed immaterial of the size of the project.	6. Industries will not be nationalised.
7. Projects become the property of the government on expiry of the license period.	

Source: EDC 1996 and MOI 1992, 1992a

4.4.3 Trade and Credit Policy

The objectives of trade policy in Nepal have been export promotion, import regulation, and trade diversification. A summary of trade policies and their implications is given in Table 4.9.

The Eighth Plan aims to increase priority sector investment by commercial banks to 15 per cent of their total loan amounts. An anomaly in this regard has been observed, some commercial banks preferring to be penalised rather than mobilise their resources for priority sector lending. Financial institutions have full freedom to fix their rates of interest on credit and deposits within guidelines set by the Nepal Rastra Bank. In 1992 the statutory liquidity ratio (SLR)[3] was lowered to 22 per cent from 24 per cent, which was one of the measures regularly advocated by the financial sector. Table 4.10 summarises credit policies and their implications.

With regard to RET development, government policy explicitly states that credit will be extended to the private sector on a priority basis for the development of small hydroelectricity projects, biogas, solar, wind, etc.

3 The statutory liquidity ratio is defined as the ratio of investment in government treasury bills or bonds issued by the Nepal Rastra Bank to the total deposits collected by the bank.

Table 4.9: Trade Policies and Their Implications

Policy statements	Implications
Waiving of the quantitative restriction and licensing system and provision of foreign exchange facilities - Convertibility of Nepalese currency for current accounts Import of materials from India Abolition of the export tax and simplification of the duty drawback system Adjustment in customs' duties. Nepalese raw material and labour content requirement for export to India	While no specific facilities for energy-related industries have been made, such industries are likely to gain from these policies. However, there have been some problems in implementation of the policies. For instance, industries exporting to third countries in convertible currency find no problem in exporting, whereas export to India has some constraints regarding local component contents (they are being waived too under a recent arrangement with India). Export to India faces some problems regarding local component contents. Under a recent trade agreement with India which has done away with this condition, this issue will likely be resolved.

Table 4.10: Credit Policy and Its Implications

Policy Statement	Implications
Committing 12 per cent of total loan portfolio to priority sector lending	Commercial banks are reluctant to invest in priority sector lending due to lack of expertise and high operation costs. Nepal Bank Ltd and Rastriya Banijya Bank have been financing alternative energy, mainly biogas, under BSP since 1995/96. Other joint venture banks do not fulfil the requirement and prefer to be penalised. Recently some commercial banks have started lending priority sector financing funds to some NGOs at a concessional interest rate for relending.
Freedom to fix rates of interest on credit	A concessional loan facility does not seem to have been provided for rural and alternative energy projects. Borrowers prefer timely availability of credit to interest subsidy.
Credit will be extended to the private sector on a priority basis	The budget allocated to rural and alternative energy financing by major financial institutions is limited.
Simplify and upgrade the quality of loan procedures	Delays in the sanctioning of loans are mainly due to the non-cooperative attitude of bank staff and policy.
Lowering of statutory liquidity ratio	No implication since commercial banks' lending activities in the rural energy sector is very nominal.

4.5 Policy Issues in the Dissemination and Development of RETs

Energy sector planning has gone through major changes, mainly due to international influence and the emergence of a focus on a market-based and liberalised economy. The focus on socioeconomic and environmental concerns specifically related to poverty alleviation has also been seen as a paradigm shift in planning. Energy planning in Nepal started in the 1970s with an assessment of the supply-

demand gap and then planning how to fill these gaps. Resulting plans and programmes were based upon planners' 'We know what is good for you' syndrome. The recent focus on a bottom-up approach, or participatory planning, at the local level and the sprouting of a liberalised market-based economy is slowly replacing older paradigms.

The shift was inevitable, given the diverse characteristics of renewable energy resources, the numerous barriers to its dissemination, and the need to link these programmes to broader national development goals. Some of the major barriers are:

- the need for high capital costs due to the non-continuous availability, low density, and non-dispatchability of renewable energy;
- inadequate rural credit systems; and
- lack of the necessary institutional base for information and services.

In spite of all these problems, accomplishments in the development and dissemination of renewable resources like biogas and micro-hydro in Nepal are commendable. Solar photovoltaic is now following a similar path. Micro-hydro dissemination picked up during the late 1980s but had slowed down in the 1990s and is facing problems that were once thought to be trivial. The improved cooking stove programme, which initially was almost a total failure, is gaining momentum. Similarly, the biogas programme, which was sluggish in the 1980s, has attained a very high growth rate in the 1990s. These trends demonstrate that the problems are dynamic, and that solutions need to be sought and timely action taken as they surface. The lead time required for the government between problem identification and action is usually long compared to private sector NGOs and has been the main reason for the need to mobilise NGOs and the private sector within the development programme; a programme which needs attention to micro-level details.

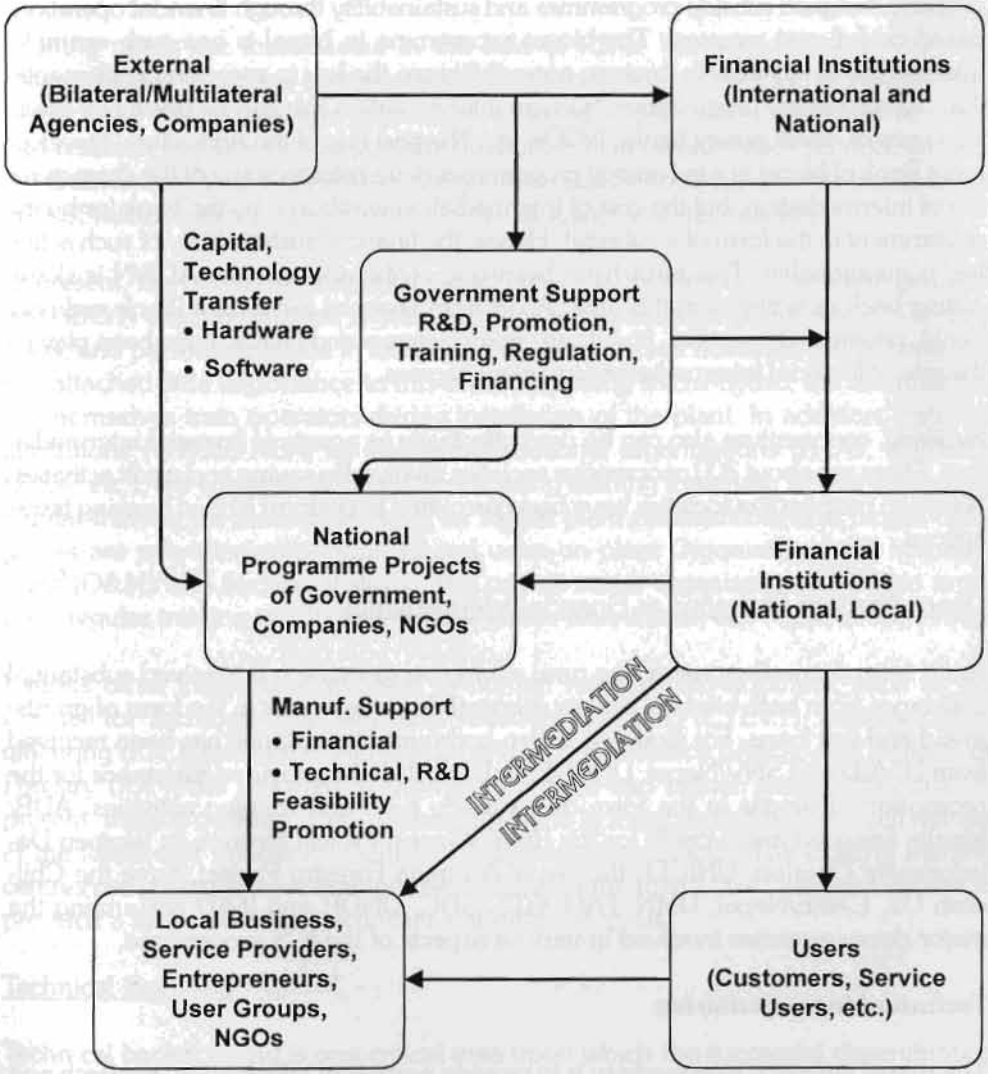
4.5.1 Intermediation

Access to the relevant suppliers is critical to rural energy investor/user choice (CRT & deLucia 1997). This access is dependent on institutions already in place in terms of available technologies, financing, information, and a host of other particulars, including sociocultural factors. In spite of the possibility of access to various options, the lack of one or more necessary institutional set-ups may result in non-access. Therefore, it is necessary to distinguish between potential and actual access.

Most rural people do not have access to the full range of possible options due to technical as well as institutional reasons. Sociocultural parameters aside, it is therefore obvious that the role of financial and technical intermediaries can be of immense help to convert whatever potential access to energy exists into actual access. Providing adequate energy, specifically in a commercial form, to rural areas logically requires a range of efforts from others apart from providers and users of the tech-

nologies. These efforts are generally called intermediation. Given the prevailing forms of rural technologies and institutional set-ups, the range of intermediation required can be classified broadly into technical intermediation, such as information dissemination, and technical support (pre- and post-installation), and financing and management intermediation such as debt financing and management support in the form of training, etc. Figure 4.1 illustrates the interaction among various agencies involved in rural commercial energy activities with specifically financial and technical intermediary roles.

Figure 4.1: Organizational Linkages within and the Scope of Rural Commercial Energy Activities



Financial Intermediaries

Financing relatively small sustainable energy investments in rural areas poses challenges. According to a rural credit survey conducted by the Nepal Rastra Bank, only about 25 per cent of the credit need is met by institutional sources (CRT&deLA 1994). The financing of rural energy programmes needs to be looked at from two angles: access to financial services and the sustainability of services in the long run. Financial sustainability can be achieved by financing institutions limiting their services to less risky projects and locations, but this means poorer access in rural areas and hence does not address the social equity aspect of development. The trade-off between these two is very delicate and requires sacrifice on the part of one or the other. Access can be improved through properly designed subsidy programmes and sustainability through financial operations based on full cost recovery. The biogas programme in Nepal is one such example. Intermediation activities to improve accessibility are the key to successful implementation of rural energy programmes. Such an intermediation role can be played by extension units of development banks, NGOs, etc. The past role of the Agricultural Development Bank of Nepal in rural energy programmes demonstrates some of the characteristics of intermediation, but the cost of intermediation was borne by the bank (or by the government in the form of a subsidy). Hence, the financial sustainability of such activities is questionable. This must have been one of the reasons why ADB/N is slowly cutting back its activities in this area. Apart from financial institutions (bank and non-bank), private sector entities, specifically manufacturers and NGOs, have been playing the role of financial intermediaries to varying degrees.

Similarly, cooperatives also can be used effectively as agents of financial intermediation. There are about 300 cooperative societies involved in saving and credit activities. Nineteen cooperative societies have been permitted to perform limited banking transactions.

Donor Agencies Operating as Financial Intermediaries

Apart from domestic sources, the rural energy programme has received substantial assistance from both bilateral and multilateral donor agencies in the form of grants-in-aid and soft loans. For example, micro-hydro grant assistance has been received from USAID and SNV/Nepal. UNCDF and SNV/N have provided assistance for the promotion of biogas in the form of a subsidy fund and training activities. ADB/Manila financed micro-credit for the Rural Women Project through its Women Development Division. UNICEF, the Nepal-Australia Forestry Project, Save the Children US, CARE/Nepal, UMN, FAO, GTZ, SDC, UNDP, and IFAD are among the major donor agencies involved in various aspects of the ICS programme.

Technical Intermediaries

The role of technical intermediary is to provide necessary information, research and development, technical services, training, etc. Considering the players in the rural

energy scenario, rural energy investment usually has an investor (e.g., NEA and micro-hydro entrepreneurs), energy service user (often the investor, as in biogas and ICS), technology supplier, and financing agency (e.g., ADB/N). Unlike large utilities like NEA, local entrepreneurs and also end users generally lack technical skills, namely, the information and capability to cope with technical intricacies. In order to improve financial viability, training to operators (often the entrepreneur) to ensure smooth technical operations is important. Equally important is developing the management skills for doing the job in a business-like manner rather than as a hobby or household activity.

Training

Training needs are multifaceted in the field of RETs. Various studies and reports have indicated that there is an urgent need to produce a cadre of lower, middle, and higher level technicians and motivators engaged in promotion, technical services, and research and development in the field of RETs in Nepal. Trade schools, such as the Butwal Technical School and Balaju Technical School, have contributed to the field of micro-hydro by producing a cadre of lower level technicians.

At present, the private sector is playing a key role in training end users and promoters. ADB/N used to organize regular training for micro-hydro operators, ICS technicians, and persons involved in financial and management activities, but at present it has attached little importance to this area. Regarding micro-hydro, the manufacturers themselves train operators during installation of the plant. In addition, national institutions (WECS, NEA) as well as international organizations (ITDG, ICIMOD, UNDP, etc.), are currently engaged in preparing training materials. BSP is organizing regular training for masons working on biogas plant construction, and biogas companies are providing orientation to end users on plant Organization and Management (O&M) and the use of slurry. The private sector organization CRT also organizes regular training to ICS technicians, *ghatta* technicians, etc. (CRT 1995, 1996).

Various other institutions involved in human resource development, such as the Council for Technical Education and Vocational Training (CTEVT), Institute of Engineering (IOE), Institute of Agriculture and Animal Science (IAAS), and Institute of Forestry (IOF), are involved in producing middle and higher level technicians. At present, there is no specific programme for RETs in these institutes. Gaps still remain at the lower and middle levels of technical human resources. The existing training centres could play a more leading role by reorienting their curriculum and course to produce a cadre of skilled technicians at different levels.

Technical Backstopping

Technical backstopping is one critical area upon which the successful dissemination of RETs depends. The biogas dissemination programme has realised this and is

providing strong technical backstopping through biogas companies. Very few ICSs installed during the Community Forestry Development Programme and Production Credit for Rural Women (PCRW) programme are currently in use, because of a lack of continuous backstopping. Similarly, micro-hydro dissemination in Dhading District is experiencing technical problems because of lack of appropriate backstop facilities. Technical backstopping becomes all the more critical for the technology disseminated in remote rural areas, given the fact that communication and transport take longer. For instance, the electricity component of the MPPU installed in Patmara VDC, Jumla, could not be made operational over a long period and virtually had to be abandoned, with a loss of investment on the generator, transmission, and household wiring. Similarly, it took more than half a year to get technical services to repair its electronic load controller.

4.5.2 Financing

The Agricultural Development Bank, Nepal, not only provides loan facilities but also channelises subsidies. The ADB/N assures local entrepreneurs of the necessary capital for investment through its loan and subsidy programme. On an average, 80 per cent of the total cost of a project is financed in the form of a loan repayable over five to seven years. The rest of the cost is borne by the entrepreneur in kind or cash. The provision of a capital subsidy minimises the entrepreneur's contribution, which helps attract private investment.

The ADB/N is one of the original major promoters and shareholders of the Biogas Company. It also assisted in installing 23,872 biogas plants, during a period of 20 years from FY 1975/76 to FY 1994/95, and financed five solar PV sets to or run water pumps with a total capacity of 7.6kW. During the current fiscal year it has financed household solar PV systems with a subsidy from HMG/N. Apart from the ADB/N, other private sector banks, viz., Nepal Bank Limited and Rastriya Banijya Bank, have been financing rural energy programmes (mainly biogas) since 1995/96 under their priority sector lending programme. Some joint venture banks are also following suit by mobilising NGOs.

One burning issue, however, involves the recent steps taken by the Agricultural Development Bank to withdraw technical support for development of RETs by closing its appropriate technology units. This has created a void in the development of RETs, since no other agencies have taken up the activities that were performed by these units in the past. Other issues pertaining to the financing of RETs are highlighted below.

Flexible Financing Schemes and Productive End Use: Important Preconditions

Rigid banking procedures, the high front-end cost of RETs, and the low risk- bearing capacity of rural entrepreneurs all add up to an environment detrimental to the

development of RETs. Most of these barriers need to be addressed through innovative initiatives.

Cumbersome Bank Procedures

Banking procedures are found to be quite rigid in the terms and conditions of financing, especially as regards collateral. Banks and financial institutions do have programmes, such as hire purchase, in which a purchased item can act as a guarantee for financing, but this arrangement is not applied in financing RETs.

High Pre-Investment Costs and Low Risk-Bearing Capacity of Rural Entrepreneurs Hinders RET Development

RETs in general involve a high investment cost compared to conventional alternatives. This is the main reason for the slow dissemination of the household solar photovoltaic, which costs about NRs 30,000 for a 35-watt system for lighting and TV. From a user's perspective this is tremendously high compared to other alternative sources, viz., kerosene, grid connection (where available), micro-hydro, etc. It is observable that only the richer levels of society have installed SPV systems; the technology being out of reach of the poorer members of the community.

The high pre-investment cost, including the cost of surveys and feasibility studies, also has affected the growth of RETs. Generally, these services are provided by manufacturers and NGOs. Recently, HMG/N made a provision to provide a subsidy for feasibility studies of RETs. However, nothing has been mentioned about the allocated budget and procedure of disbursement.

Consumptive Rather than Productive Use Deters Financial Viability: The Need to Diversify End Uses

It is a fact that, in almost all micro-hydro plants, supplying electricity for lighting alone is not financially viable, due to the low load factor (recall the case of the Urthu micro-hydro plant in case studies). Similarly, most peltric sets have been acquired by the efforts of a group of households joining together to buy and install the equipment for electrical facilities, mainly for lighting. Often these peltric sets do not provide opportunities for end use diversification because of their smaller size. It is seen that entrepreneurs who have been able to integrate such end uses are operating successfully in financial terms.

4.5.3 Appropriate Tax and Other Incentives (Subsidies): A Need to Reform

In order to analyse the subsidy policy, it is necessary, as with any other policy, to see it in the light of development objectives. These objectives range over social equity (income redistribution), economic growth, environmental concerns, liberalisation of

the economy, regional balance in economic development activities, etc. As the objectives become more explicit and well defined, it becomes easier to analyse whether the subsidy policies and programmes agree with the development objective.

Subsidies in the energy sector can broadly be distinguished as price subsidies and capital subsidies. The Nepal Electricity Authority's lifeline tariff and incremental block tariff for residential consumers are examples of a price subsidy and cross-price subsidy. Similarly, among the petroleum products marketed by the Nepal Oil Corporation, diesel and kerosene are supplied at a subsidised rate, i.e., below the cost of supply to NOC at most locations in Nepal. The capital subsidies for installing various rural alternative energy technologies, such as micro-hydro, biogas, and solar photovoltaic, are examples of subsidies that have assumed different shapes and sizes in the past. The subsidy for alternative energy has widely been referred to as being inappropriate, inadequate, and inconsistent in many reports and publications (ITDG 1995, Nepal 1996).

There are, however, other aspects apart from financial returns on which the proper operation and sustainability of alternative energy projects depend such as adequate training, R&D, and end-use promotion. If these 'software' aspects of the project needed to be carried out by the manufacturers themselves, costs would eventually add up. Therefore such assistance, if provided by the government or outside agencies, is called parallel financing or a software subsidy.

Table 4.11 shows the major direct HMG subsidies for the year 1996/97. How much is spent in parallel financing is very difficult to determine because programmes, such as training, R&D, and information dissemination, are spread over many agencies — including GOs and NGOs.

Table 4.11: Major Budget Allocations of Subsidies for the FY 1996/97 (in '000 NRs)

Purpose	Amount	Percentage
Food (price and transport)	224,500	21
Fertilizer (price and transport)	600,000	57
Irrigation	110,000	11
Biogas	99,000	9
Rural electrification (Solar photovoltaic and micro-hydro)	20,000	2
	1,053,500	100

Source: Annual Expenditure Budget, Ministry of Finance, 1996/97

The Need to Analyse and Formulate Subsidy Policy on a Par with Budget Allocations

Barring some exceptions, it is commonly found that subsidy policies generally do not meet target-based criteria. In fact, adequate analyses are rarely carried out. In spite of good intentions, subsidies can have negative impacts if they are improperly designed and implemented. This is especially true when resource availability tends to be a constraint. For example, the limited amount of 2.5 million rupees allocated for a 50 per cent subsidy for solar PV in the year 1996/97 was barely sufficient to finance 200 units. This resulted in a flood of demand for solar PV, but neither the

government nor ADB/N, through which the subsidy is channelled, has been able to meet the demand; the consequence being a quota and suppressed demand. In spite of the good intention of promoting dissemination, the immediate demand has possibly been suppressed in anticipation that the subsidy will be available in coming years. There are also equity concerns with regard to such subsidies. Often beneficiaries of subsidies tend to be a group not envisaged under the overall national development objective.

Inconsistent Subsidies

The present solar PV subsidy does not address equity or development concerns well when compared with micro-hydro installations, which have a substantial potential for providing energy for productive use and for generating income and employment opportunity. Compared with the micro-hydro subsidy, by which only the electrical components of the system excluding household connection and wiring are subsidised, the subsidy for solar PV is provided as a complete package, including house wiring and even the purchase of fixtures. There is inconsistency (Box 4.1) and the need for a cohesive, objective, and target-oriented subsidy policy (Box 4.2).

Box 4.1: Examples of Inconsistent Subsidies on RETs in Nepal

During the Seventh Plan period, 84 plants were installed, and, during the first three-year period of it, 156 plants were financed by ADB/N. ADB/N has so far distributed NRs 24.28 million in subsidies for rural electrification to private entrepreneurs. The subsidy on rural electrification was introduced in 1985, but discontinued in 1986. It was reintroduced again in 1988, and in 1989 again discontinued until 1992. The government started releasing subsidies once more from 1993. Inconsistent subsidy policy is one of the major grievances of the micro-hydro sector. A similar story can be traced in the history of biogas subsidies. Unpredictability and inconsistency with respect to subsidies affect investment decisions, and hence are the major impediments to dissemination. ADB/N loan investments for turbines during FY 1993/94 were NRs 7.3 million, and this dropped to NRs 2.8 million in 1994/95. Loan investment was 60 per cent measured against the target, and it dropped to 16 per cent over the same period. The percentage of outstanding loans overdue was 44 per cent in 1993/94, and 60 per cent in 1994/95. It is reported that, during the current year, only about half of the subsidy budget has been used, indicating a further slowing of pace in micro-hydro installation.

Is Existing Subsidy Policy Instrumental in Widening Social Disparity?

The social equity issue in the existing subsidy policy is very prominent. The present subsidy policy framework on biogas allows very limited access to subsidies for the poor. The poor usually lack access to finance, since they cannot fulfill the collateral conditions of the Biogas Support Programme's participating banks. In spite of their

Box 4.2: Justification of and Limits to Existing Solar PV Subsidies

In spite of justifications put forward in favour of subsidies, in the long run the latter are difficult to continue if tangible benefits in terms of socioeconomic development are not forthcoming. According to one study (WLG/WECS 1995), with an electricity price of NRs 60 per kWh, the economic and financial IRR are 11.7 and 10.4 percentage rates of return, respectively; whereas for the same electricity price micro-hydro yields 34.9 and 32.1 percentage rates of return respectively. The limited cash savings from kerosene were in some cases significantly counterbalanced by SPV system maintenance costs related to bulb replacement (WLG/WECS 1995). Therefore, the subsidy for solar PV cannot be justified based upon economic criteria alone. The other criteria for a subsidy need to be clearly mentioned in the policy document. However, it is important to note that household PV systems provide substantially better quality and cleaner light than kerosene. Source: CRT and de Lucia 1997.

capability to make monthly payments, and their having enough animals to fulfill the raw material requirements for biogas digesters, the poor cannot avail themselves of the existing subsidy. Therefore, access to subsidies, particularly for biogas and solar PV, is limited to the richer individuals and communities. A flat subsidy rate for all sizes of biogas plants reduces the cost of energy from smaller plants targetted at low-income farmers (Table 4.12).

Table 4.12: Cost of Biogas for Different Sizes of Biogas Plants in the Hills 1996/97 (before and after subsidies)

Size (m^3)	Total Investment		Yearly Cost		Yearly Gas Production	Cost of Biogas	
	Before (Rs)	After (Rs)	Before (Rs)	After (Rs)	(m^3)	Before (NRs/ m^3)	After (NRs/ m^3)
4	17,481	7,481	3898	1668	350	11.14	4.77
6	20,256	10,256	4,517	2,287	525	8.60	4.36
8	23,885	13,885	5,326	3,096	700	7.61	4.42
10	27,355	17,355	6,100	3,870	875	6.97	4.42
15	34,342	24,342	7,658	5,428	1,315	5.82	4.13
20	41,962	31,962	9,358	7,128	1,750	5.35	4.07

Source: Updated from BSP sources using GGC prices

An Unfair Diesel Subsidy

A study conducted by New Era (1993) found that, out of 25 micro-hydro schemes looked into, 20 had overdue loans despite the fact that 19 had generated enough income to service the debt. The study considered that five of the 25 were economi-

cally not viable, since many competing mills, mainly diesel mills, had been set up in the vicinity. Poor management was identified as the main reason for faulty repayment of bank loans (New Era 1993). Investment for diesel generators and mills being less costly than for micro-hydro projects, diesel engines are competing with micro-hydro plants. This may be mainly due to the subsidy on diesel equipment and its relative ease of operation.

Tax Policy: Unfavourable for Renewable Energy Development

The availability of tax and duty exemption on the import of renewable energy-related material and equipment is provided for at various levels, in acts and rules and regulations. However, in practice, availing oneself of such facilities is found to be very cumbersome. In spite of such facilities, manufacturers, particularly in the micro-hydro field, are generally supplied through local market channels and end up not using such facilities. One of the underlying problems is that demand for RET-related equipment and accessories is sporadic. In contrast, it is not uncommon to see the import duty on alternators for micro-hydro being as much as 40 per cent, whereas the organized import of diesel generator sets gets by with much less. This, in turn, increases the final delivery price of RETs. The recent organized import of main valves for biogas digesters and photovoltaic panels resulted in users taking advantage of the tax facilities.

4.5.4 Gender Concerns: A Neglected Dimension

Women play key roles in the collection, management, and use of energy resources and technologies. These multifaceted roles and responsibilities force them to face a number of problems. The growing scarcity of fuelwood and other biomass resources adds hours to a woman's work-day (WECS 1995a). There are renewable energy technologies that offer significant potential in terms of reducing women's drudgery and improving health conditions. For example, the ICS, an improved version of the traditional cooking stove, has had a positive impact on addressing gender concerns. Similarly, the impact of other RETs, such as biogas (ADB/N, SNV-Nepal, and GGC, 1994), micro-hydro, and solar PV, is found to have had a positive effect on women's daily work load, their living conditions, and economic empowerment (East Consult 1994).

While most energy-related policies and programmes have great implications in one way or the other, none of the policy statements have made any reference to the importance of gender roles in the energy sector and the involvement of women in energy development programmes. Thus, energy sector policies are found to be completely blind to gender issues from both a practical and strategic point of view (CRT & deLucia 1997).

It seems that the role of women in and relationship with energy-related sectors have yet to be well understood by policy-makers (who are usually male). Policies seem

to have been formulated on the premise that development is a gender-neutral process, that participation of men and women in the development process is an automatic phenomenon, and that both men and women benefit equally from development. This assumption is a distortion of the real situation, given that women lag behind men in the socioeconomic, legal, and political spheres of life and that women's roles, needs, concerns, and constraints greatly differ from those of men. Until women's practical and strategic needs are addressed and internalised by policies, and gender-based programmes planned and implemented, the rural energy programmes are likely to remain ineffective and unsustainable.

4.5.5 Legislative and Regulatory Issues

The Need to Differentiate RETs by Modes of Ownership and Management

Technologies have inherent characteristics, based in part on their degree of technical sophistication, scale, and mode of management. In the case of micro-hydro, its degree of sophistication and its scale range from the traditional *ghatta* to the pelton turbine — including add-on and stand-alone electrification units, each with its own characteristics. These characteristics also vary distinctly according to the mode of ownership and management. Different modes of ownership and management will require different levels and kinds of support for successful operation. The implications of these different modes of ownership and management for policy are generally neglected in policies relating to RETs and Energy Saving Devices (ESDs). The various modes of ownership and management are private, community, and corporate (or limited liability). All of these modes, have their own advantages and disadvantages. Community-based management and ownership fosters participation, local resource mobilisation, reduced cost, easier conflict resolution, distributed risks, etc. Private and corporate-based modes, on the other hand, foster zeal, innovative ideas, entrepreneurship, etc. Scarcity and risks tend to bring the community together for resource management. However, for successful operation it has been found that an agent needs to be present who is capable of enforcing rules acceptable to the community (Wade 1988). In the absence of such an enforcer, free-wheeling behaviour prevails, resulting in partial or full failure of the operation.

Property Rights' Issues

Water Rights' Issues

The Water Resources' Act 1996 prioritised the use of water resources, with the generation of hydroelectricity ranking fourth in order after drinking water, irrigation, and agricultural uses. The law does not specify any right of prior use of water resources for micro-hydropower (MHP) projects. This caused the closure of the Charaundi micro-hydro plant in Dhading District, the water that was used to generate power having been diverted for an irrigation project (Bishaltar Irrigation Project).

This sort of problem is very prominent when private companies or individuals own the micro-hydro station. Understandings and water-sharing arrangements are usually functional when an individual is able to collaborate with the community or when the micro-hydro unit is installed as a community venture. In any case, the individual entrepreneur is always at the mercy of the community, since existing laws do not provide any protection in the form of water rights for the micro-hydro entrepreneur.

Forest Rights' Issues

The implications of policies and legislative measures on forests and their management are important for renewable energy development. Renewable energy technologies in many ways divert or reduce the demand for firewood from forests. The productive use renewable energy technologies are geared to could, however, put additional pressure on forests if such production is based upon raw materials found in them such as timber.

With community forestry becoming more successful as a mode of forest management, as envisaged by the Forestry Sector Master Plan, property rights' issues, such as the degree of control over the management and use of forest products, are becoming important. The community management mode, which is still in the process of evolution, with varying degrees of support from the government, is bound to become standard. The government's institutional setup, however, is not yet fully geared up, either physically or in terms of human resources. The traditional bureaucracy within the forest sector will take time to fully accept the community-based approach.

As in the case of water resources, disputes occur among locals over rights over forests, and this has been found to be a serious hurdle, causing delays in their being handed over to the community.

R&D and the Intellectual Property Right Issue

Research and development (R&D), specifically in its adaptive capacity, is a critical aspect of RET and ESD development in Nepal. Biogas plant design, turbine design, and local adaptation of the design of solar PV, ICS, and wind power units are examples of such R&D. In order to adapt these technologies to the prevailing situation, R&D needs to be strongly focussed. So far, research activities have been carried out either by the private sector and such NGOs as BYS, DCS, and ITDG, or by research agencies like RECAST and RONAST. When it come to investment in research by the private sector, patent and intellectual property laws have to be effectively in place; otherwise the private sector will shun away from such investment.

4.5.6 Warranties, Standardisation, and Guidelines

Standardisation of Equipment and Safety Guidelines for Construction and Operation of RETs

There are no formal guidelines or mandatory safety provisions established for the construction and operation of RETs. Due to unprotected belts and rotating parts of machines, particularly in the case of micro-hydro installations, there have been a number of accidents that could have been avoided if proper protection measures had been taken. Similarly, design standardisation is not practised. The lack of a formal standardisation of procedures and guidelines has resulted in errors, again, especially in micro-hydro. Standardisation and quality control in the implementation of the BSP programme have been achieved to a reasonable level. The number of biogas plant in operation has increased in recent years.

The Issue of Warranties and Design Guidelines

Warranties are an important mechanism to ensure quality output from manufacturers. They ensure that manufacturers or suppliers of services and equipment are made responsible for what they specify or promise to deliver. In the absence of warranties, manufacturers will get away with inferior equipment and after-sales' services. Often, unrealistic assumptions are made in economic and socioeconomic analyses to make schemes seem financially viable.

4.5.7 Lack of Sectoral Integration and Linkages

Energy issues are currently not well addressed in rural development programmes. These issues are considered in a non-integrated fashion by individual line agencies and institutions (for example, rural electrification by NEA, community afforestation by the Ministry of Forests (MOF), biogas and micro-hydro by ADB/N, and ICS by the Women's Development Programme in the Ministry of Local Development). Local development offices at the district level, and in branches of the Forestry Department and Nepal Electricity Authority, formulate individual programmes for implementation and submit them to their respective central offices.

RETs have demonstrated that they can be instrumental in providing electricity in rural areas at a different level. Solar PV household units do not cater to power needs but can provide electrical lighting in remote rural areas that otherwise would never be electrified. Micro-hydro and other RETs have the capability of providing rural energy in a modern form that can be instrumental in bringing much needed economic development. The issue is, then, what comprises rural electrification and what not. Should the direct public investments and subsidies for infrastructure apply to these different levels of rural energisation differently? How are the spin-offs, ranging from hygienic and health benefits, awareness building, and access to infor-

mation, communications, etc treated in decision-making processes relating to public investment?

The most commonly touted feature of RETs is their fuel-saving and replacement capability: improved stoves reduce the need for fuelwood, MH and biogas take over for kerosene and fuelwood, and solar PV for kerosene. This in itself is an important aspect of RETs, but more important are the further spin-offs stated above. Often these benefits are so important, especially in terms of their backward and forward linkages, that energy bonuses and the unit cost of energy become unimportant. Opening up communications with solar PV is one such benefit, awareness and increased learning opportunities are others, and there are many more such benefits.

Addressing social equity in terms of access to technology through financial and necessary institutional arrangements has been practically absent in programmes related to RET development. Often it is found that the poorer segment of society has been forgotten on the design and implementation of these programmes.

4.5.8 Institutional Arrangements and Issues

Inadequate Institutional Infrastructure and Commitment to Technology Promotion and Dissemination

Currently, lack of the institutional capability once upheld by Appropriate Technology Units (ATUs) of ADB/N is causing serious setbacks to the promotional activities of RETs. A lack of adequate support from government and donor agencies is often cited as the reason for the withdrawal of ADB/N from these activities. The private sector and NGOs are gearing up to take on the role of ATUs but have not been very effective due to lack of appropriate funding and institutional support.

Weak Central Coordination and Monitoring

There is no Ministry or Department of Energy in Nepal. The Water and Energy Commission Secretariat (WECS) has been instrumental in generating necessary information on RETs for planning, through surveys, investigations, and studies, which in turn lead to policy recommendations. At one point in time (the early 1990s), there was a half-hearted effort by WECS to coordinate and promote renewable energy development and channel some funds into training and research. However, these efforts got crowded out by large national issues of water resources' development.

Although the Alternative Energy Promotion Centre under the Ministry of Science and Technology has come into existence recently to take over this responsibility, it may be some time before it becomes fully functional. This is especially likely given its inherited organizational characteristics, it having been established as a wing of HMG/N, complete with red tape, other types of bureaucratic inefficiency, and a lack of financial commitment.

Apart from the National Planning Commission's regular budgetary allocation and monitoring, there is no coordination and monitoring of the RET programme at a national level. One exception is the programme on biogas, the Biogas Support Programme, which is governed by a board. This is due to donor funds being available for the programme — a reflection of the government's indifference towards and donor-driven nature of the RET programme in Nepal.

4.6 Conclusions and Recommendations

4.6.1 General Conclusion

Based on a review of relevant policies and various case studies, it can be concluded that, in spite of some major unresolved issues, Nepal has made remarkable progress in the development and dissemination of RETs. Progress made in the dissemination of biogas is phenomenal, and this is specifically due to the establishment of an institutional set-up overlooking the programme in an integrated manner. Another factor, which has helped in the success of the biogas programme, is availability of funds for the programme and donor commitment. In the case of other RETs, such commitment and support is lacking. For example, micro-hydro development is infested with lots of technical problems, such as a low load factor, quality control, and high up-front costs, and institutional issues, such as water rights and adequate back-up services. The solar photovoltaic programme is in the early stages, the major issues being related to social equity, its very limited linkage to economic activity, and an inadequate and inappropriate subsidy policy. There is hardly any programme to speak of in wind energy, and the improved fuel-efficient cooking stove (ICS) programme has in the past had a misguided target-driven approach. In the ICS programme, the latter and a lack of users' participation at the design and planning level, have meant that a majority of installed stoves are unused. There are, however, positive developments taking place in the ICS programme. Users' participation and the mobilisation of NGOs and the private sector recently have proven to be a better path for ICS development.

In spite of the merits and demerits of the different technologies (a function of their spatially specific advantages and load versus output characteristics), unconventional technology stands out as an important option at individual locations. Under unfavourable hydrological and/or smaller load conditions, solar photovoltaics can be an attractive proposition. Output maximisation, cost minimisation, socioeconomic concerns, and financial sustainability should be the key criteria in devising policies in this respect. Policy should avoid disturbing market forces unless the need arises to address socioeconomic concerns and market imperfections.

4.6.2 Recommendations

In order to accelerate the development and dissemination of renewable energy technologies to help the rural economy grow in line with overall national development

objectives, the issues identified in the previous section need to be resolved. The following recommendations are made.

Legislative and Regulatory Action

Appropriate legislative and regulatory frameworks are necessary preconditions for the development of enterprises. Micro-hydro and other renewable technologies are environmentally sound options and need to be encouraged. Policies should be oriented to providing a level playing field in the market for RETs and ESDs alongside other energy options. Legislative and regulatory measures are also crucial for the necessary protection of investments. Prior or formal users of resources should be guaranteed adequate property rights so that other users do not hamper or come into conflict with them. In addition to the priority specification of resource use, as in the case of water, existing users' rights along the lower stream must be explicit. Similarly, appropriate legislation is necessary to safeguard intellectual property rights in order that responsibility for R&D can pass to the private sector. In order to safeguard common users' interests, there is an urgent need to develop warranty and technical standards for manufacturing and construction that incorporate safety guidelines.

Financial and Economic Measures

In order to make RETs financially more viable, it is necessary to improve the revenue generated or benefit realised. Especially in the case of micro-hydro, it is found that the load factor of plants is often less than 25 per cent, which translates into the underutilisation of investment. Since costs cannot be reduced, the only way to improve financial performance is to improve revenue. To achieve this, especially in cases like micro-hydro, increasing the load factor in order to use the investment in a productive manner is necessary. For example, the attempt to promote knitting and tailoring in Pulimarang by women entrepreneurs is a remarkable example of the productive end use of a solar photovoltaic lighting system. In this respect, the government, NGOs, and the private sector can play a positive role by providing the necessary training to entrepreneurs and by conducting awareness programmes.

Most important, however, is to see that RETs become financially sustainable propositions. In other words, they should be developed in such a manner that all forms of subsidies can be removed in due course of time. In order to achieve this, they should be provided with a level playing field in terms of subsidies and cross-subsidies, taxes, duties, and other support that distort market functioning. We cannot expect solar photovoltaic or micro-hydro to compete with kerosene lighting and diesel generators if fuel and equipment are taxed unevenly.

A General Subsidy Framework

There is no framework upon which subsidy policies are based. The framework for subsidy policy should be explicit and made public. There is a need to differentiate

between rural electric lighting and village electrification. The former provides limited services without opportunities to develop backward-forward economic activities in the rural area, whereas fully fledged electrification provides unlimited economic opportunities. In addition, there is also a need to improve the continuity of the subsidy programme and its predictability in order to avoid investment shunning by the private sector.

Simplified Banking Procedures and Special Programmes to Enable the Poor to Access RETs

The general impression entrepreneurs have about banking procedures is that, for a variety of reasons, they are cumbersome and take a long time. It is also found that interest rates are not uniform among banks. It is therefore desirable that banking procedures be simplified and interest rates and other conditions on loans be unified. Similarly, there is a need to develop special programmes to ensure increased access to RETs by the poor.

The Need for a Holistic Approach in RET Development

It is important to realise that not all benefits from programmes like ICS can be quantified, one example being hygiene and the health of family members, particularly women and children. Environmental benefits that accrue from savings in fuelwood are also important, even though they may not look very significant in financial terms. Similarly, the micro-hydro programme should be looked at as a starting point for other economic activities that may develop due to the availability of power and the related generation of income and employment.

Therefore, it is necessary to refocus the RET programme so that it acts as a 'catalyst' to rural economic activities rather than as a purely technical programme, the level of government support being proportioned according to social and environmental benefits.

Gender Concerns Must Be Reflected Adequately

As an entry point, HMG/N energy sector agencies should provide credit facilities and subsidies for time- and energy-saving technologies. With these facilities, women will have access to technology that will give them the extra time needed for skill development, and confidence-building and income-generating activities. Once women have access to and control of income, they will be able to invest in other technologies or directly in their families (WECS 1997). A major obstacle to meeting the basic needs of poor rural families is the lack of productive resources and the time available to women for the fulfilment of their triple role as managers, producers, and users of energy. Women could prove to be effective in initiating development activities and especially in motivating and mobilising other rural women and men as well. Development efforts without the participation of rural women are sure to fail since

most rural activities are women-oriented, and women have an intimate relationship with energy, environment, economy, and natural resource management.

Devising Effective Institutional Set-ups

Institutional responsibility for the energy sector is spread over many entities, including many ministries, departments, and other sectoral and sub-sectoral entities. The level of commitment for the development of RETs has been inadequate, and efforts have been half-hearted. The level of commitment in terms of programme and budgetary allocation for RETs needs to be increased drastically. Also, the institutional and financial sustainability of the programme needs to be seriously reconsidered. The government has demonstrated its commitment by establishing Alternative Energy Promotion Centre (AEPC), and a matching programme and budget are highly awaited. The primary focus of AEPC should be of the coordination and monitoring of RET programmes, with provision for a decentralized technical backstop facility.

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Dome-type biogas plant installed in the Panchkhal Valley, Kabhrepalanchok, Nepal

Improved Cooking Stove installed in a hill village in Nepal