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NEPAL

POWER DEVELOPMENT PROJECT

SECTORAL ENVIRONMENTAL ASSESSMENT

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1.1 Preamble

HMGN has agreed in principle to the creation of the Power Development Fund (PDF). The PDF is being established to supplement private and other public financing available for the development of Nepal's power sector to meet the domestic demand for electricity and to export power where possible. HMGN has recognized that in order to fully benefit from the hydro-power potential in Nepal, it is necessary to institute a transparent and participatory process for project selection that recognizes technical, economic, financial as well as environmental and social concerns. To be eligible for funding from the PDF, all projects will have to go through such a process.

The range of projects that could be financed will be kept as wide as possible and could include generation, transmission and distribution projects in order to be able to respond quickly to the financing needs which may occur. It is, however, expected that initially the PDF would contribute to the financing of 10 to 300 MW capacity hydro-power projects mainly aimed at supplying the domestic market, but larger or smaller generation projects beyond the range of 10 to 300 MW, isolated rural power systems and export oriented projects as well as transmission and distribution projects are in principle also eligible for financing from the PDF.

1.2 Sectoral Environmental Assessment

Sectoral environmental assessment (SEA) is used as one of the criteria to identify candidates for PDF support. SEA is used to move traditional project-specific environmental assessment (EA)* 'upstream' into the process of selection of candidate projects for further development. Hitherto, practically all EAs worldwide were project-specific and undertaken when a specific project had been identified for detailed design. Thus while project-level EAs could adjust the design of the project such as weir height or position of the weir or dam on the river, such EAs could not help decide which supply option or projects were to be selected for further study in the first place. SEA is defined as EA applied to the whole sector, above the individual project level.

SEAs should be consistent with and support the national resource management policies and priorities. These strategies seek to optimize the use of the water resources of the nation for all

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*** The acronym EA is used here to incorporate environmental impact assessment (EIA) including the assessment of impacts on relevant social and socio-economic aspects for the project affected people. This acronym is used in lieu of the often referred EIA/SIA.**

purposes, such as for hydropower and irrigation, and aim at reducing competing claims and conflicts.

The primary reason for using SEA is, first, to incorporate environmental and social criteria in the selection of electricity supply options and projects. This SEA seeks the optimal project solution to a power or water demand while minimizing the environmental and social costs. The SEA thus builds on traditional economic least-cost analysis by adding environmental and social criteria alongside the economic criteria.

Second, governments are increasingly concerned with encouraging private sector participation in power development as this is a vehicle to alleviate the heavy burden on the Government budget for financing all physical infrastructure development. Private developers and their investors want to reduce all risks including the up-front planning and preparation costs. SEA helps reduce such risks and makes investments more attractive to private developers by undertaking much of the expensive project selection costs. Third, by means of broad stakeholder participation and a consensus building approach, SEA helps to ensure broad public endorsement and avoid costly delays on all projects implemented in the public/ private sector. Fourth, to a certain extent, SEA assists in project optimization and feasibility design, including environmental and social mitigation measures and provides the start of the necessary environmental and social action plans.

This SEA outlines Nepal's hydropower potential, HMGN's hydropower policy, the existing power system with the past and future load growth, the export potential and explores alternative generation options/prospects of fossil fuels, renewable energy sources, demand side management. The SEA also outlines how this sectoral approach has been successfully applied by the Medium Hydropower Study Project in selecting 7 hydro projects out of an inventory of 138 in the 10-300 MW range for full feasibility study.

2.1 Water Resources Policy

The National Water Resources Development Council under the chairmanship of the Prime Minister and the Secretary of MOWR as the member-secretary of the Council has been formed. The main functions of the Council are to bring up a national consensus in the proper utilization of water resources and to identify the strategic policy planning.
Currently, HMGN is formulating the National Strategy for the multi-sectoral and integrated approach to the balanced development of water resources. The World Bank has provided technical assistance for the water resources strategy formulation.

The existing sectoral hydropower development policy, together with the standard terms of reference (TOR) for the EAs of specific hydropower projects, plus generic EA guidelines, and the Environmental Act provide the current policy framework.

2.2 Hydropower Potential

Nepal's theoretical hydropower potential is vast; the technical and economically feasible potential is above 42,000 MW, with an ultimate potential of 83,000 MW. Of this, only 0.3% has been harnessed so far. Electricity currently represents about 1 percent of energy consumption. Nepal's indigenous energy resource is hydropower and the resource with the most potential for development, as all other forms of commercial energy are based on imported fossil fuels (petroleum and coal). At present, only 10 per cent commercial energy is hydropower. Hence, a substantial portion of the foreign exchange earnings will be spent on importing commercial fuels. Nepal's policy to shift its GDP from the agricultural to non-agricultural sector will continue and this will accelerate the demand for more commercial energy.

Hydropower development is the main element in the national energy strategy. Properly done, as by using the social and environmental coarse and fine screening methods, hydro can become a fully sustainable – socially and environmentally – form of energy, much more so than any of the current realistic alternatives.

2.3 Hydropower Development Policy

In 1992, HMG adopted a national hydropower development policy with the following four objectives. First, to supply electricity as per the demands of the people in urban and rural areas by exploiting the high potential of water resources. Second, to enhance hydropower to meet industrial needs. Third, to promote national and foreign private sector investment in hydropower development. Fourth, to conserve the environment by supplying clean hydropower.

These objectives were to be achieved by the following 10 policies (abbreviated). 1. To undertake a variety of sizes and types of hydro project; 2. to emphasize rural electrification; 3. to emphasize hydroelectricity in the transport sector to reduce petroleum use; 4. to use indigenous human resources as well as foreign investment and technology in hydro; 5. to export hydro in excess of national demand; 6. to promote hydro to minimize fuelwood use and to conserve forests; 7. to diversify use of electricity; 8. to make supply reliable; 9. to control losses; and 10. to provide electricity sufficiently available to the people and at practical tariffs.

Policies 3 and 6 on transport, fuelwood and conservation of forests are clearly environmentally motivated. Policy 5 on exporting hydroelectricity also benefits the environment of the importing country by offsetting coal-fired pollution. Policies 2, 4, 7, 8 and 10 are clearly socially motivated.

The policies also have clear social and environmental motivations with regard to land acquisition, use of local labor and human capital, technology transfer, local benefits and minimization of environmental risks. The policy recognizes the need to optimize and prioritize the uses of water resources and reduce conflict.

3.1 Load Forecasts and Public/Private Generation Addition

The system peak of the interconnected system recorded in year 1995 is 275 MW. The average growth rate of both the peak load and energy demand in the last 10 years is about 10% whereas in the early 1980s it was nearly 15%. NEA's load forecast of January 1992 estimated the average growth rate of peak load demand as 10.2% and that of energy demand as 10.6 % upto the year 2012.

Two hydro power projects, 6.2 MW Puwa Khola (48 GWH) and 14 MW Modi Khola (91 GWh), HEPs are under construction with target completion dates of December 1997 and the early part of FY 1998 respectively. Similarly, 60 MW Khimti-I HEP (350 GWh), 20 MW Chilime HEP (137 GWh) and 36 MW Bhote Koshi HEP (246 GWH) are three committed projects being undertaken by the private sectors. The first project is scheduled for commercial operation by the end of 1999. The second project is being taken up as a public /private joint venture with majority NEA equity participation and is scheduled for commissioning by the middle of FY 1999. The third project, the Bhote Koshi HEP has signed the PPA with NEA and the financial closure is expected within this 1996/97 fiscal year. The 144 MW (840 GWh) Kali Gandaki-A Hydro Project has been launched as the priority project and this is scheduled to be operational in year 2000. The addition of 13 MW to the existing 26 MW multifuel plant at Biratnagar is under construction. This is expected to the completed by FY 1997/98.

3.2 Rural Electrification

The percentage of population of Nepal having access to electricity is presently about 14% and the majority who are availing this service are from the urban areas. But with growth rates of over 10% per annum much remains to be done in urban areas also. Of the rural population, which accounts for 90% of the population for Nepal, less than 4% have access to electricity. It is necessary to reinforce and extend the sub-transmission and distribution system in the potential urban and rural areas. This is in line with the Government objective of extending electricity services to rural areas for the socioeconomic development and for the substitution of kerosene and fuelwood through Nepal's own indigenous hydro electric resources. As a part of that objective HMGN has formulated the Agricultural Perspective Plan wherein over a 20 year period about 600 MW of power is required for the operation of shallow tubewells and the electrificaiton of the villages in that vicinity. In general, expansion of electrification network to unelectrified area is expected to act as a catalyst to improve economies, and an effective means to reduce dependence on imported fuel consumption. HMGN is acutely aware of the need to carry out rural electrification either through grid extension, isolated hydros or other forms of renewable energy.

3.3 Transmission and Distribution

Nepal's transmission system consist of 1,178 km single circuit 132 kV line, 27 km of double circuit 132 kV line, 179 km of 66 kV single circuit, 153 km of double circuit 66 kV line and 1,216 km of 33 kV single circuit transmission line.

The basic policies to reduce the environmental and social impacts of power lines is first, to avoid any displacement of people, to minimize land intake, to prevent dwellings in or too near the ROW, to completely avoid any conservation units (such as National Parks) by re-routing, and to avoid siting towers where they may cause aesthetic (visual) impacts such as in viewing beautiful landscapes. These will be fully assessed in all future EA as now mandated for all 132kV lines that are over 75 km.

3.4 Electricity Export and Import

Exchange of electricity with India through two 132 kV and thirteen 33 kV existing interconnections across the Nepal-India border continue. The electricity imported from India along the points of exchange for the year 1994/95 was 110 GWh whereas the export for that year was 42 GWh. Import of power from India has been identified as an effective method of alleviating short term power shortages. As India does not have much excess capacity either, energy exchanges, while mutually beneficial, are unlikely to be a medium or long term solution to Nepal's burgeoning demand. Importing electricity leaves the main environmental and social impacts with the exporter.

There is considerable scope over the longer term for increasing cross-border power trade between Nepal and India. Nepal should plan and develop stronger interconnection ties with the Indian Power Grid Network. Linking the potential hydro based Nepal system with the predominantly thermal based Indian power system could provide net environmental and social benefits, such as reduced pollution, as well as attractive investment opportunities. In the long run, Nepal could become a net exporter of hydropower, generating substantial income, provided that social and environmental impacts are adequately mitigated in the development of Nepal's hydro resources.

3.5 Medium Hydropower Sub-sector

Recently, the Sectoral Environmental Assessment approach has been successfully used by Nepal Electricity Authority during the Medium Hydropower Study Project (MHSP). The MHSP work is part of HMGN's power sector planning process. It involves completion of technical and environmental studies necessary to arrange project financing for hydropower projects which will be developed through either public or private sectors. The MHSP work supports HMGN's efforts to ensure that an adequate number, and an appropriate mix of medium-scale hydropower projects are constantly introduced into the project development "pipeline". This is to ensure that HMGN has flexibility to meet power supply requirements in Nepal with an environmentally and socially attractive range of medium-scale hydropower options, which are timely and cost effective.

The MHSP is being carried out in three phases. The first phase of Screening and Ranking was undertaken in two steps, (1) Coarse and (2) Fine Screening and Ranking. A process was established to systematically screen all the available medium scale hydropower options in the range of 10-300 MW and then apply a ranking system to the most attractive projects to identify those projects that will advance to full EA and feasibility study. While conducting this phase, open consultation process and information sharing with government stakeholders, the professional community and NGOs and the general public was extensively done. In this phase, out of an inventory of 138 projects, 24 projects were selected from Coarse Screening and seven projects were selected for Feasibility Study through fine screening.

In Phase-II, fully feasibility study and EA of the seven medium-scale hydropower sites selected in Phase-I process is being undertaken. In Phase-III, detailed design and tender documents of two projects will be prepared. These projects will be selected by NEA through generation expansion planning and system studies.

The seven projects selected under MHSP are all located on tributaries to the Kosi, Gandak and Karnali rivers. Six of the seven projects are run-of-the-river projects. Natural flows will, hence, not be influenced by these developments, with the exception of dewatered stretches where flows are diverted offstream for generating electricity. The riparians along the dewatered zones will be suitably taken care of as per the Environment Protection Act. The seventh intended project, Dudh Kosi, will be planned as a storage project. This will affect natural hydrology, mainly by storing water in the monsoon season, and releasing for power production during the critical low-flow dry season thus augmenting the low flows.

The EA process for seven projects will consist of five stages namely (i) scoping which will include dissemination of project information with the local community and initial public consultation to prepare TOR, (ii) conducting detailed studies in accordance with the approved TORs, (iii) compilation, consultation and finalization of reports which will be disseminated to local communities and NGOs, (iv) approval of reports, where report will be submitted to NEA and EDC/PDF will be reviewing the reports and endorsement of MOPE will be required and (v) monitoring of implementation, which will be done by NEA and MOPE acting as watchdog. Wherever possible, participatory monitoring by community groups, possible supported by local NGOs will be integrated within the monitoring plan.

Public consultations with local communities, NGOs and other stakeholders will form an integral part of the EA process. During project implementation, a Project Information Centre, with all information relevant to that project, will be established at each project site.

4.1 Fossil Fuels Generation

Fossil Fuels & Thermal Generation: Fossil fuels supply 5 percent of the total energy requirements in Nepal. The major fossil fuels are petroleum products (85 percent) and coal (15 percent), nearly all of which are imported. As Nepal does not have any oil reserves and refineries, environmental impacts of oil production and refining, do not arise. Nepal buys petroleum fuels in the world market and then exchanges these fuels with the Indian refineries who supply refined products. Similarly, the environmental and health hazards of coal mining and supply do not arise in Nepal, as most of Nepal's coal is imported from India.

Petroleum Products: Nepal's total annual petroleum use exceeds 3 million kl., of which two thirds is diesel and kerosene. The consumption of petroleum products is increasing by more than 8 percent per year.

Coal: Overall coal consumption is about one percent of total energy. Only scattered deposits of mud-coal, lignite and peat occur in Nepal, but they contribute little to the sector. Kathmandu alone consumes 40 percent of the more than 100,000 MT of coal imported into the country. Kathmandu's 175 brick kilns are the major consumers of coal and coal dust, and are the major sources of air pollution. Consumption of these fuels frequently impairs air quality and poses health risks in this densely populated area. Both regulation and education are needed to reduce pollution..

Existing Thermal Generation: With air pollution as high as it already is, social and environmental concerns would not support location of further thermal plants in the Kathmandu valley which is the main load center in the country. There are five major diesel stations, of which the biggest are Duhabi multifuel (26 MW), Hetauda (11.3 MW), Marsyangdi (2.3 MW), Mahendra (1.6 MW), and Biratnagar (1 MW).

Future Prospects for Thermal Generation: There are limited future prospects for thermal generation except for standby and peaking power from diesel and multi-fuel turbines. Diesel supply for isolated locations could also be considered. Nepal could develop major thermal options based on imported fuels, however, such a strategy is considered to be inappropriate under current national policy, because of susceptibility to changes in the international supplies and prices, and the fact that indigenous energy options are available and are preferred.

4.2 Renewable Energy Sources

Renewable energy sources could become the backbone of rural electrification. Alternative energy technology (AET), basically renewables, excluding grid-linked hydro, have potential to meet a significant portion of the commercial energy demand in rural areas, but are much more limited for urban and industrial supply. National policy is to develop and promote sustainable AET in Nepal wherever possible, and where the supply of energy to the inaccessible parts of the country through an integrated national network may be less cost-effective and more time-consuming. Today's policy of prioritizing urban and industrial consumers before rural consumers needs to be redressed to a certain extent, especially by promoting hydros under 10MW, in order to promote rural equity, reduce environmental deterioration, and boost sustainability such as by eco-tourism.

The most successful AETs in the context of Nepal are micro hydropower, biomass energy (biogas, briquetters, improved cook stoves), solar energy (solar water heaters, dryers, cookers , generators and pumps) wind energy (wind turbines, wind mills), etc. There has been a series of efforts going on in the development of AETs, particularly from the private sector. A number of donor agencies have been supporting various AET projects. Also, the initial infrastructure for R&D, fabrication, promotion and dissemination has been developed.

Micro Hydro: There are over 6000 rivers in Nepal, and many small streams and rivulets whose total length is more than 45,000 km. The total number of micro-hydropower turbines manufactured and installed in Nepal stands at 933 units and its total installed capacity is about 8.7 MW, which corresponds to less than 4% of the total hydroelectric power output of the country. Local manufacturing capability of 1500 KW per year shows the huge potential for the future development of the micro-hydropower sector in Nepal. While Nepal's 25,000 vertical-axis traditional water wheels are inefficient, their power output is sufficient to grind cereals. Their proliferation shows the significant demand for such units. Micro-hydropower is seen as an important potential contribution towards reduction in the demand for traditional fuels. In order to enhance the economic viability of micro- and mini-hydropower, it is necessary to increase the end-uses such as irrigation and cottage industries. Because of hilly topography, micro-hydro has great potential for fulfilling the energy requirement of rural Nepal to a great extent.

Biogas: An assessment of the livestock population in Nepal reveals that biogas plants are capable of catering to the requirement of a million households. About 2,400 MW equivalent of power could be obtained from these plants. The number of biogas plants already installed in the country is about 36,000 which is about 2.5% of total potential of 15 million plants. The target for the fiscal year 2054/55 is to increase the number of biogas plants by 12,000 of which 40% is estimated to be in the terai districts, 50% in the hilly districts and 10% in the inaccessible hilly districts. During the 9th Five Year Plan, 90,000 biogas plants are proposed to be installed. To achieve the target private companies should not only be encouraged but also be supported with access to easy loan, additional training and support for quality control.

Active Solar Thermal Energy: Devices using solar energy are solar water heater, solar dryers, solar cookers, solar pumps and solar generators. Through it is somewhat expensive in the initial stage, it has been found useful in the rural areas where other forms of energy may not be available. During the 8th Five-year plan, 5,000 solar water heaters, 2,500 solar dryers and 5,000 solar cookers are to be distributed. Besides a Master Plan will be prepared for the diversification of the use of solar energy. An appropriate policy on environment will be created to involve the private sector in the production of solar energy related equipment and its use in different sectors.

Active Solar Collectors (Photo-Voltaic): The use of solar photovoltaic in remote communication and solar P.V. based rural electrification has been carried out by the Nepal Electricity Authority in three solar power stations at Simikot (50kW), Gamgadhi (50kW) and Kodari Tatopani (30kW), totaling 130 kW. A private assisted site is Pullmarang in Tanahu district. 43 airports in the Kingdom utilize solar P.V. Energy. Similarly, Nepal telecommunication has installed solar P.V. sets in 16 locations. Solar water pumps are being tested in Dhode (40 kW) and Sundarighat (4 kW). Nepal averages 300 sunny days a year, so has many locations for the exploitation of this renewable energy. The theoretical solar energy potential in Nepal is estimated at 26 million MW.

Wind Energy Development Program: Utilization of wind energy is still in a research phase in Nepal. There is scope for using smaller and self-contained systems utilizing this resource for the generation of electricity, particularly in scattered and sparsely-populated settlements in various parts of the country. Site wind measurements indicate a potential to generate about 200 MW of electrical power with an annual energy production of 500 GWh. This is about 40% of the present electricity production of the country.

Biomass Energy: Biomass energy has an important role in Nepal. About 95 per cent of the total energy consumption is met from forest products and biomass energy. However, most of this energy is wasted due to high inefficiencies. A major contribution to the national energy scenario can be made if existing technology can be made available to raise end-use efficiency.

Alternate Energy: Conclusion

The conclusion of this brief on alternate energy is that there is indeed scope to accelerate alternate power generation, but that this will not substantially postpone the need for medium hydro. Alternate energy should indeed be accelerated, but in parallel with medium hydro, rather than instead of it. The main challenge is to boost micro and mini-hydro for rural areas which are less able to pay for electricity than are urban consumers. Micro-hydro and biogas should be pursued in the rural areas. Worldwide, there is a historic evolution from traditional fuels, through kerosene, to mixed commercial fuels including electricity. Nepal faces the burden of increasing consumption of kerosene as the Terai region phases out of traditional energy.

4.3 Conservation and Demand Side Management

Demand Side Management reduces investment needs for excessive generation, transmission and distribution capacity. While DSM is of primary importance in mature electricity-intensive economies, there is substantial scope for it in Nepal, along with supply development. With such low per capita consumption, Nepal is still on the supply side of the curve. A combination of demand management and boosting supply is needed.

Energy Pricing: Most of Nepal's energy is not traded, hence outside the market. Of the main energy source, fuelwood, little is traded. Most traded fuelwood (e.g., from the Timber Corporation of Nepal) is priced below cost. Imported diesel and LPG prices are set by HMG to provide low cost energy to the general public. Coal price is set at its border price and is exempt from taxes and duties. The price of electricity is set by the Tariff Fixation Commission and the present tariff though high compared to the neighbouring countries is approaching the long-run marginal cost of supply. Phasing down electricity and fuel subsidies would be effective in promoting demand-side management, promoting efficiency and conservation, curbing waste, and reducing environmental damage.

Non-Pricing Potential for Load Management: The NEA/Electricite de France (EdF) study on Load Management Options calculated the maximum load management potential of INPS in 1990 to be around 60 MW as per the following opportunities:

Opportunity	**MW to be Saved**
1. Lighting scheme with CFL retrofits	25
2. Time of Day metering	7
3. Captive generation	10.5
4. Increased exchange with India	11.5
5. Loss reduction	8.5
6. Others	5

Two of the above listed potentials, namely compact fluorescent lighting (CFL) and loss reduction, may potentially result in direct energy saving of 32 MW. However, the economically viable energy saving and demand management options and incentives needed to instigate desired changes in the residential, industrial and commercial sectors needs to be worked out in more detail before they can be implemented.

NEA's losses remain very high at about 25%. DSM is a relatively new discipline in Nepal. Except for some energy awareness surveys and several studies with far reaching recommendations, concrete steps for demand side management have yet to be been taken.

5.1 Environmental and Social Issues

The Screening and Ranking study has resulted in the selection of projects where social and environmental impacts are smallest and where residual impacts can be fully mitigated. The social impacts on people examined by the S&R study include (i) the conventional approach to resettlement assessing the impact of land acquisition for the reservoir inundation area, the power house, access roads, and transmission lines on human settlements, livelihoods and local infrastructure, and (ii) the socio-economic impact of a large imported labor force, the emergence of boom towns, growth of local markets, and changes in the water regime downstream. Social impacts can be adverse, requiring mitigation measures, or positive, enhancing benefits and services to the local population and creating the conditions for more equitable growth. These factors will be examined in much greater detail by incorporating social impacts that affect the PAFs into the presently mandated EIAs and such an EIA will be undertaken as an integral part of the feasibility studies.

The indicators of social impact were organized in the S&R study to arrive at a ranking both with and without the enhancement factors. This dual ranking was necessary because adverse impacts of any project would occur necessarily while socio-economic enhancement is simply a potential which would materialize only if planned investments are made to maximize their potential. The cost of simply mitigating adverse impact will thus be less than that of maximizing enhancement potential. However, the benefits, hence the economic attractiveness of the project would be much greater with the investment in enhancement potential.

On the environmental side, the impacts on biodiversity or wildlife habitat lost to the project, especially rare, endangered, listed or economically significant species are assessed. Special regard is addressed to impacts on fish and aquatic resources in general. The potential for sedimentation, maintenance of adequate water quality, and glacial lake outburst floods also are addressed. Sedimentation risk is especially severe in Nepal. Kulekhani hydro (I & II 92MW) began commercial operation as recently as 1981 with 12 million cubic meters of dead storage capacity which was calculated to be adequate for 100 years. Half of the dead storage was filled with sediment by 1993, and the exceptional floods of 1993 filled another 5 million cubic meters. A sloping intake is, at present, under construction to prevent the blockage of intake by sedimentation.

The S & R process shows that reservoirs in steep uninhabited canyons or run-of-river schemes where water regime is little altered pose far fewer impacts than large shallow reservoirs in populated agricultural land. In addition, hydro impacts are mainly local, whereas thermal impacts (air pollution, water pollution, acid rain, greenhouse gas production) are often regional and global as well.

5.2 Environmental Protection Act (2053) and EA Guidelines

In 1993, Nepal adopted EA Guidelines prepared with IUCN assistance. In 1997, HMG has adopted the Environmental Protection Act (2053) mandating the use of EA for all relevant projects. The Act provides a legal basis to ensure that environmental considerations are fully dealt with in all future projects.
Recent EAs, such as those for Kali Gandaki and Khimti Khola show that the hydro policy, legislation and environmental guidelines are being well implemented. These measures, combined with public consultations for consensus-building in the SEA process, strengthen Nepal's claim to be one of the forerunners in the region in fully integrating social and environmental considerations in the development of the hydropower sector.

For the purposes of the PDF, a draft policy framework has been formulated to harmonize existing legislation and policies with Bank policies. The policy framework will be finalized during negotiations. All sub-projects financed by the PDF will follow the procedures and policies laid down in the proposed framework.

5.3 Institution Strengthening

The process of EA has focused on project-level feasibility studies which are based on national guidelines for EA. These are an important basis for the process and project documentation for the licensing of power projects. As EA is a relatively new field in Nepal, it needs to be fostered for quality assurance, and expedited with more realistic data collection and analysis. The establishment of the Ministry of Population and Environment (MOPE) in 1995 followed by the recent enactment of the Environment Protection Act (2053) (EPA) are landmark achievements in enhancing the EA process in Nepal. The EPA has made the EA process mandatory for all relevant development projects by any proponent whether the governmental or non-governmental.

Water Resources Development (WRD) is the backbone of Nepal's national development. The liberalized economic policy of HMG of Nepal has opened possibilities for investment by private sector entrepreneurs in WRD apart from the considerable emphasis on this sectoral development by Nepal Electricity Authority (NEA). The project licensing procedures, laid down in the Water Resources and Electricity Acts, are designed for providing a process that is credible and efficient, both for potential investors and regulatory authorities. MHSP and the PDF, supported by the World Bank (WB), will catalyze the involvement of private sector investment in the power sector. These two operations seek to accelerate the identification and construction of many hydropower projects in Nepal, which has by far the greatest potential in the sector and the country. Specifically, hydropower projects of medium size (10-300 MW) would become attractive for investors.

The Screening and Ranking (S&R) process adopted by NEA for the selection of Medium Hydropower Study Projects (MHSP) have taken into consideration environmental and social impacts of projects, and have held consultations with affected communities, NGOs and members of the inter-governmental Steering Committee. Experience has shown that appropriate measures cannot be designed to mitigate adverse social impacts and maximize positive impacts without realistic and sound analysis of project impacts on affected communities. Adequate attention to social issues would enhance Nepal's ability to develop its hydro-power potential. The S&R process has focused on social dimensions, along with bio-physical dimensions of the environment early during the project selection process thereby ensuring that all projects emerging through this screening process will include development plans based on sound analysis of anticipated impacts.

At this initial stage, EA reports themselves cover socio-cultural impacts as well. In the future, SIA is expected to grow into an independent field of study, parallel and coordinated with EA. More comprehensive approaches to socio-cultural impacts are needed. In addition, more attention will be given to making the reports available in Nepali, so as to make them understandable to affected people and at the grass-root level. The reports incorporating specially the social aspects is crucial to affected people, who should be given ample access to the study findings so that they are fully aware of project impacts and the measures proposed to deal with them.

In the case of Nepal, the country also possesses a high proportion of the unique and fragile ecosystems of the Himalayan realm. In this realm, the role of the water resources as a factor for sustaining these ecosystems is vital. Similarly, potential user interests, both upstream and downstream of any water resources development on Nepal's rivers, requires assessment of impacts and user/legal implications of the development.

Many governmental and non-governmental institutions which are in some ways concerned with the EAs or reserve the obligations to provide their comments and suggestions, have not yet been strengthened adequately. In the course of the finalization of EA reports, the proponent has to be critically made aware of additional investment and mobilization of other resources in order to satisfy environmental concerns and the affected people in the project area.

In order to ensure sustainability of development activities through proper and continual analysis of policies and project proposals, capacity build-up of the concerned GOs and NGOs, together with the local communities, is urgent. IUCN (1977) provide details of what is needed and what is available. The process of finalizing the EAs should ensure mutually acceptable, non-controversial results.

Subsequent to the EA and Licensing processes for power projects, follows the construction and operational phases. The proponent will be responsible for implementation and internal monitoring of the approved environmental and social plans. HMGN will establish safeguards for proper monitoring so that corrective measures can be taken adequately if anything irregular should occur during implementation.

This forms part of the responsibility of the EDC as licenser, and MOPE as environmental and social regulator to monitor compliance with the environmental and social framework. It will therefore be necessary that EDC and MOPE closely cooperate on how their control and monitoring functions be conducted for these issues and develop the institutional capacity to fulfill these tasks.

Steps are now being taken to ensure adequate institutional capacity in all institutions in the licensing process. Capacity building for the licensing authority EDC is supported by USAID, and for the major project proponent NEA by ADB. Discussions are taking place with ADB and NORAD for proposed technical assistance to the concerned agencies such as MOWR, EDC and MOPE. The NORAD technical assistance forms part of the proposed IDA project and will focus specifically on the necessary capacity building related to hydropower development.

5.4 Public Consensus Building

According to the Constitution of Nepal, every Nepalese citizen has the right to be informed about any public activities going on within the country. Similarly, the Nepal Electricity Authority Act and rules, and the 1993 National Environmental Impact Assessment Guidelines specifically provide for people's participation in different stages of any hydro development process. In addition, international development agencies have their own policies mandating peoples' participation, with which Nepal seeks to comply. Based on these above guidelines Public Consultation Programs are an integral part in different phases of the study of any potential hydropower project.

Public Consultation at the Central level: Public consultation meeting at the Central level is held with the objective of receiving comments and suggestions of intellectuals, professionals, INGOs, NGOs, and of the general public. This sort of meeting needs to be held at several stages of the project cycle and certainly at least before the final take up of the project.

Public Consultation in the Project Specific Areas: This type of meeting is held in the project area. Project Affected Families (PAFs), local NGOs, and the general public are informed about the physical, biological, socio-economic and environmental impacts (positive and negative) due to the construction of the project, and consulted to arrive at practical and acceptable mitigation.

Process of the Consultation Meeting: Advance notification is given in newspapers and individual letters of invitation and notification are sent to the concerned Village Development Committee(VDCs), DDC, and district government offices.

Distribution of Brochure: Brief descriptions of the project, positive and negative impacts and mitigation measures are described in the project-specific brochure which is written in Nepali language. The brochure explains how further information can be obtained and whom to contact for any queries.

Public Participation: Such public consultation meetings have been conducted with increasing frequency during the last few years and significant numbers of people including the PAFs and SPAFs have participated. People's participation and involvement has been most intense from the feasibility study level.

Stakeholder Identification

Primary Stakeholder: Inter-Agency group for the MHSP: National Planning Commission (NPC), MOF, MOWR, NEA, EDC, WECS, MOPE, DOR, Ministry of Forest and Soil Conservation.

Stakeholders in general: Government Agencies, Local professionals, NGOs, PAFs, General Public (Power Customer and Tax Payers), Donors and Financial Community and Private Sector-Companies.

Transparency

Establishment of the Public Information Center in NEA's head office, notices and information in Newspapers about the projects, distribution of salient feature brochures are all now becoming systematic and contribute to a significant degree of transparency. Interaction with different interested groups and the availability of photocopies of project reports to the interested parties (at their own cost) is proving effective in promoting transparency.

6.0 Specific Recommendations

The Screening and Ranking Process undertaken by the Medium Hydro Study Project helped in prioritizing the selection and investment of 10 to 300 MW projects. S & R also is a robust means of prioritizing large hydro and multipurpose projects. Now that the S & R process has been successfully applied, the lessons learned during its application need to be internalized and this will lead to a refinement of the process. The S & R process needs to be periodically updated, probably in advance of each of HMGN's 5-year planning cycles.

More storage sites in the 50-300MW range suitable for domestic peaking requirements are needed, and a site investigation program should be established to identify such sites.

As access roads are so important and expensive for hydro development, regional road planning needs to be coordinated with hydro planning. As hydro projects commonly require construction of camps to house about 5000 workers for nearly 5 years, and these catalyze boom towns, regional development would benefit by close coordination. If the camps and boom towns are planned to become permanent facilities for regional development after hydro construction is complete, their design will be different, but not necessarily more expensive. Construction camps and boom town planning are becoming more important. Coordination with rural electrification also would benefit both hydro development and regional development.

As sedimentation is such a risk to hydro in Nepal, monitoring of relevant watersheds and their appropriate management would decrease such risks and conserve valuable topsoil from loss by erosion. Some provision for investment required for watershed management and Catchment Area Treatment needs to be incorporated in investments for Power Development.

The data base for optimizing power sector work needs to be enhanced. For example, gauging stations should be installed at sites that have been selected for feasibility studies where no station currently exists and for other attractive sites identified by the fine screening; air photographs, imagery or monitoring capability need to be acquired for some sites, for glacial lakes above existing or proposed hydro, and for monitoring watershed quality to ensure its appropriate management and to reduce sedimentation risks; rulings on what is permissible inside National Parks are needed; nationwide fish surveys are needed as a matter of urgency especially on migrations; the few mentions of tigers, which are exceedingly rare worldwide, in the MHSP need to be verified by specialists.

7.0 References and Abbreviations

A. References

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B. Abbreviations

ADB	Asian Development Bank
AET	Alternative Energy Technology
DDC	District Development Committee
DOR	Department of Roads
EA	Environmental Assessment
EDC	Electricity Development Center
EPB	Environmental Protection Bill
GO	Governmental Organization
HMG	His Majesty's Government
ICIMOD	International Center for Integrated Mountain Development
INGO	International Non-Governmental Organization
IUCN	International Union for the Conservation of Nature
MHSP	Medium Hydropower Study Project
MOF	Ministry of Finance
MOPE	Ministry of Population and Environment
MOWR	Ministry of Water Resources
MW	Megawatt
NEA	National Electricity Authority
NGO	Non-Governmental Organization
NPC	National Planning Commission
PAF	Project Affected Family
PDF	Power Development Fund
PV	Photo-voltaic
Rs	Rupees
SEA	Sectoral Environmental Assessment
SIA	Social Impact Assessment
SPAF	Seriously Project Affected Family
TOR	Terms of Reference
VDC	Village Development Council
WB	World Bank
WECS	Water & Energy Commission Secretariat

8.0 Tables

Table 1: Coarse Ranking Criteria and Criteria Weights

A. Technical / Economic Ranking Criteria

Criteria	Scoring System		Weighting
Economic Supply Cost (75%)	Based on Discounted Cost/Discounted Energy (in US cents/k Wh.). Inclusive of civil,E&M transmission, road access, environmental mitigation and cost contingencies		75%
System Fit for Medium-Term Supply (25%)	Project Size	Score based on the installed capacity in 3 size ranges reflecting what is needed in the "Project Basket" for system planning.	3%
	Firm Energy Contribution	Score based on ratio of firm to average energy production from the project.	10%
	Flexibility of Dispatch	Score based on ROR, PROR or Storage and ability to dispatch at peak or seasonally.	7%
	Regional Location	Score based on regional supply-demand balance.	5%
			100%

B. Environmental / Social Ranking Criteria

Criteria	Scoring System		Weighting	
			ROR/ PROR	Storage Project
	Land Take	Score based on the amount of land required for the project facilities, reservoir and access roads.	17	14
Physical Environment	Watershed Condition	Score based on the ICIMOD classification of watersheds in Nepal.	17	14
	Downstream Impacts	Score for storage projects only, based on the potential of adverse downstream impacts.	-	14
Biological Environment	Biodiversity Impact	Score based on the potential for the project to adversely impact sensitive biological areas.	17	14
	Aquatic System Impact	Score based on the length of river stretch and aquatic habitat adversely affected.	14	14
	Number of PAP	Score based on estimated number of persons directly and indirectly affected by the project in terms of relocation or other disturbance.	27	23
Socio-Cultural Environment	Cultural Sensitivity	Score based on the potential for adverse socio-culture impacts of the projects.	8	7
			100%	100%

Table 2: Fine Ranking Criteria and Criteria Weights

A. Technical / Economic Criteria

Criteria	Scoring System		Weighting
Economic Supply Cost	Based on Discounted Cost/Discounted Energy (in US cents/k Wh.). Inclusive of civil, E&M transmission, road access, environmental mitigation, and cost contingencies.		65%
Project Risk	Schedule Risk	Score based on the length and difficulty of road, bridges and transmission connection to the grid.	3.1%
	GLOF Risk	Score based on the type and number of GLOF hazard lakes.	2.3%
	Sediment Risk	Score based on the degree of sediment related issues for PROR and Storage Projects.	2.3%
	Hydrological Risk	Score based on the availability of a gauging station and the length of records.	2.3%
System Fit for Medium-Term Supply	Project Size	Score based on the installed capacity in 3 size ranges reflecting what is needed in the "Project Basket" for system planning.	3%
	Firm Energy Contribution	Score based on ratio of firm to average energy production from the project.	10%
	Flexibility of Dispatch	Score based on ROR, PROR or Storage and ability to dispatch at peak or seasonally.	7%
	Regional Location	Score based on regional supply-demand balance.	5%
			100%

B. Environment / Social Criteria

Qualitative Environment and social Criteria	Physical Environment Weight	Biological Environment Weight	Social Environment Weight
Project Site/Selection	8	8	10
Construction Phase Impacts	8	8	10
Operation Phase Impacts (Long-term)	6	6	10
Enhancement Factors	8	8	10
Column Total	30	30	40

Notes:

1. A total of 74 adverse environmental impact factors and 16 enhancement factors were considered and each scored from 0-3; 0 meaning not significant and 3 meaning potentially significant.
2. Each of the above categories in the (4 x 3) matrix had factors. The scores for these factors (0 to 3) were summed and the sums were multiplied by the weighting out of 100 for that category.
3. It may be seen from the column totals that the overall weighting was:
   - Physical Environment (+ve and -ve impacts) - 30%
   - Biological Environment (+ve and -ve impacts) - 30%
   - Social Environment (+ve and -ve impacts) - 40%

     100%

Table 3: Names of Seven Fine Screened Projects to be Advanced to Full Feasibility and EIA Study Under Phase II of MHSP

1	BG-0	Budhi Ganga	22 MW	Run-of-River
2	RH-0	Rahughat Khola	24 MW	Run-of-River
3	LK-4	Likhu Khola	34 MW	Run-of-River
4	KB-A	Kabeli-A	35 MW	Run-of-River
5	TM-4/5	Tamur	72 MW	Run-of-River
6	KR-1A	Upper Karnali	240 MW	Peaking Run-of-River
7	DD-1	Dudh Koshi-1	134 MW	Storage