

Water Resources Development

1.0 General

Nepal has around 83,000 MW of hydropower potential of which about 43,000 MW is considered technically and economically feasible. As compared to this huge potential, present installed hydro-electric capacity in Nepal including the public sector and others is around 559 MW (about 1.3 percent of the total potential) including around 7 MW of micro-hydropower. Private operators have total installed capacity of 144 MW from which NEA purchases power. Apart from large and medium sized hydropower plants, NEA has also 40 small hydro plants of which nine are grid connected (12.55 MW) and the rest (6.4 MW) are stand alone plants. Thus present installed hydropower capacity in the national system including private and others is around 552 MW. Statistics show that some 40% of the population, mostly in urban and semi urban areas, are estimated to have access to grid electricity and another 7% to some form of electricity through alternative energy sources.

It is estimated that the total energy consumption in 2000/01 was about 338 million Giga Joules (GJ) or 7,940 Tons Oil Equivalent - TOE), which comes around 14 GJ per capita energy consumption. In Nepal traditional energy sources are the biggest contributors having their share of 86 percent in the total energy. These sources comprise of fuel wood (76%), and agriculture residues and animal waste (10%). Commercial energy sources share 13.64 percent leaving rest to other non-conventional sources. Electricity contributes about 1.2 % of the total energy needs. If per capita energy consumption is any indicator of the status of industrial development of the country, Nepal has long way to go with around 60 KWH consumption per annum before coming close to industrialized countries where it is around 1,000 KWH. Hydropower development has potential to raise the contribution of electric energy in the total energy demand and thus relieve pressure on fuel wood, a principal cause of environmental degradation in Nepal.

Various sectors of the economy - industrial, commercial, irrigation and others - require cheap and reliable energy for rapid development. Having no source of its own for fossil fuels but at the same time with high potential for hydropower, Nepal's almost entire energy demand could be met by the development of this clean energy source. His Majesty's Government of Nepal (HMG/N), therefore, has placed hydropower development as one of the top priorities in its development agenda.

Prior to 1960, all the hydropower stations were constructed through grant aid from friendly countries like the USSR (Panauti), India (Trishuli, Devighat, Gandak, Surajpura- Kosi) and China (Sunkosi). Since 1970, hydropower development took a new turn with the availability of bilateral and multilateral funding sources. The major donor countries in the period were Japan, Germany, Norway, and South Korea, Canada, Finland, Denmark, Sweden and USA. The financial lending agencies were the World Bank, Asian Development Bank (ADB), Japanese Bank for International Cooperation (JBIC), Saudi Fund for Development, Kuwait Fund, and others.

From the 1990s, subsequent to the adoption of the policy of economic liberalization, hydropower development took yet another turn with the private sector entering the arena. His Majesty's Government, along with other relevant policy and regulatory reforms, approved Hydropower Policy 1992 in order to attract private sector investment in the sector. Private sector hydropower projects such as Khimti, Bhotekosi and Indrawati materialized as a consequence of introduction of that policy. In order to encompass projects of various scales intended for domestic consumption as well as to export hydropower, the old policy was replaced by the Hydropower Development Policy 2001 to provide further impetus to the active participation of the private sector.

Development of hydropower in Nepal is a very complex task as it faces numerous challenges and obstacles. Some of the factors attributed to the low level of hydropower development are: lack of capital, high cost of technology, political instability, lower load factor due to lower level of productive end-use of electricity and high technical and non-technical losses.

2.0 Sector Strategy

Nepal has joined hands with the international community in the World Summit for Sustainable Development in expressing its commitment to take joint actions and improve efforts to work together at all levels to improve access to energy services for sustainable development sufficient to facilitate the achievement of the Millennium Development Goals. These goals include halving the proportion of people in poverty by 2015. Similarly, Nepal joined its voice with the international community in the Third World Water Forum for integrated development of the water resources geared towards poverty alleviation, achieving food security, generating renewable energy and promoting regional cooperation. These commitments are well reflected in the national policies and programmes.

The government is at present implementing the Poverty Reduction Strategy which is the Tenth Five Year Plan (2002-2007), and coincides with the first five years of the 25 years Water Resources Strategy- Nepal, 2002.

2.1 Hydropower Development Policy, 2001

The Government is pursuing water resources development in Nepal from three different approaches. Firstly, to develop small and decentralized hydropower projects to meet the local demands in remote and isolated regions of the country. Secondly, to develop medium sized power projects to meet the national demand within the national grid including surplus for export, and to develop local capacity. Thirdly, large-scale multi purpose projects to meet the regional demand for food, energy and flood control. With this vision, the Government has adopted the new Hydropower Policy 2001 that is designed to attract both the local and foreign private developers.

Through the Hydropower Development Policy 2001, Nepal has expressed its commitment on the institutional reforms in this sector. The Policy is keen on establishing a strong regulatory body that would not only fix electricity tariffs but would also oversee the qualitative aspects such as safety, quality of supply, reliability, safeguarding consumers interest, criteria for load dispatch etc. The existing Tariff Fixation Commission would be expanded to act as the regulatory body. Similarly clear roles have been given to the existing Water and Energy Commission (WEC) to act as a policy making and planning body and the Department of Electricity Development (DOED) to act as a study and promotional body. The Policy has also clarified its intention to go for multi users and multi buyers mode from the current monopoly enjoyed by the NEA. The NEA will be restructured with necessary reforms leading to the formation of an autonomous National Grid accessible for wheeling energy to all the buyers and suppliers in order to create a favourable situation for foreign investors and the competitive market necessary for consumers to obtain electricity at affordable prices.

2.2 National Water Resources Strategy, 2002

Realizing the fact that the development and management of water resources should be undertaken in a holistic and systematic manner aimed at the sustainable use of the resources ensuring conservation and protection of environment, Nepal has adopted the National Water Resources Strategy (NWRS). Acknowledging the prevailing issues and the constraints in the water resources sector, the Strategy has identified ten different strategic outputs and defined strategies for each of them. Regarding Hydropower development, the strategic output defines Nepal's strategy as to achieve "Cost-Effective Hydropower Development in a sustainable manner". The Strategy further defines the activities required to meet the following objectives:

- ?? Develop cost-effective small (including micro- and mini-) and medium hydropower projects to meet domestic demand at an affordable price.
- ?? Encourage private investment in hydropower development and power distribution.
- ?? Provide increased government support to accelerate rural electrification.
- ?? Integrate improved social and environmental mechanisms into hydropower development.

- ?? Encourage Nepal's power-based industries and transportation system to create markets for large hydropower generation plants.
- ?? Facilitate the flow of funds from the domestic financial sector to the hydropower sub-sector.
- ?? Strengthen institutional and physical infrastructure for power export.
- ?? Promote hydropower research and development.
- ?? Restructure the power utility company.

The strategy then prescribes indicators for the (i) short (5 years), (ii) medium (15 years) and (iii) long term (25 years) for achieving the outlined outputs, which are:

(i) Short-term

- ?? by 2007, 820 MW (revised to 700MW) hydropower capacity developed to meet projected demand
- ?? by 2007, laws making national contractors/consultants participation mandatory in all types of projects promulgated;
- ?? by 2007, 25% of households supplied with electricity;

(ii) Medium-term

- ?? by 2017, 2230 MW hydropower developed to meet projected demand of 2230 MW, including 400 MW for export;
- ?? by 2017, 38% of household supplied with electricity;

(iii) Long-term

- ?? by 2027, 60% of households have access to grid supplied electricity; and
- ?? by 2027, Nepal is exporting substantial amounts of electricity to earn national revenue.

The strategy not only takes into account of water uses such hydropower and irrigation but also recognises other uses of water in areas such as tourism, fisheries. Due considerations are also given in conservation and environment protection.

The following policy measures have been adopted to attract foreign and national investors in Nepal:

- ?? One window policy
- ?? Attractive investment features
- ?? Repatriation of foreign exchange
- ?? Fixed royalty payments
- ?? Import concessions
- ?? Export potential
- ?? No Nationalization of projects

2.3 Tenth Five-Year Plan (2002/03 – 2007/2008)

Based on the long-term vision and to achieve the long-term targets set out by NWRS; the objectives, targets and strategy for the Tenth Five-Year Plan (2002/03 – 2007/2008) have been fixed. These are described hereunder:

2.3.1 Plan Objectives

During the Tenth Plan period electricity will be developed to achieve the following objectives:

- ?? Generate electricity at low cost by utilizing the available water resources of the country.
- ?? Extend reliable and qualitative electricity services all over the country at a reasonable price.

- ?? Tie-up electrification with economic activities.
- ?? Support development of rural economy by extending rural electrification.
- ?? Develop hydropower as an exportable commodity.

2.3.2 Plan Targets

The following targets have been set for the Tenth Plan.

- ?? Increase installed capacity of hydroelectric projects in the National Electricity Grid to 700 MW (revised to reflect present reality) from the present 552 MW.
- ?? Increase electricity services to 55% of the population from the present 40%.
- ?? Increase per capita electricity consumption to 100 kWh from the present 60 kWh.

2.3.3 Plan Strategies

In order to meet the Plan objectives and to achieve the Plan targets, following strategies will be adopted:

- ?? Make electricity accessible to rural economy from the viewpoint of social equity.
- ?? Adopt clear, simple and transparent procedures to increase private sector participation in electricity development.
- ?? Implement small, medium, large and storage hydroelectric projects by harnessing the water resources of the country towards fulfilling national interest, environment conservation and maximum benefit.
- ?? Implement hydroelectric projects by attracting investment from private sector and joint venture of private and public sector and even by public sector as required.
- ?? Make river basin planning approach the basis for the development and management of some rivers.
- ?? Adopt a strategy to develop hydroelectricity with bilateral/regional co-operation.
- ?? Minimize risks arising in hydroelectric projects through the joint effort of the government and the private sector. Either the Government or the private sector to bear those risks that cannot be eliminated, but affordable at the lower cost.
- ?? Extend transmission interconnections with the Indian power grid.
- ?? Carry out overall power sector reform along with the restructuring of the NEA.

2.4 Specific Policies and Actions for Rural Electrification

Recognising the importance of rural electrification in poverty alleviation, the government has adopted some specific policies and actions for the development of rural electrification which are presented below.

2.4.1 Specific Policies

- ?? In remote areas, electrification programs will be encouraged by implementing small and micro-hydroelectric projects at local level.
- ?? Rural electrification program will be expanded to provide electricity services to maximum number of people.
- ?? Use of surplus electricity during off-peak period will be encouraged in rural water supply, irrigation, industry and tourism sector.

2.4.2 Specific Actions

- ?? The government will gradually expand the rural electrification program. A 'Rural Electrification Fund' will be established for micro-hydropower development and rural electrification program by apportioning some of the royalty amount.

- ?? Reasonable provision will also be made to include rural electrification while granting electricity distribution licenses.
- ?? Electrification will be encouraged in the rural areas directly affected by the electricity generation projects. Energy royalty will be exempted on electric energy consumed in such areas. Such exemption will be allowed for the first fifteen (15) years from the date of commercial operation of the projects.
- ?? One (1) percent of the royalty received by the government from hydroelectric projects will be provided to those Village Development Committees (VDCs) that are directly affected by the structures of such projects. This amount shall be utilized for rural electrification in the project area.
- ?? The government will provide subsidy for the construction of micro-hydroelectric stations of up to 100 kW at rural level by domestic private sector Alternative Energy Promotion Centre (AEP) for electricity generation and distribution.
- ?? Electricity will be supplied to hilly rural areas away from the reach of the National Electricity Grid through small and micro-hydroelectric projects. Responsibility of Operation and Maintenance (O&M) of such projects will be given to local co-operatives and such co-operatives will be associated right from the project planning and implementation stage.

2.5 MTEF (Mid-Term Expenditure Framework) Approach of Prioritization

The MTEF aims to integrate policy making with economic planning and budgeting in the context of a multi-year cycle, and ensures that expenditure programs are driven by strategic priorities and disciplined by hard budget constraints. Linking policy making, planning and budgeting through the MTEF is believed to enhance the probability that the allocation of public funds will achieve strategic objectives and targets in an efficient and effective manner.

The first MTEF period covered the three fiscal years from 2002/03 to 2004/05. Building on the experience of the first MTEF, a second MTEF has been prepared for the period 2003/04 to 2005/06 with improvements in project prioritization and relation of project outputs with poverty monitoring indicators in line with the Poverty Reduction Strategy Paper (PRSP).

3. Present Status

The present status of hydropower development in the country is highlighted in the sections to follow.

3.1 Hydro Plants in Operation

There are 10 major existing hydro projects operated by NEA with a total installed capacity of 389.15 MW. These are shown in table 1.

1	Trisuli	24.00 MW
2	Sunkosi	10.05 MW
3	Gandak	15.00 MW
4	Kulekhani I	(Storage type) 60.00 MW
5	Devighat	14.10 MW
6	Kulekhani II	32.00 MW
7	Middle Marsyangdi	69.00 MW
8	Puwa Khola	6.20 MW
9	Modi Khola	14.80 MW
10	Kali Gandaki "A"	144.00 MW

Total	389.15 MW
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Table 1. Major Projects operated by NEA

In recent years, Nepal's remote villages have seen a surge in small turbines with capacities ranging from 1 kW to 100 KW, which are used to electrify isolated settlements on the mountain slopes and in valleys, and to run water mills. It is estimated that there are over 2,000 such turbines, which are generating around 7 MW of electricity as well as providing mechanical power.

3.2 Hydro Plants under Construction

There are some hydro plants under construction by NEA and private companies. These are presented in table 2.

Project	Capacity	Developer
Middle Marsyangdi	70 MW	NEA
Upper Modi	14 MW	GITEC
Gamgad	0.40 MW	NEA
Heldung	0.50 MW	NEA
Sunkosi Small	2.6 MW	Sanima HP
Chaku Khola	1.50 MW	APCO

Table 2. Projects under Construction

3.3 Private Sector Involvement in Power Generation

NEA is a public utility with the mandate for generation, transmission and distribution of electric energy in the country. Apart from NEA, there are several independent power producers, some of which have already established hydropower plants. The IPPs falling in this category are Himal Power Limited, Bhotekosi Power Company, Chilime Power Company, National Hydropower Company, Butwal Power Company, Syange Vidyut Company and Arun Valley Hydropower Development Co. Foreign investors such as Asian Brown Boveri (ABB), Panda Energy Group, Statkraft are also involved in some of these companies. Snowy Mountain Engineering Corporation (SMEC) of Australia is another company working in Nepal for the West Seti Project (750 MW) intended to export power to India. PPA has been initiated with India for the purchase of power from the West Seti project.

There are several other IPPs that are working in the domestic sector and have concluded power purchase agreements with NEA. A list of IPPS is presented in Annex I. Of 31 small plants constructed by NEA, 12 plants are now being operated by private sector in isolation in remote villages on lease.

3.4 Power Development Fund

A US\$ 35 million Power Development Fund (PDF) assisted by the International Development Association (IDA) of the World Bank is being established with the aim of providing long term debt financing for power projects and promoting the development of hydropower in Nepal. PDF will act as a catalyst to facilitate the inflow of private capital. The purpose of the fund is to supplement private financing available for the development of the power sector to meet the demand for electricity.

3.5 Power Sector Reform

HMG/N has expressed its commitment for power sector reform through various policy initiatives and accordingly a number of activities are being undertaken.

The process of internal restructuring has been initiated by NEA with the creation of discrete entities of generation, transmission and system operation, distribution and consumer services and engineering services as core business groups in its corporate structure. It has formally launched eighteen Distribution Centres with increased autonomy, authority and accountability in its operations. It is in the process of signing performance agreements with the other core business groups. NEA has also adopted a Distribution Centre Operation By-law and a separate Community Rural Electrification By-laws 2003, and is in the process of formulating a Grid Code and putting in place a wheeling charge or transfer price.

With an assistance from Asian Development Bank, a study is currently being undertaken with the objective of evaluating options and preparing a general plan for reforming and restructuring NEA and its distribution system in order to improve accountability, efficiency and reduce the cost of power supply.

A Study has been conducted with the USAID assistance on the establishment of the Nepal Electricity Regulatory Commission and preparation of a road map for the role and strengthening of the Department of Electricity Development (DOED). A detailed implementation plan for the roadmap is expected in a separate package.

JBIC is currently undertaking a specific study on sustainable energy sector development strategy.

3.6 Development of the Grid System

At present, the Integrated Nepal Power System (INPS) consists of 1,132 Km of 132 kV single circuit, 412.1 Km of 132kV double circuit, 231.46 Km of 66 kV single circuit, 161.3 Km of 66 kV double circuit, 22 Km of 66kV and 132 kV double circuit, 3.37 Km of 66 kV four circuit and 2,362 km of 33 kV single circuit transmission line. Total sub-station capacity of the system is 902.45 MVA.

3.7 Community Participation in Rural Electrification Schemes

HMG/N has adopted the concept of community participation in rural electrification schemes in order to accelerate the pace of expansion into the rural areas and to manage such rural distribution systems in a sustainable manner through Local Users' Group Cooperatives. In this regard, the NEA has received 127 applications from such cooperatives, and sanctioned 27 such applications, out of which 18 agreements have already been signed. If such Users' Group cooperatives agree to contribute 20% of the expenses needed for network expansion, then the government policy is to provide remaining 80% of the cost requirement.

4.0 Future Programs

4.1 Load Forecast

The load forecast for Integrated National Power System (INPS) is shown in Annex II. The load has been forecasted considering the country's macro-economic indicators and rural electrification expansion programs. The forecasts revealed that the energy and peak demand is expected to grow more than three times between 2004 and 2020.

4.2 Power Generation Expansion Plan

NEA has prepared the Power Generation Expansion Plan to meet the projected demand until the year 2010/11. It is now conducting exercises on a new Least Cost Generation Expansion Plan in coordination with an overall generation expansion plan, which will also incorporate projects proposed with private sector investment.

List of candidate projects comprising the project basket of the generation expansion plan until the year 2010/11 is presented in Annex III.

4.3 Potential for Cost/efficiency Improvement

There is a significant potential in Nepal for cost and efficiency improvement in hydropower harnessing. The major features of such an improvement are:

- a) There is a need for increased use of local resources in project development. Project development for domestic power needs through indigenous resources will reduce the vulnerability of exogenous risk to a large extent.
- b) Project selection based on ranking with sufficient alternatives would make the project more efficient. In the past, some projects in Nepal had to be selected due to lack of sufficient alternatives. At present a number of projects have been studied to feasibility level, which provides sufficient alternatives.
- c) Enhanced use of domestic manpower and manufacturing base for planning, design and construction of hydropower projects will not only increase the manpower skills but will also reduce the cost in obtaining such services from out side. Now, Nepal has more than 600 engineers that have multiple skills and vast experience in such activities. Local construction and manufacturing skills have been considerably improved after the successful completion of a number of medium sized projects in recent years in the public and private sectors. This capability needs to be effectively utilized for future project development on a wider scale.
- d) Transmission line development particularly along the north- south corridors will enhance the attractiveness of hydropower schemes, which are located mainly in the remote north of the country. In this regard, NEA has studied six north-south corridors, of which the Shivpur-Tamghas-Modi and the Damak-Phidim-Hille corridors are studied at feasibility level.
- e) The creation of a regional grid will greatly help the project development of export- based projects in Nepal for regional benefit.
- f) Project development of higher capacity will have benefits of economy of scale if a sufficiently competitive institutional environment can be fostered.

4.4 Opportunities for Plant Upgrading

Most of the projects in Nepal are relatively new ones built in the late '80s and in fact no major upgrading is taking place at the moment. Trishuli Devighat project with a combined capacity of 35 MW was upgraded in 1994-96. However, there are some plants suitable for upgrading like the 10 MW Sunkosi built in 1971, 2.5 MW Panauti built in 1965. A few small plants, which are a vital source of power in the remote parts also require upgrading and capacity expansion as most of their supply has been outstripped by the increasing demand.

4.5 Potential for New Projects

Apart from the projects listed in the Generation Expansion Plan (Annex III) there are a number of projects identified and studied for development; Annex IV lists some of these. Local developers in Nepal have been involved mostly in the smaller power plants. Larger projects require external financial support. Foreign investors are showing interest on the prospects of hydropower marketing in the region, particularly in India, before investing in energy developments. At present, the Snowy Mountain Engineering Corporation (SMEC) of Australia has been successful in initialing a Power Purchase Agreement (PPA) with India for the 750 MW West Seti Project. This heralds a good beginning for future export-oriented power projects. A Nepal-India joint committee is also working on the preparation of the Detailed Project Report of the 6,000 MW Pancheswor Project on the Mahakali River.

4.6 Regional/Bilateral Perspectives

Nepal's hydropower development prospect is not limited only to its own development but it can be helpful in the promotion of regional economic development. The potential of Nepal's hydropower opens the possibilities for bilateral and regional cooperation. This development is associated with other multiple benefits, such as flood control, increased regulated flow facilitating navigation and increased area under irrigation in lean season that open up the possibility of ushering in a new cycle of economic growth in the poverty stricken areas of the Ganges Basin. Significant in the regional perspective is Nepal's policy that allows financing by both private and public sectors at national, bilateral or multilateral level. Nepal has several storage as well as cascade projects suitable for development under a regional umbrella of cooperation. Some initiatives have taken place involving sub-regional countries Nepal, India, Bangladesh and Bhutan. Inspired by the Mekong River Commission, the Asian Development Bank has introduced the concept of the South Asia Growth Quadrangle (SAGQ) and has initiated the South Asia Sub-regional Energy Cooperation (SASEC). Similarly, USAID has also shown keen interest in this aspect and is playing a catalyst role in fostering sub-regional cooperation in energy sector through South Asia Regional Initiative in Energy (SARI-E).

At the bilateral level, the Government of India has expressed its willingness to conduct the study of the 600 MW Budhi Gandaki Storage Project. The National Hydropower Company (NHPC) of India has expressed its interest in taking up the 300 MW Upper Karnali Project in joint venture with NEA. Under the ongoing power exchange arrangement with India, Nepal exported to India around 186 GWh of energy and imported around 150 GWh of energy in 2002/03.

5.0 Financing of NEA's Key Programs and Activities

NEA self-finances most of the programs and activities. HMG/N also provides budgetary support to NEA from its own resources and through foreign aid (grants and loans). NEA also invests its own resources to partially support running these programs and activities.

5.1 Targeted Projects and Budgetary Requirements

The physical targets\ expected outputs during the period (2003/04-2006/07), which comprise a combination of public sector, public-private and private sector projects, are depicted in Table 3.

	2003/04	2004/05	2005/06	2006/07
Power Generation (excluding thermal and alternate energy)	553Mw	563 Mw	578 Mw	652 Mw
Transmission Line (Km)	1962	1989	2101	2357
Access to Electricity service from national grid	35%	37%	39%	41%

Table 3 : Targets

Expected power generation in the period 2004/05 to 2006/07 is presented in Table 4.

Project	2004/05	2005/06	2006/07	Developer
Middle Marshyangdy			70	NEA
Mailung		5		Private Sector
Others Below 5 MW	7.9	11.2		„
Total	7.9	16.2	70	

Table 4: Additional Power Generation (MW) until 2006/07

Starting from the fiscal year 2002/03, budget allocation and expenditures are being regulated through the Medium Term Expenditure Framework under the umbrella of the Tenth Plan.

NEA has different programs under 4 major headings- power generation, power system reinforcement and transmission, power distribution and electrification, and survey studies & miscellaneous. Details of those programs are depicted in Annex V. The total budget proposed to implement the above-mentioned programs for the fiscal year 2003/2004 is NRs.6,693.50 million (NRs 530.10 million from government resources, NRs.795.50 million from NEA resources, and NRs.5367.50 million from foreign aid). For the subsequent two fiscal years 2004/05 and 2005/06 the estimated budgets are NRs. 11,845.40 million (NRs.1,313.40 million from government resources, NRs.1,913.70 million from NEA resources, and NRs.8,618.30 million from foreign aid) and NRs. 12,869.00million (NRs.3,869.00 million from government resources, NRs.2,683.00 million from NEA resources and NRs.6,317.00 million from foreign aid) respectively.

In addition to the NEA requirements mentioned above, the Department of Electricity Development will require NRs.284.20 million in 2003/04, NRs.332.60 million in 2004/05, and NRs.279.10 million in 2005/06. The Water and Energy Commission Secretariat will require NRs.16.55 million in 2003/04, NRs.18.95 million in 2004/05, and NRs.9.70 million in 2005/06. The Water and Energy Commission Secretariat is expected to complete the on-going National Water Plan at a cost of NRs.10 million by FY 2003/04. The allocated and anticipated budgets of these organisations are annexed (Annex VI – XI). For Alternate Energy and Micro-hydropower the budgets planned under the Ministry of Science and Technology are NRs.171.4 million for FY2003/04, NRs.180 million for FY2004/05, and NRs.220 million for FY 2005/06.

It is to be noted that of the total budgetary requirement for the Electricity Sector, the major share of the funding, around 70% - 90 %, is anticipated to come from donor agencies.

6.0 Projects with Donor Support

Apart from the IDA funded Power Development Fund Project and the Power Sector Reform initiatives that have already been mentioned, HMG/N has undertaken the following programs in cooperation with different donors:

The USAID has extended cooperation for the feasibility study of five small hydropower projects. An agreement has been signed recently between the governments of Nepal and Norway for the feasibility study of up to ten small and medium size hydropower projects. Preliminary arrangements are being made for the joint study of the Saptakoshi Multipurpose Project in cooperation with the Government of India. The Government of India has agreed to conduct the study of the 600 MW Budhi Gandaki Storage Project.

Slated for commercial operations in 2006 is the 70 MW Middle Marshyangdi Project undertaken under the German Government grant assistance. There are a number of pipeline projects of different sizes at various stages of development. PDF with World Bank funding is expected to be a milestone for promoting private sector investment in power generation. One medium (30 MW) and a number of small (total 10 MW) projects are expected to be developed from private investors with support from PDF. The feasibility study of the Upper Tamakoshi (250 MW) is on-going with the grant assistance of NORAD of Norwegian Kroner 14.8 million. Financial assistance is being sought for the detailed study and implementation of Upper Seti (122MW) storage Project and Upper Modi A (42 MW) Project. In generation expansion, the Government intends to rely more on the private sector and public-private joint ventures than

on public initiative alone. Until the private sector comes out adequately to meet the current demand, the Government may have to continue to take up some projects.

In the field of transmission, NEA is operating at system voltage levels of 132kV and 66kV. Rising load demands have created load saturation in some sectors of these transmission lines leading to poor regulation and reliability at the supply terminals resulting in increase in technical losses. The completion of projects like the Middle Marshyangdi would require augmentation in the current carrying capacity of the major 132 kV network and construction of some 220 kV lines. The urgently needed 220 kV sections are Hetauda- Bardghat and Khimti –Dhalkebar. The Khimti –Dhalkebar 220 kV transmission line is going to be constructed with loan assistance of the world Bank, while efforts are underway with donors for the implementation of the 220 kV Hetauda – Bardghat section. NEA is also constructing three power exchange links, namely, Butwal- Sunauli, Parwanipur – Birgunj and Dhalkebar – Bhittamod at the 132 kV level to enhance the transfer capability of the Nepal-India crossborder interconnections.

Nepal Power Development Project includes a component for NEA which carries a total assistance of US\$ 32.6 million (US\$ 15.4 million as credit and US\$ 17.2 million as grant) for expansion of transmission lines to strengthen the national grid and reinforcement and expansion of the distribution system. This will enhance the quality of grid connected supply to 34,000 consumers including 17,000 new connections. In the area of distribution system expansion in the Mid and Far Western regions of the country, the Swedish Government has conveyed its commitment to provide concessionary credit of about US\$ 20 million.

The Rural Electrification, Transmission and Distribution Project aided by the Asian Development Bank and OPEC has five different components that will in addition to providing transmission and institutional support, develop the distribution system to connect about 123,000 rural households of 277 Village Development Committees

7.0 Challenges and Issues

Around 40 [percent of the population has access to](#) some form of [electricity, the majority being in the urban areas.](#) [In a steep terrain country like Nepal with dispersed villages in the hills and mountains, electrification is very costly. This situation poses challenges in managing the financial resources to expand the electrification network.](#)

[The electricity tariff in Nepal is high, and is beyond the capacity of many of the consumers. The reasons are manifold. The basic infrastructure is not well developed. The cost of project development often includes infrastructures such as long approach roads, transmission lines and so on. The majority of equipment and materials also have to be imported, which requires foreign currency and transportation overland for a long distance from the port. The major share of the financing for the projects is from external loans and investment, which are to be paid back in foreign currency under strict conditions. The ever-weakening local currency against foreign currency escalates the tariff further. The total loss in the system is about 24 percent indicating scope for improvement. The challenges lie in developing cheap and reliable hydropower projects so as to keep the tariff within the reach of everyone.](#) HMG/N is, therefore, undertaking power sector reform measures with a view to bring about improvements to remedy the situation.

It is encouraging to note that the private sector is gradually entering the power market. The local banking sector's interest in forming consortiums with private developers as in the case of the Piluwa, Indrawati and Sunkosi Small projects also heralds a new dawn on the horizon despite

present security situation. The main challenge to the private sector is the transfer of technical know how and easy access to the international markets for financing mechanisms.

The domestic demand over the forecast period of 25 years is relatively small, limiting many developments. The challenge lies in the ability to establish a number of energy-intensive industries and transport system within the country for creating a greater demand for hydroelectricity, which will lead to a higher energy growth rate than the load forecast. A break-through along this line will provide ample opportunities for development of this clean and renewable energy.

Nepal's own resources both in the public and private sector cannot meet the financial investment needed for hydropower development. A large investment is required from foreign development agencies and private sector entrepreneurs. Although significant foreign investment has been attracted in recent years, much still remains to be invested for meeting both internal demand and the significant potential for the export of power.

Nepal needs to utilize the commitments on renewable energy made by the international community for developing nations and utilize financial instruments and mechanisms such as Global Environment Facility to get financial resources for hydropower development. Donors and friends of Nepal are requested to come ahead in helping it in making best use of these opportunities.

8.0 Major On-going Actions to meet the Challenges

Nepal's hydropower development is guided through the vision provided by National Water Resources Strategy 2002. Water and Energy Commission Secretariat (WECS) is at present finalizing National Water Plan to further clarify the way ahead and prepare a roadmap for water resources development of the country including hydropower development. Hydropower Policy 2001 is in line with the strategy. The Government is committed to implement this policy through an appropriate legal framework.

Based on the recommendation of the ongoing studies on institutional reforms, actions will be taken towards unbundling of NEA, institutional strengthening of WECS and formation of autonomous regulatory body.

It is evident that electrical energy occupies only a small portion of the total energy requirement. Therefore, hydropower development should be integrated with the overall energy strategy of the country. The Government is considering preparation of National Energy Strategy to streamline the energy related development and replace fossil fuel energy by hydropower and other renewable form of energy.

The internal restructuring of NEA and establishment of distribution centers have shown positive indication towards reducing electricity theft and improving overall governance. The result of communities' involvement in distribution is yet to be seen but is expected to have positive impact on improving the distribution efficiency and reducing administrative cost of NEA. Based on the experience of these endeavors, further actions would be taken for efficiency improvement by tuning up policies and procedures as felt necessary.

After a long period, Nepal's export of electric energy to India has exceeded the import in 2002/03 under a bilateral agreement of power exchange. The export of energy would be further strengthened through infrastructural development with an aim to export saleable energy existing in the system.

For the optimal utilization of the existing system and to meet the demand, Upper Seti Storage Project will be developed on priority basis. Other projects such as Upper Tamakoshi, Tamur will

also be developed in phased manner. A number of transmission and distribution lines are also being undertaken.

Nepal has given priorities for the use of electricity in transport, tourism, industry and agriculture sectors. Special attention is provided to increase the load factor of small and isolated generations through the use of electricity in domestic industries.

Considering high liquidity in the local financial market, efforts should be made to channelise local resources in electricity sector through various initiatives such as establishment of rural electricity fund, power development fund and encouraging other financial instruments. The involvement of private sector in generation is encouraging. The Government is open to public-private partnership.

Annex I

List of Independent Power Producers and their Projects

S.No.	Name of Company	Project	Capacity (kW)	Status
1	Butwal Power Company	Andhi Khola	5,100	In operation
2	Butwal Power Company	Jhimruk	12,300	In operation
3	Himal Power Ltd.	Khimti-1	60,000	In operation
4	Bhotekoshi Power Co.	Upper Bhotekoshi	36,000	In Operation
5	Chilime Hydropower Co.	Chilime	20,000	In Operation
6	National Hydropower Co.	Indrawati III	7,500	In Operation
7	Syange Vidyt Co.	Syange Khola	183	In Operation
8	Arun Valley Hydropower Development Co.	Piluwa Khola	3,000	In Operation
9	Gitec Nepal	Upper Modi	14,000	
10	Gorkha Hydropower	Daram Khola	5,000	
11	Alliance Power Nepal	Chaku Khola	1,500	
12	Khoranga Khola Hydropower	PHEME Khola	995	
13	Khudi Hydropower Limited	Khudi Khola	3,500	
14	Molnia Power P. Ltd.	Mailung Khola	5,000	
15	Kantipur Hydropower Co.	Langtang Khola	10,000	
16	Unique Hydrel Co.	Baramchi Khola	980	
17	Sanima Hydropower P. Lt	Sunkoshi Khola	2,600	
18	Sinkoshi Hydropower Co.	Lower Indrawati	4,500	
19	Rairang Khola Hydropower .	Rairang Khola	500	
20	Thoppal Khola Hydropower	Thoppal Khola	1,400	
21	Gandaki Hydropower Devt.	Mardi Khola	3,100	
22	Bavarian Hydropower Nepal	Lower Nyadi	4,500	
23	Annapurna Group P. Ltd.	Madi-1	10,000	

Annex II

Load Forecast For INPS

Year	Energy (GWh)	Growth (%)	Peak (MW)	Growth (%)
2003	2261.13		470.33	
2004	2321.5		509.6	
2005	2595.8	11.82	569.9	11.83
2006	2889.7	11.32	634.4	11.32
2007	3172.9	9.8	696.5	9.79
2008	3417.7	7.72	750.3	7.72
2009	3677.3	7.60	807.3	7.60
2010	3936.4	7.05	864.2	7.05
2011	4235.0	7.59	929.7	7.58
2012	4552.2	7.49	999.3	7.49
2013	4889.4	7.41	1073.4	7.42
2014	5247.8	7.33	1151.1	7.33
2015	5629.0	7.26	1235.7	7.26
2016	6034.4	7.20	1324.7	7.20
2017	6465.7	7.15	1419.4	7.15
2018	6924.6	7.10	1520.2	7.10
2019	7413.0	7.05	1627.4	7.05
2020	7933.0	7.01	1741.5	7.01
<i>Average Growth</i>		7.98		7.98

Annex III

Projects in the Power Generation Expansion Plan

FY.	Project	Capacity (MW)	Comments
2004/05	Chaku Khola	1.50	IPP, PPA concluded
	Rairang Khola	0.45	IPP, PPA concluded
2005/06	Pheme	0.95	IPP, PPA concluded
	Sunkoshi (small)	2.60	IPP, PPA concluded
	Lower Nyadi	4.50	IPP, PPA concluded
2006/07	Middle Marshyangdi	70	NEA, Under Construction
	Khudi	3.50	IPP, PPA concluded
	Mailung	5.00	IPP, PPA concluded
	Baramchi	0.98	IPP, PPA concluded
	Lower Indrawati	4.50	IPP, PPA concluded
	Upper Modi	14.00	IPP, PPA concluded
	Mardi	3.10	IPP, PPA concluded
2007/08	Madi-1	10.00	IPP, PPA concluded
	Daram khola	5.00	IPP, PPA concluded
2008/09	Kabeli-A	30.00	Private
	Lower Modi	19.00	Private
	Chameliya	30.00	NEA-Private Joint Venture
	Upper Modi A	42.00	NEA-Private Joint Venture
2009/10	Rahughat	27.00	Private
	Upper Marshyangdi-A	50.00	Private
	Budhi Ganga	20.00	Private
	Hewa Khola	10.00	NEA-Private Joint Venture
2010/11	Khimti-2	27.00	NEA-Private Joint Venture
	Likhu-4	44.00	Private
	Upper Seti (Storage)	122.00	NEA, Planned
2011/12	Upper Karnali	45.00	NEA-Private Joint Venture
	Upper Tamakoshi	250.00	NEA-Private joint venture
2012/13	West Seti	75.00	Private
	TOTAL	917.08	

Annex IV

Additional Potential Hydropower Projects

No.	Project	MW
1	Seti (West)	750
2	Arun-3	402
3	Budhi Gandaki	600
4	Kali Gandaki No. 2	660
5	Lower Arun	308
6	Upper Arun	335
7	Karnali (Chisapani)	10,800
8	Pancheshwar	6,480
9	Upper Marshyangdi "A"	121
	Total	20,456