I. Introduction and Context

Country Context

Nepal is passing through a prolonged political transition. The promulgation of a new Constitution has been delayed. The new Constitution is expected to lead to a major restructuring of Nepal into a federal state. This process will involve challenges in terms of managing ethnic aspirations and maintaining political stability. While the peace process has been strengthened after the implementation of the political understanding on army integration, a consensus on the new Constitution could not be reached leading to the dissolution of the Constituent Assembly in May 2012.

The economy grew by 4.6% in FY12, above the average post-conflict level of 4% but below the target set of 5 percent growth rate. Service sector aided by agriculture contributed substantially to the achievement of growth rate while manufacturing sector growth rate has faltered with deteriorating investment climate and labor issues. While the country has reaped a peace dividend, the economy is yet to move towards its full growth potential. The post conflict growth rate is one percentage point per annum higher than the average growth rate achieved during the conflict. Real GDP growth rate during post conflict (FY07-12) has averaged 4% per annum compared to an average growth rate of 3.1% during the conflict period (FY02-7).
Sectoral and Institutional Context

Energy Sector Background

Huge Hydropower Potentials vs Limited Development. Nepal’s hydropower potential estimates range from about 42,000 MW to about 83,000 MW. Despite this huge hydropower potential, the current installed hydropower capacity is merely 653 MW, which represents 92% of the country’s 713 MW total installed capacity, the rest being thermal generation (mainly diesel generating sets). The total peak demand is 946 MW. The country suffers from chronic under investment in the power sector. Over the past 10 years since 2002, only 92 MW has been added to the system. About 90% of the survey licenses for new hydropower projects issued by the government were granted to Independent Power Producers (IPPs) that are struggling to raise financing. Poor transmission system for power evacuation is also a major barrier for hydropower development. There is no nationally integrated transmission system and only 40% of the population has access to electricity due to shortage of supply and limited coverage of distribution networks.

Mismatch of Available Hydropower Supply and Demand. Since the majority of the 653 MW hydropower capacity is with run-of-river plants, the available capacity for power generation is at the mercy of the hydrological cycle. In Nepal 80% of rainfall occurs in the monsoon months of July, August and September, coinciding with glaciers melting. The electricity demand reaches its peak in winter, when the generating capability of run-of-river plants is at the minimum level (35% of the total installed capacity) since water available for generation is low. On the other hand, the available generating capacity is the highest in summer when demand is low, thereby creating an electricity surplus, which can be neither stored nor used for domestic consumption, nor exported due to lack of power evacuation. Because of this inherent seasonal mismatch between supply and demand Nepal will ultimately have to take advantage of power trading with neighboring countries, mainly India, from which it could import power when in deficit and export power when in surplus.

Acute Shortage of Electricity Supply. While a big portion of the country is not covered with electricity services, the existing consumers are affected by acute power shortages—load shedding reaches up to 16 hours per day in winter time. The main causes are (i) insufficient generation capacity to meet the demand; (ii) high seasonality of supply as 653MW of the total 713MW is hydropower generation, mostly run-of-the-river, hence decreasing to 35% capacity (about 230MW) in dry season while demand peaks beyond 900 MW; and (iii) low availability of the existing plant capacity due to severe sediment conditions causing damages to the hydro equipment and resulting in more frequent and longer shutdown of the power generation units than expected. Such is the case for the 144-MW Kali Gandaki A hydropower plant (HPP), which was commissioned in 2002 and is providing nearly 25% of Nepal’s annual electricity supply.

Institutional context

The electricity sector falls under the responsibility of the Ministry of Energy (MoE), which was split from the Ministry of Water Resources in 2011. The MoE serves as sector regulator and oversees planning, investment, and development of the power sector. It is responsible for issuing licenses for electricity generation, transmission and distribution. The Department of Electricity Development (DOED) provides necessary support to MoE on these particular issues and any other technical issues related to hydropower and electricity.

Nepal Electricity Authority (NEA) is a vertically integrated government-owned utility responsible for generation, transmission and distribution. It acts also as single buyer of IPPs’ power for
domestic consumptions. IPPs represent about 25% of the country’s total power generation. The Hydroelectric Investment and Development Company (HIDC) was established in July 2011 to raise funds from national and international sectors to finance hydropower projects with a capacity of more than 25 MW. The Investment Board (IB) was established in November 2011 and entrusted with the responsibility of developing large infrastructure projects including hydropower projects of 400 MW and larger. Currently, the development of 14 “national pride” projects is under its responsibility, including five hydropower and seven other infrastructure projects.

Relationship to CAS
The Interim Strategy Note for Nepal for 2012-2013 has three pillars under which pillar 1 includes increased access to electricity, enhancing connectivity and improved reliability of power supply.

The ongoing and planned projects in the pipeline of IDA supported energy portfolio are aligned with this pillar, addressing the key sector issues stated above. IDA is currently providing financing through components of the following projects – Power Development, Kabeli Transmission, Kabeli A Hydropower Project and the Nepal-India Electricity Transmission and Trade Project. The proposed rehabilitation project will also contribute to the increase in power generation in the country.

II. Proposed Development Objective(s)
Proposed Development Objective(s) (From PCN)
The objective of the proposed KGAHRP is to improve the reliability of power supply and safety of the hydropower plant that provides nearly a quarter of Nepal’s annual electricity generation.

Key Results (From PCN)
The outcomes will be measured by the following key performance indicators:
1. Hydropower generation capacity rehabilitated under the project (MW).
2. Increased availability of the hydropower plant (%).
3. Dam Safety Plan (prepared and adopted).

III. Preliminary Description
Concept Description
Background
Kali Gandaki A HPP is a 144 MW run-of-river plant, located on Kali Gandaki river in Syangja, three hours drive from Pokhara. The dam is located below the confluence of Kali Gandaki and Andhi Khola rivers. The plant was largely funded by the Asian Development Bank and commissioned in 2002 at a cost of US$453 million. Today it is the largest hydroelectric power station in Nepal, and it supplies nearly 50% of NEA’s total annual electricity generation which represents a quarter of the country’s total annual electricity generation. This important plant is facing the following problems:

Severe Damages to Power Generation Equipment. Severe damages were found at critical plant equipment, including the main inlet valve (MIV), guide vane, and turbine runners caused by both erosion and cavitation due to reduced efficiency of the sediment handling facilities and increased sediment concentration in the water passing through these parts of power generation units. The damages are increasing, reducing generation efficiency and reliability, and threatening the safety of the plant.
An international consultant was hired under the Bank-funded Power Development Project to assess the damages and prepare the design of the rehabilitation work. The assessment concluded that the electro-mechanical equipment has to be retrofitted to avoid more severe damage and to enhance the performance of the equipment against erosions and cavitation.

Low Availability of Generation Capacity. Although the plant was designed to generate about 842 GWh of electricity annually, the plant availability was lesser than expected, generating only about 700-760 GWh annually. Indeed, severe sedimentation conditions affect the plant operation and force extended shutdown of power generation units to repair erosion and cavitation damages.

During the monsoon season, rivers Kali Gandaki carry increased sediments and floating debris to the plant. The mineralogical composition of the sediments is dominated by Quartz, a highly abrasive material capable of damaging machinery in a power plant. Poor control of the floating debris chokes the intake screen and reduces the efficiency of the sediment settling basins. Instead of settling, the highly abrasive sediment particles in high concentrations (above permitted limits) are transported into the flow passage of the power generation units, causing severe damage to the hydro machinery. Unless this problem is addressed, there will be perpetual wear and tear of the machinery and needs for shutting down the power generation units for repairs, and subsequently further reduce availability of this critical plant.

Lowering sediment concentration of the water within the limits through proper settling before the water passing through the power generation equipment is the key to keep the damages to the equipment within acceptable range. Nepal HydroLab was hired to assess the performance of headworks and sedimentation handling facilities. Based on physical model tests, HydroLab proposed options for modification of the headworks and the sedimentation handling facilities to improve the performance of sediment settling. Detailed design and preparation of bidding documents are to be completed.

Safety risk. The severe damage to the MIV that functions as a safety device is already posing serious safety threat to the plant and need urgent repairs. There are also dam safety issues consisting mainly of improper maintenance and negligence of dam safety instrumentation. There is no dam safety plan including an emergency preparedness plan.

The proposed project consists of three components:

Component A: Civil Works (US$8.5 million IDA, US$1.0 million Cofinancing) will consist of headworks modifications to address the floating debris problem and increase the effectiveness of the settling basins. This will lead to improved operating conditions of the plant and increased availability of plant capacity. Laser based real time sediment monitoring instruments will be installed to assist the plant operators with improved sediment guided operations to increase plant availability.

Component B: Electro-Mechanical Works (US$15.5 million IDA, US$2.0 million Cofinancing) will consist of repairs or installations of various equipment. This will lead to increased availability of the equipment for power generation and mitigation of safety risks. The MIV will be retrofitted with special seals to ensure proper opening and closing of the valves, improving safety of the plant. Other items will include special hard coating to resist Quartz abrasion, repairing damaged runners.
by welding and gridding, adding one new spare runner, installing turbine air admission system to prevent cavitations, modifying the cooling water supply into a closed loop system, repairing the dam stoplog seat plates, and purchasing spare parts and a new trash rack cleaning machine.

Component C: Technical Assistance for Safeguard Management (US$1.0 million IDA). Though no major social issues are anticipated since most of the physical activities will be carried out within the existing plant facilities, this component will provide support should any issue emerge during implementation. This component will support implementation of the EMP, including monitoring and evaluation, capacity-building and training of the project management staff working on the environmental and safeguard issues. A dam safety plan including an emergency preparedness plan and an asset management plan will be developed and adopted to ensure long-term safety of Kali Gandaki.

Total initial project cost (excluding taxes, duties and VAT, at about US$ 3.0 million) is estimated at US$ 25.0 million. With the increased availability of plant capacity for power generation, initial economic and financial analysis indicate an EIRR of about 15% and a FIRR of about 6%, without considering the saved investment cost due to reduced damages in the future and benefits from avoided potential destruction of the plant due to power generation equipment and dam failures.

Safeguards Assessment
The Project is not expected to cause any significant environment and social safeguard impacts. Consisting largely of rehabilitation work, the proposed project consists of physical activities that will be mostly restricted to the existing plant facilities and its immediate surroundings. There will be no land acquisition and involuntary resettlement.

The Seti Beni Bazaar and the Holy Stone at about 5 km upstream of the plant are of cultural importance to the local villagers. Initial consultation with them revealed their concerns about the impacts of the rehabilitation works in the Seti Beni Bazaar and the Holy Stone. The possible impacts will be assessed including numerical model studies to determine the flood profile along the Kali Gandaki River from the dam to the area of concern and enhanced consultation with local communities will be conducted during the project preparation and implementation.

Other social impacts may arise as a result of contractor operations. An environmental and social policy framework (ESPF) will be prepared in this regard.

Environmental impacts are likely to be limited. There will be minor civil works involved in the modification of the headworks. In the immediate construction area there will be no impacts on the present land forms and land use, including agricultural land, forest and natural habitats. The operation of a construction site, including workers’ camps, workshops, batching plants, machinery, heavy equipment etc. will produce minimum emissions (noise, dust, exhaust gases) and generate limited quantities of solid waste and sewage. Such impacts will be most significant during the construction phase and abate once the repair is completed and the plant is in operation. Good housekeeping measures, a detailed EMP that contains clearly defined, contractually agreed mitigation measures and implementation arrangements, and a well-established and empowered environmental site supervision firmly linked with construction supervisions, are deemed sufficient to address these construction-related impacts.

Spoils from road construction and waste disposal from villages and towns introduced from outside the project areas into the Kali Gandaki and Andhi Khola rivers pose serious threat to the health of
the river system. It also has a negative impact on the Kali Gandaki A plant due to exposure to excessive sediments and floating debris. Further assessment will be conducted during the project preparation and possible mitigation measures discussed with the Government and local authorities.

A safeguard performance review will be conducted during the project preparation to: (i) review the social and environmental management and performance of the Kali Gandaki A Hydropower Plant; (ii) identify any social and environmental issues outstanding from the Completion Review, (iii) identify new social and environmental issues emerged recently, and (iv) identify and assess potential social and environmental consequences of the project activities under the proposed rehabilitation project. Following the conclusions of the safeguard performance review, action plans such as Environmental Management Plan (EMP) will be prepared as needed during the project preparation.

IV. Safeguard Policies that might apply

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VI. Contact point

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