

Performance
Evaluation Report

Nepal: Kali Gandaki "A" Hydroelectric Project



Independent
Evaluation



Performance Evaluation Report
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NOTES

- (i) The fiscal year of the government and the Nepal Electricity Authority ends on 15 July. "FY" before a calendar year denotes the year in which the fiscal year ends, e.g., FY2011 ends on 15 July 2011.
- (ii) In this report, "\$" refers to US dollars.
- (iii) For an explanation of rating descriptions used in ADB evaluation reports, see IED. 2006. *Guidelines for Preparing Performance Evaluation Reports for Public Sector Operations*. Manila: ADB.

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Currency Equivalents

Currency Unit – Nepalese rupee/s (NRe/NRs)

	At Appraisal (March 1996)	At Project Completion (March 2004)	At Independent Evaluation (September 2012)
NRe1.00 =	\$0.0179	\$0.0137	\$0.0118
\$1.00 =	NRs56.00	NRs73.00	NRs84.39

Abbreviations

ADB	– Asian Development Bank
BPC	– Butwal Power Company
DSR	– debt service ratio
EDC	– Electricity Development Centre
EIA	– environmental impact assessment
EIRR	– economic internal rate of return
EMU	– environmental monitoring unit
ESSD	– Environmental and Social Studies Department, NEA
FINNIDA	– Finnish International Development Agency
FIRR	– financial internal rate of return
FY	– fiscal year
IED	– Independent Evaluation Department
KGEMU	– Kali Gandaki Environmental Monitoring Unit
NARC	– Nepal Agriculture Research Council
NEA	– Nepal Electricity Authority
NEA-ED	– Nepal Electricity Authority-Environment Division
O&M	– operation and maintenance
OECF	– Overseas Economic Cooperation Fund
PAF	– project-affected families
PCR	– project completion report
POE	– panel of experts
POE S&T	– panel of experts for safety and technical aspects
PPER	– project performance evaluation report
ROR	– rate of return
RRP	– report and recommendation of the President
SARD	– South Asia Department
SDR	– special drawing rights
SMEC	– Snowy Mountain Engineering Corporation
SFR	– self-financing ratio
SPAF	– seriously project-affected families
TA	– technical assistance
UNDP	– United Nations Development Programme

Weights and Measures

GW	– gigawatt
ha	– hectare
Hz	– Hertz
kg	– kilogram
km	– kilometer
kV	– kilovolt
kVA	– kilovolt-ampere
kW	– kilowatt
kWh	– kilowatt-hour
L	– liter
m ³	– cubic meter
m ³ /s	– cubic meter per second
m	– meter
mg	– milligram
mm	– millimeter
MW	– megawatt
MWh	– megawatt-hour
rpm	– revolution per minute
W	– watt

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Basic Data

Kali Gandaki "A" Hydroelectric Project (Loan 1452-NEP[SF])

Technical Assistance

TA No.	TA Project Name	Type	Person -Months	Amount (\$)	Approval Date
2613-NEP	Institutional Strengthening of NEA's Environmental Division	ADTA	20.5	534,000	23 July 1996
2614-NEP	Power System Master Plan for Nepal	ADTA	32.4	600,000	23 July 1996

Key Project Data

(\$ million)	As per ADB Loan Documents	Actual
Total Project Cost	452.8	354.8
Foreign Exchange Cost	320.0	241.3
Local Currency Cost	132.8	113.5
ADB Loan Amount/Utilization	160.0	140.7
ADB Loan Amount/Cancellation		7.7

Key Dates

	Expected	Actual
Fact-Finding		22 Jan–9 Feb 1996
Appraisal		21 Mar–1 Apr 1996
Loan Negotiations		10–13 Jun 1996
Board Approval		23 Jul 1996
Loan Agreement		27 Aug 1996
Loan Effectiveness	25 Nov 1996	12 Dec 1996
Loan Completion	Nov 2000	May 2002
Loan Closing	15 Jul 2001	31 Dec 2003
Extensions		1
Effectiveness to Completion (months)	55.5	68
Project Completion	15 Jan 2001	16 Aug 2002

Internal Rates of Return (%)

	Appraisal (1996)	PCR (2003)	PPER (2011)
Economic Internal Rate of Return	15.0	18.2	15.9
Financial Internal Rate of Return	9.8	12.6	5.6

Borrower

Executing and Implementing Agency

Government of Nepal
Nepal Electricity Authority

Mission Data

Type of Mission	No. of Missions	No. of Person-Days
Fact-Finding	2	166
Appraisal	1	99
Inception	3	65
Project Administration		
Review	17	238
Special Loan Administration	2	146
Project Completion Review	1	45
Independent Evaluation	1	45

Project Performance Report Ratings

Implementation Period	Development Objective	Implementation Progress
1 Jan 1997 to 31 Dec 1997	Satisfactory	Satisfactory
1 Jan 1998 to 31 Dec 1998	Satisfactory	Satisfactory
1 Jan 1999 to 31 Dec 1999	Satisfactory	Satisfactory
1 Jan 2000 to 31 Dec 2000	Satisfactory	Satisfactory
1 Jan 2001 to 31 Dec 2001	Satisfactory	Satisfactory
1 Jan 2002 to 31 Dec 2002	Satisfactory	Satisfactory
1 Jan 2003 to 31 Dec 2003	Satisfactory	Satisfactory

Executive Summary

This project performance evaluation report (PPER) provides the findings of the Independent Evaluation (IED) Mission that completed its site visit in December 2011 in preparation of a project performance evaluation of the Kali Gandaki “A” Hydroelectric Project financed by the Overseas Economic Cooperation Fund and the Asian Development Bank (ADB).

The objectives of the project were to (i) assist meeting the demand for electricity power in Nepal at least cost in an environmentally sustainable and socially acceptable manner, (ii) promote institutional strengthening, and (iii) improve the cost recovery of the National Electricity Authority (NEA). ADB assisted with the design, supported the project with a loan of \$160 million, helped supervise project implementation, and provided two technical assistance (TA) grants, of \$534,000 and \$600,000, for (i) strengthening NEA’s Environmental and Social Studies Department, and (ii) NEA’s power system master planning capacity. Implementation started in 1996 and was completed in 2002.

Despite the long period since the project was completed, the IED considered it worthwhile conducting this evaluation, as it considered that it could arrive at lessons for other alternative sustainable energy projects. In addition, many environmental and social impacts were not clear immediately after project completion, and so a review 10 years on provides more insight on how project-impacted people have benefitted from the project over a longer period. Likewise, least-cost engineering conflicts in many instances with value engineering, which factors operation and maintenance costs over the life of the project into design factors and contractor selection. So, again, a review of 10 years of operation provides insights into the engineering and cost effectiveness of the project that an evaluation at an earlier stage could not have yielded.

IED rated the project *successful*. IED also rated both TA operations *less than successful* because, 10 years on, the IED Mission found little evidence of lasting capacity in master planning or in environmental and social management of hydropower.

The IED Mission found that the project design was *relevant* to the needs of the country. Increasing the availability of power was relevant to economic development and poverty reduction, and consistent with the country’s development goals. The IED Mission found that the objectives were clear and in line with ADB and Government of Nepal mandates and sector priorities, although they were not optimally measurable.

The project is rated *effective*. It contributed to economic growth by producing on average close to 592 gigawatt-hours/year since commissioning, which has been fed into the grid, thus benefiting consumers nationwide. While 4,142 households were also found to have been electrified as a part of the project, Nepal continues to endure severe power shortages.

The ADB capacity strengthening TA provided to NEA was found not to have improved NEA management sufficiently. NEA management of contractors, marked as a risk in the

RRP, remained constrained by the organization's internal processes and decision making in spite of the TA's work, resulting in considerable delays in approval of variation orders and payment disputes with the contractor.

The project is rated *efficient*. While least cost was not demonstrated because of higher-than-expected maintenance costs, in turn due to possible design errors, the total capital cost was significantly below the engineer's estimate and, as such, beneficial to the country. Construction funding was sufficient, with the project being finalized about \$98 million under budget. The environmental and social program budget was limited to 1.2% of project estimated cost. The recalculated economic internal rate of return is 16.05%, which is quite similar to the RRP estimate of 15% but less than the project completion report estimate of 18.2%. The IED Mission found that the distribution of net benefits could have been more in favor of local project-impacted people had the environmental and social mitigation measures been up-scaled in terms of scope and budget. The project has affected 12 villages of Syangja, Gulmi, Palpa, and Parbat districts and expropriated the assets of 1,468 families from the affected villages. However, resettlement impact was mainly concentrated in Syangja district, especially in Shree Krishna Gandaki and Jagatra Devi village development committees. Of the 1,468 families, 263 were defined as seriously project-affected families and 1,205 were project-affected families (PAFs). The project expropriated altogether approximately 209 hectares of land and 90 houses. The total PAFs also include 17 Bote and 2 Magar households in the dam site area. The project also created impact on and changes to the traditional occupation of some Bote families. Similarly, the project generated risk of flood and inundation at Seti Beni Bazaar and the religious and cultural site (holy stones [Saligrams]) located upstream. Likewise, there is impact even in the downstream area due to inadequate water flow for performing "holy dips" and other rituals.

Electricity tariffs were increased in mid-2012, and some losses have been reduced since 2001 as required in the loan covenant.

The project is rated *likely sustainable*. The operational efficiency of the facility was found to be lower than design due to the intake to the desanders, the desander basins, and the hydraulics of the turbines. This resulted in the turbines not operating at their design capacity, which translates into revenue losses for the NEA. However, the \$20 million refurbishment proposed by the NEA is expected to enhance its sustainability well into the future. The PPER recalculates the financial internal rate of return for the project as 6.05%, which is slightly higher than the weighted average cost of capital of 5.7%. Provided that NEA's financial situation improves due to recent tariff increases and if the pending refurbishment to Kali Gandaki "A" proceeds, design energy production is likely sustainable in the long term. The IED Mission found that the outcomes of the TA activities were not sustainable, as the NEA had not implemented the power generation master plan nor significantly changed its structure and management and that the Kali Gandaki Environmental Monitoring Unit (KGEMU) that was created no longer exists. While some KGEMU staff work with NEA's Environmental and Social Studies Department, the IED Mission found that ADB safeguard concerns had remained project-specific contrary to their intent and had not been mainstreamed into national policy, as was covenanted. With intended domestic and export peak power coming from larger reservoirs to improve national revenue and the economy, limited capacity or concern seems to exist with the NEA on the environmental and social aspects of dams.

Recommendations

The PPER presents three major recommendations:

- (i) The NEA should invest \$20 million to the plant to rectify problems, including intake and desander configurations, cavitations of turbine parts, and vibrations in the powerhouse. ADB should seriously consider making the needed funds available to carry this out.
- (ii) The government should revise its electricity tariffs to encourage cost recovery and foreign investment in the energy sector.
- (iii) Environmental and social mitigation measures should be formulated comprehensively to ensure that the “do good” in addition to “do no harm” principle is applied. For the greatest benefit to be conferred to the impacted population, including indigenous peoples, the suite of mitigation measures typically derived from the EIA process should foster rural development more broadly.

Walter Kolkma
Officer-In-Charge
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CHAPTER 1

Introduction

1. The Independent Evaluation Department (IED) of the Asian Development Bank (ADB) included the Kali Gandaki “A” Hydropower Project¹ in Nepal in its annual work program for 2011.

A. Evaluation Purpose and Process

2. The project was selected for evaluation because of the following:

- (i) IED will undertake a special evaluation study on safeguards implementation (inclusive of country systems) by 2014, and supporting studies on safeguards related to country systems and financial intermediaries in 2013.
- (ii) ADB and member countries including Nepal will be looking to invest in energy projects in Asia and the Pacific during the next decade, and specifically in hydropower as “sustainable and renewable energy.” The ADB Community of Practice energy database reveals that ADB was involved in hydropower projects since 1995 with a combined project cost of \$4.5 billion. IED can thus play a forward looking role for the benefit of operations teams by evaluating the performance of past hydropower projects including (but not limited to) complex issues related to environment and social impacts.
- (iii) Installed capacity in hydropower in Asia is forecast to increase from 315 gigawatts (GW) in 2011 to 485 GW in 2021,² which is the equivalent of about 157 Nam Theun 2 projects. To date, safeguards implementation remains difficult, challenging sustainable development in the regions involved. IED aims to disseminate this project performance evaluation report (PPER) to hydro project developers and concerned ADB departments to assist in designing and implementing meaningful and cost-effective environmental and social protection measures.³
- (iv) The time lag between loan closure and the current evaluation is judged appropriate because hydropower projects’ environmental and social impacts take many years to develop. Likewise, the financial position of the Nepal Electricity Authority (NEA) as forecast during appraisal will become clearer after some years of operation, and this period is needed to assess financial and economic viability.
- (v) The Tanahu Hydropower Project in Nepal with a pipeline value of \$75 million is intended to benefit directly from this PPER.

¹ ADB. 1996. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Technical Assistance Grants to Nepal for the Kali Gandaki “A” Hydroelectric Project*. Manila (Loan 1452-NEP[SF], for \$160.0 million, approved on 23 July).

² US Energy Information Administration. <http://www.eia.gov/>

³ September 2011 discussion with ADB’s Energy Community of Practice supports the idea of a knowledge product for the hydropower industry as well as ADB teams.

The evaluation aims to provide lessons useful for the design and implementation of other hydropower projects

3. The project was started in 1996 and completed in 2002 to assist the Government of Nepal to meet the increasing demand for electric power. Almost 9 years after the loan completion, IED fielded an independent evaluation mission (IED Mission) on 13–30 November 2011 to evaluate the project's relevance, effectiveness, efficiency, sustainability, and other impacts⁴ and with a view to provide lessons useful for the design and implementation of other hydropower projects by ADB and other lending agencies.

4. This report was prepared in accordance with IED guidelines.⁵ The evaluation draws upon a review of project documents in electronic form only,⁶ other relevant studies, and discussions with ADB staff. Discussions were also held with the (i) NEA, (ii) Ministry of Environment, (iii) Ministry of Finance, (iv) Ministry of Energy, (v) communities at the project site, (vi) Water and Energy Users' Federation-Nepal, and (vii) World Bank Resident Office. A survey was also conducted among the project-affected people to triangulate study findings (Appendix 1). The IED Mission also spent 6 days at the project site including the dam site; powerhouse; and Seti Beni village and its holy stone (Saligram). The findings were summarized in an aide memoire and discussed with NEA and other stakeholders invited by the NEA at a meeting on 29 November 2011. A copy of the draft evaluation report was shared with the South Asia Department and the government through the Ministry of Finance. Their views were taken into account and incorporated where judged appropriate.

B. Project Objectives

5. As stated in the 1996 report and recommendation of the President (RRP), the project's objectives were to (i) assist meeting the demand for electric power in Nepal at least cost in an environmentally sustainable and socially acceptable manner (footnote 1), (ii) strengthen the institutional and financial (management capacity) position of the NEA, and (iii) improve cost recovery to promote efficiency in power consumption. The RRP does not discuss proposed project outcomes and impacts, nor does it feature a design and monitoring framework. These ADB requirements were institutionalized after the Kali Gandaki "A" project was approved by the Board. Nevertheless, based on information provided elsewhere in the RRP, the project was proposed to meet the growing domestic demand for electricity and, beyond that, to produce electricity for export to India—and these can be interpreted as project outcomes. The impact is not mentioned in the RRP, but it can be derived that, from electricity being made available to residential and commercial consumers in Nepal, economic gains and improved living standards would occur. The project completion report (PCR) states that the major impacts of the project are the "displacement of inefficient and polluting diesel generators burning expensive imported fuels for industrial and commercial consumers,

⁴ The IED Mission comprised Jean Foerster, Evaluation Specialist and Team Leader; Alvin Morales, Evaluation Officer; Klaus Schonfeld, international consultant; and Govind Nepal and Sachin Upadhyaya, national consultants.

⁵ IED. 2006. *Guidelines for Preparing Performance Evaluation Reports for Public Sector Operations*. Manila: ADB.

⁶ This made review awkward and more time-consuming than what was previously practiced; i.e., hard copy review. Many documents were located in file folders without adequate titles (e.g., General). A number of documents that would have enhanced this evaluation were not among the project files: (i) construction contract for Lots 1–3; (ii) design, supply, and installation contracts for Lots 4–7; (iii) bid evaluations for Lots 4–7; (iv) engineer's project completion report; (v) several monthly progress reports (only reports 12 and 40–58 were available); (vi) several panel of experts (POE) reports, both technical, and environmental and social; (vii) essentially all documentation on ADB's coordination of the Overseas Economic Cooperation Fund (OECF) loan portion; and (viii) all documentation on the financial and economic modeling developed to justify the project.

and switching from kerosene to electric lighting for rural consumers.” This PPER reformulated a design and monitoring framework based on the RRP (Appendix 2).

6. The PCR,⁷ which was circulated to the Board of Directors in April 2004, assessed the project as *highly relevant*, *highly effective*,⁸ *efficient*, and *likely sustainable*. Overall, the PCR rated the project *successful*. The project would have been rated *highly successful* had more attention been given to addressing environmental and social concerns. The PCR assessed the project design as closely aligned to the government’s and ADB’s objective of reducing poverty. The project was assessed as *relevant* to ADB’s country strategy⁹ for the energy sector and *effective*, as it achieved its long-term objective of improving power transmission and distribution. In terms of *efficiency* and *sustainability*, the PCR calculated the economic internal rate of return (EIRR) at 18.2%, compared with 15.0% at project appraisal. The financial internal rate of return (FIRR) was estimated at 12.6%, compared with 9.8% at project appraisal.

⁷ ADB. 2004. *Completion Report: Kali Gandaki “A” Hydroelectric Project in Nepal*. Manila.

⁸ PCR assessment of effectiveness does not include whether the project met the demand for electric power in an environmentally and socially sustainable way or whether it met the technical assistance (TA) objectives to improve the operational and financial performance of NEA and cost recovery. These were also stated as objectives in the RRP.

⁹ ADB. 1993. *The Bank’s Operational Strategy in Nepal*. Manila.

CHAPTER 2

Design and Implementation

7. The project was for a long time a prime candidate for hydropower development of the Kali Gandaki River in Nepal and was identified as an integral component of NEA's Least-Cost Generation Expansion Plan.

A. Formulation

8. The original feasibility study was completed in July 1979 by Snowy Mountain Engineering Corporation (SMEC).¹⁰ In 1990, the government, with the support of the United Nations Development Programme (UNDP), initiated an update of the feasibility study, and the final report of the consultant¹¹ was completed in January 1992. ADB's association with the project commenced in February 1992, when the government requested ADB to utilize some \$20 million of the savings under the Fifth Power Project¹² to cofinance, with UNDP and the Finnish International Development Agency (FINNIDA), consulting services for site investigations, detailed engineering, hydraulic model study, and preparation of tender documents for the project,¹³ and to be the lead financier. Board approval of the proposed use of loan savings was given on 11 June 1992. The engineer completed a Project Formulation Report I in May 1993 and the Final Project Formulation Report II in May 1994. A draft engineering design was issued in June 1994, followed by the Acquisition, Compensation, and Rehabilitation Program and the Mitigation, Management, and Monitoring Plan in August 1994, and a draft environmental impact assessment (EIA) in February 1995. All design work was completed, and draft tender documents were prepared for all civil works, mechanical and electrical equipment, and the transmission lines by the end of March 1995 with the aid of a panel of experts (POE),¹⁴ established in May 1993, who provided design review and guidance.¹⁵ Normal practice with large civil works projects is to obtain bid prices before appraisal; consequently, ADB approved on July 1994 advance procurement action to allow prequalification of civil works contractors, invite bids from prequalified bidders, and negotiate with the lowest evaluated bidder. On February 1995, NEA submitted its report on the prequalification of 13 civil works contractors for ADB's review. (For a chronology of significant events, see Appendix 3.)

¹⁰ Snowy Mountain Engineering Corporation. 1979. *Gandaki Basin Master Plan Study*. Kathmandu.

¹¹ UNDP. 1992. *Kali Gandaki "A" Detailed Feasibility Study*. Consultant's Report. Kathmandu.

¹² ADB. 1983. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to Nepal for the Fifth Power Project*. Manila.

¹³ The Kali Gandaki "A" Associates (KGAA) were comprised of lead consultant Morrison Knudsen International (USA), Norconsult (Norway), and IVO International Ltd. (Finland).

¹⁴ Later, the POE was split in two: a panel of experts for safety and technical aspects (POE S&T, also known as PoSTE) and a panel of experts for environmental and social advisory aspects (POE E&S).

¹⁵ The main differences between the 1992 Norconsult design and the design adopted for bidding were (i) the inlet arrangements, (ii) the above-grade desanders as compared with the underground desanders, (iii) the much larger (and less effective as discussed in *Integrated Design of Water Treatment Facilities* by Susumu Kawamura) width-to-length ratio adopted for the bidding design, (iv) the surface-located powerhouse compared with the underground powerhouse, and (v) the change from 2 turbo units producing 100 megawatts (MW) to 3 units producing 144 MW.

9. The 28-kilometer (km) access road that was part of the 1992 project design was funded and constructed by NEA, which proved to be a time (and monetary) saving undertaking. The road also provided the main social benefits to local residents through year-round access to local markets for the sale of agricultural produce. NEA created a project information center in January 1996 for wider dissemination of information to the public and to complete the 2-year public consultation process. NEA envisaged commissioning the project by July 2000. However, due to several reasons including unforeseen geological features and NEA's slow approval process, turbo-generating units 1, 2, and 3 were commissioned only in March, April, and May 2002, respectively, and the transmission line to Pokhara became operational only in August 2002. These marked the beginning of full commercial operations of the project.¹⁶

10. The government had not issued policies relevant to the power sector in Nepal at the time of the appraisal in 1996. However, later on, two policies were established: (i) the Hydropower Development Policy (2001), and (ii) the Energy Crisis Management Plan (2008). In 2011, the government produced an investment plan for scaling up renewable energy in Nepal. All policies support the development of hydropower in Nepal, indicating that Kali Gandaki "A" continues to fit well in the government's strategy for energy development. The responsibilities for generation, transmission, and distribution throughout Nepal continue to rest with NEA, further demonstrating the importance of the creation of the utility¹⁷ and project activities related to its strengthening. Other agencies involved at the time were the Ministry of Water Resources, Electricity Development Centre (EDC), and Electricity Tariff Fixation Commission. The institutional assessment at the time of project design found the institutional setup fragmented and uncoordinated. EDC at the time had an ambitious set of functions including planning, licensing, promotion, and advisory functions. The PCR did not assess how well EDC had coped with these functions and its impact on Kali Gandaki "A." Currently, the Electricity Tariff Fixation Commission continues to decide on tariff adjustments as recommended by NEA, and this is an issue for NEA's financial viability (refer to the Sustainability Assessment in section III.E), as the latter cannot set tariffs based on the cost of electricity production and willingness to pay.

Policies support the development of hydropower in Nepal

11. Other agencies involved in project formulation during consultation are listed in Appendix 4. It is not clear from the files how much influence they had on project design except for Nepal Agriculture Research Council, which continues to operate the fish hatchery. This is discussed in more detail in Chapter 4 and Appendix 5.

12. SMEC, UNDP, and Danish International Development Assistance (Danida) were major players in the earlier project formulation. This showed interagency commitment and strengthened the design, as all development agencies tend to have not only their own due diligence process (for design as well as construction) but also their own development approaches. This acted as a form of triangulation for design and implementation. In its expansion plan at the time, NEA considered that an optimal least-cost generation expansion plan for electricity generation would come from both public and private schemes; mini (for remote loads), small (mainly private), and medium and large (mainly public) projects; and run-of-river, pondage, and storage projects.

¹⁶ Plant records indicate that some 175 gigawatt-hours (GWh) of power were produced from March to August 2002.

¹⁷ NEA was created on 16 August 1985 (Bhadra 1, 2042) under the Nepal Electricity Authority Act, 1984. The objective of the NEA was to remedy the inherent weakness associated with these fragmented electricity organizations with overlapping and duplication of works; thus, a merger of these individual organizations became necessary to achieve efficiency and reliable service.

B. Rationale and Scope

1. Rationale

Economic growth in Nepal was constrained by power shortages

13. At the time of project design in 1992–1996, economic growth in Nepal was constrained by power shortages, which resulted in frequent load shedding. The government reasoned that unless action was taken to add new generation facilities to the system, the situation would become even more acute in the future. While only limited measures could be implemented to overcome the short-term deficits, the government's long-term strategy for the power sector was to maximize the use of indigenous water resources in the implementation of a generation expansion program that would meet the forecast demand at the least cost and be consistent with the agreed-upon macroeconomic resource supply envelope for both foreign and local cost capital expenditures over the period fiscal year (FY) 1994 to FY2000. The Kali Gandaki "A" Project was thus an integral component of the least-cost expansion program, and was developed after considering a number of hydro and thermal alternatives. ADB's strategy for Nepal's power sector was twofold: (i) improve NEA's efficiency, recognizing the need to develop the country's hydropower potential; and (ii) support the government efforts to mobilize resources from both the public and private sectors for hydropower projects that are part of the Least-Cost Generation Expansion Plan.

The project's rationale was to meet growing power demand at least-cost and with minimal environmental and social impacts

14. The stated rationale in the project RRP was to meet growing power demand in a least-cost manner and with minimal environmental and social impacts. The project was designed to reduce system load shedding by building year-round capability to meet daily peak load requirements and to complement nonpeaking run-of-river type smaller projects envisaged in the private sector. The project was also intended to strengthen NEA's institutional and financial capacity, improve cost recovery, and promote efficiency in power consumption.

15. Nepal's electricity needs are met mainly by hydropower, which accounts for about 86% of the generation capacity in the country. The main thrust of the government's energy policy therefore has been to develop the large hydropower potential to provide a renewable source of energy for domestic use and for export. In line with this, the government adopted the Hydropower Development Policy in 2001, which aims to develop the large hydropower potential in an environmentally sustainable manner for (i) meeting the country's energy needs, and (ii) exporting electrical energy to generate revenue for the country.

16. At the time of project design in 1996, Nepal had an energy crisis, with load shedding and brownouts occurring regularly, averaging about 16 hours per day. The documentation justifying the project advised that lack of dependable power was significantly affecting the country's gross national product and its economic growth. The documentation further advised that only about 10% of Nepal's population had access to electricity, with the Kathmandu area receiving a disproportionate share. The country's peak power demand in FY1992 was 215 megawatts (MW) according to NEA's Power Development Plan, which also forecast that Nepal would need some 475 MW by 2000. It was argued that the project, with 144 MW, would eliminate load shedding and brownouts and allow further economic development and an extension of peak power to additional segments of the population that did not have electric power. The project was designed to reduce load shedding by building in the year-round capability to meet

daily peak load requirements—6 hours per day during the dry season—making use of a relatively small reservoir.¹⁸

2. Scope

17. The basis of the project design was to short-circuit an approximately 45 km long loop in the Kali Gandaki River connecting a diversion dam and desander facilities at Mirmi with the powerhouse at Beltari by a 6 km, 7.4-meter (m) diameter headrace tunnel and thereby developing a gross head of about 124 m. At appraisal in 1996, the project had several components involving civil, hydraulic, mechanical, and electrical works. These are discussed in detail in Appendix 6. The institutional component is supported by two technical assistance (TA) grants in the project.¹⁹ The two TA operations were (i) Institutional Strengthening of NEA's Environmental Division,²⁰ and (ii) a Power System Master Plan for Nepal.²¹

C. Cost, Financing, and Executing Arrangements

18. The total project cost was estimated at \$452.8 million, of which \$320.0 million (about 71%) was in foreign exchange, including \$7.9 million for service charges and interest during construction; and \$132.8 million (about 29%) was in local currency costs, including duties and taxes. ADB provided a loan of \$160 million equivalent from Special Funds resources to finance 50% of the total foreign exchange cost, including service charges and interest during construction. The Overseas Economic Cooperation Fund (OECF) provided a loan of \$160 million equivalent to meet the balance of the foreign exchange requirement.²² ADB and OECF financing amounted to \$320 million, or 71% of the total project cost. The remaining cost of \$132.8 million equivalent was to be funded from the government and from internally generated sources of NEA. The ADB loan of \$160 million equivalent financed the civil works packages Lot C1 and Lot C3, construction engineering, project management, environmental mitigation, and the loss reduction component. The total cost of each ADB financed contract is shown in Appendix 7.

19. The value of all the ADB contracts negotiated amounted to approximately \$143.5 million. The ADB civil works contracts were signed at significantly lower costs than originally estimated.²³ At the time of the PCR mission, approximately \$140.4 million had been disbursed on the ADB contracts, leaving a loan balance of

¹⁸ The volume of the reservoir at the dry-season operating level of 524 meters above sea level is about 3 million cubic meters.

¹⁹ Section IV.E. Technical Assistance.

²⁰ Attached to footnote 1. Technical Assistance on the Institutional Strengthening of NEA's Environmental Division [TA2613-NEP], for \$534,000, approved on 23 July; Hassall & Associates Pty. Ltd, in association with Arcadis Euroconsult.

²¹ Attached to footnote 1. Technical Assistance on Power System Master Plan [TA2614-NEP], for \$600,000, approved on 23 July; Norconsult International A.S. in association with Norwegian Electric Power Research Institute.

²² The OECF loan was pledged at the Consultative Group Meeting of Donors in Paris on 10–12 April 1996. OECF had “no objection” in inviting tenders for civil works before the conditional pledge. OECF conducted its fact-finding in November 1995.

²³ Civil works contracts financed by ADB; i.e., Lots C1 and C3, were signed for approximately \$121.1 million compared with \$134.6 million estimated at appraisal; i.e., a loan saving of about 10%. Lot C2 was funded by OECF. As all civil works bidders offered a discount for being awarded multiple lots (Impregilo was awarded all three based on its evaluated bid, which included a 22% discount), which discount was not reflected in the Engineer's estimate, the difference of 10% should not be regarded as significant.

approximately \$7.8 million.²⁴ It could not be determined at the time of the PCR mission if this loan balance was sufficient to meet the outstanding payments for the unresolved contract disputes related to unpaid work per engineer-certified variation orders and contractor-claimed prolongation costs. NEA indicated to the PCR mission that there were committed pending payments of \$4.8 million, liquidated damages to be paid amounting to \$2.4 million, and prolongation costs of about \$3.5 million, resulting in approximately \$5.9 million due to the contractor plus a further \$0.6 million due to the engineer in retention money and other invoices. The total estimate by NEA of the amounts outstanding for the project was approximately \$6.5 million.²⁵

20. Taking into account the outstanding payments still to be made as described above, the PCR mission estimated the project's actual cost at \$365.7 million equivalent, with a foreign exchange cost of \$248.1 million or about 68% and a local currency cost of \$117.6 million or 32%.

21. As agreed upon in the financing plan at appraisal, proceeds of the ADB loan were re-lent to NEA at an interest rate of 10.5% per annum, repayable over 25 years, including a grace period of 5 years. The foreign exchange risk was borne by the government. Table 1 summarizes appraisal estimates; bid prices for Lots 1, 2, and 3; and actual project costs by component.

Table 1: Cost Breakdown by Project Component
(\$ million)

Item	At Appraisal			Lowest Evaluated Bid (Total) ^a	Actual			Actual/ Appraisal (%)
	Foreign Currency	Local Currency	Total Cost		Foreign Currency	Local Currency	Total Cost	
Preliminary Works		4.7	4.7				0.0	0.0
Civil Works								
Lot C1 (Dam and Desanders)	75.7	12.6	88.3	64.2	76.0	4.5	80.5	91.2
Lot C2 (Headrace Tunnel)	54.6	6.4	61.0	46.1	40.2	2.7	42.9	70.3
Lot C3 (Powerhouse)	36.2	11.6	47.8	47.8	40.9	3.3	44.2	92.5
Electromechanical Equipment								
Lot 4 (Hydraulic Steel Work)	21.6	0.9	22.5		18.5	0.5	19.0	84.4
Lot 5 (Electrical Equipment)	31.1	1.0	32.1		18.3	1.6	19.9	62.0
Lot 6 (Mechanical Equipment)	19.5	0.8	20.3		10.0	0.2	10.2	50.2
Lot 7 (Transmission System)	10.5	2.9	13.4		11.9	1.1	13.0	97.0
Other Project Costs								
Construction Engineering	13.0	2.1	15.1		18.3	2.7	21.0	139.1
Project Management	2.1	6.1	8.2		1.0	4.9	5.9	72.0
Environmental Mitigation	2.3	3.0	5.3		0.0	3.8	3.8	71.7
Loss-reduction Component	2.3	0.9	3.2		1.7	0.0	1.7	53.1
Taxes and Customs Duties		18.3	18.3			11.0	11.0	60.1
Contingencies	43.2	12.5	55.7				0.0	0.0
Interest during Construction	7.9	49.0	56.9		4.5	77.2	81.7	143.6
Total	320.0	132.8	452.8		241.3	113.5	354.8	78.4

²⁴ The \$160 million equivalent had been reduced to about \$148 million equivalent due to an approximately 8% decline in the value of the special drawing rights-denominated loan against the United States (US) dollar.

²⁵ The passage of time and contract provisions that included local commercial interest rate plus 3% (compounded monthly) may have increased the contractor's claim to as much as \$50 million. During an informal meeting with the IED Mission, NEA and the contractor's representative did not agree with the amount but agreed once again to seek an amicable settlement, this time perhaps through a binding mediation process. In the absence of any further clarification on the subject of NEA's outstanding liability, the FIRR and EIRR recalculations in this PPER will assume a settlement of \$25 million, although there is no factual basis for that amount.

IED = Independent Evaluation Department, OECF = Overseas Economic Cooperation Fund, PCR = project completion report.

^a All bids were submitted in Nepalese rupees. The totals shown in Table 1 were converted based on NRs56/\$1.

Sources of basic data: PCR, bid evaluation report, and IED. (The lowest evaluated bid prices for OECF-funded Lots 4–7 were not available, as the project files did not include bid evaluation reports on OECF-funded contracts.)

D. Implementation Arrangements

22. The implementing arrangements were as envisaged at appraisal. It is noteworthy that the implementation arrangements relied on fewer agencies than were involved during the consultation phase (Appendix 4). NEA was the executing agency for the project. The managing director of NEA was to be responsible to NEA's Board for overall project management. As required under the Loan Agreement,²⁶ NEA appointed a project director with the responsibility for the daily activities of the project under a clearly defined level of delegated authority. NEA also appointed the two POEs. ADB did not object to the selection of either POE. NEA also established the Kali Gandaki Environmental Monitoring Unit (KGEMU)²⁷ for project environmental monitoring. The consultants²⁸ who carried out the design and engineering of the project continued to assist NEA with project implementation under ADB financing. The NEA organizational chart is in Appendix 8.

Implementation relied on fewer agencies than were involved during the consultation phase

23. Several delays in the management of the project occurred. The setting up of the KGEMU was also delayed. The loan agreement required that the KGEMU be fully staffed and operational within 3 months of loan effectiveness; i.e., by mid-March 1997. When that date was not met, NEA agreed with the October 1997 ADB Mission to establish the KGEMU by mid-November 1997, which did not happen. The POE recommended a new KGEMU establishment deadline of March 1998, which they extended on their subsequent visit to the end of June 1998. Still, the KGEMU was not fully staffed and not operational, which prompted a letter from the engineer, noting that for over a year, the KGEMU was only half-staffed, and only one of the eight professional positions was filled by a competent person. On August 1998, NEA's managing director advised an ADB mission that NEA had difficulties in finding suitable applicants but that it had almost made up its complement and that the KGEMU was functional,²⁹ albeit about 1.5 years late. The IED Mission believes the significance of the late staffing of the KGEMU reflects the government's focus on constructing the facility.

Several delays in the management of the project occurred

E. Procurement, Construction, and Scheduling

1. Procurement

24. All procurement financed by ADB was undertaken in accordance with ADB Procurement Guidelines (2010, as amended from time to time), while procurement financed by OECF followed OECF procurement guidelines. Some local competitive

²⁶ Loan Agreement, Schedule 6, paras. 1–3.

²⁷ The KGEMU (which was to be a cornerstone of the project's environmental and social monitoring program) was given considerable emphasis by ADB to ensure that the project was implemented in an environmental and socially responsible manner. It was established within NEA for purposes of carrying out the project acquisition, compensation, and resettlement plan; the environmental protection and health safety plan; the mitigation monitoring management plan; and monitoring the progress of the construction activities under the project.

²⁸ Kali Gandaki "A" Associates.

²⁹ ADB. Back-to-Office Report, 7 September 1998. Unpublished.

bidding was performed for the preliminary works and for a small but critical part of the excavation of the dam site, which was carried out before the international contracts were awarded. The remaining procurement was undertaken through international competitive bidding. The contract packages were divided between ADB and OECF to facilitate parallel financing in accordance with procurement requirements. Advance procurement action was justified by the need to deliver power to consumers at the earliest possible time. Also, a firmer picture could be presented to the Board on the project cost once bids were opened in June 1996.³⁰ The loan was processed relatively quickly as ADB had been working on the project since 1992, had fielded several missions during the project preparatory stage, and had been closely involved in project development at every stage. ADB indicated to the government the very tight time schedule from the opening of bids in the middle of 1996 to the targeted commencement of civil works in December 1996 and the need for compressing the processing time to half the normal required time. On 4 October 1996, ADB approved the request of NEA to award the contract to Impregilo.³¹

25. Much was said in the project files about Impregilo's bid for the three civil works contract, Lots 1, 2, and 3. In particular, NEA opined that Impregilo bid low to win the contracts and then planned to recoup by charging for extras under variation orders. The time to determine whether a contractor has underbid was during bid evaluation. Often, a bid can be seen to be unbalanced, in which case, the engineer should advise the owner not to accept the bid. Such was apparently not the case. A meticulously conducted bid evaluation considered all aspects of all of the responsive bids, including discounts offered for multiple contracts (22.1% offered by Impregilo³²), and recommended award of Lots 1, 2, and 3 to Impregilo as the lowest evaluated responsive bidder. The bids were required in Nepalese rupees (NRs) and all entries in the appraisal estimate were in United States dollars (\$). Table 2 compares the estimate and the bids.

26. It can be seen that the appraisal estimate was not so radically different from the actual costs incurred as has been speculated, and that the bid prices were not so radically different from the actual costs once allowances are made for (i) the significant scope changes due to geotechnical difficulties encountered that were unforeseeable,

³⁰ Board members approved the advance procurement for the project, noting that it would help avoid construction and commissioning delays.

³¹ The prequalification and tender documents for the civil works packages (C1 for the dam and desanding facilities, C2 for the headrace tunnel, and C3 for the power station; C1 and C3 were financed by ADB, and C2 was financed by OECF) were prepared by the consultants and reviewed by NEA and ADB. In response to the invitation for prequalification in August 1994, 36 firms submitted an application, of which only 13 firms satisfied the prequalification criteria. The lowest bid was from Impregilo S.p.A. of Italy (Impregilo), with a read-out price of \$123 million for all three lots. All of the bids received showed a longer construction schedule (2–9 months more) than required in the tender documents. It is assumed that OECF likewise approved the award, since its loan portion also included one of the three lots comprising the civil works contract; but the project files contain no reference to OECF's involvement. Impregilo's quoted price for lot C1 had to be increased by approximately \$6.5 million, as their original quoted price was based on receipt of a letter of acceptance from NEA on November 1996. This date could not be met and a new date of 15 December 1996 was indicated by Impregilo. It was pointed out by Impregilo that this 6-week delay could lengthen project completion due to curtailed availability of dry flow season days. NEA requested Impregilo to accelerate the schedule to achieve the original start date of 1 July 2000 for testing the first unit. Impregilo indicated that this would require additional earthmoving equipment, concreting equipment, and personnel. The cost of this was mutually agreed on between NEA and Impregilo and resulted in a net cost increase for Lot C1 of \$6.5 million.

³² Some critical views were expressed in the project files regarding Impregilo's discount. In that regard, it should be noted that (i) it is normal practice for contractors to offer discounts for multiple parts of a project, (ii) the tender invited contractors to offer discounts, and (iii) all bidders offered discounts. There was nothing improper in offering discounts, nor accepting them.

and (ii) the significant outstanding claims by the contractor against the owner. The comparison is shown in Table 2.

27. The IED Mission found no record of OECF-funded electromechanical portions, particularly bid evaluations, except that the PCR recorded the actual costs. The comparison between actual costs and the appraisal estimate is shown in Table 3.

28. When the difference between the estimated and bid costs for the electromechanical equipment (Lots 4 and 5) was noted, the IED Mission expected to find substandard equipment on site. Such was not the case. However, three items were regarded as anomalous: (i) the geographic information system (GIS) equipment from Hyundai was apparently not a current model when it was purchased, as witnessed by the fact that spare parts were not readily available and had to be specially manufactured (at additional cost); (ii) the same situation was noted with respect to control cabinets by Alstom that were well made and exceptionally well maintained but were based on 30-year old relay logic; and (iii) the main transformers were manufactured in Croatia.³³ The cost overrun of the transmission systems can be explained by the requirement to reroute the Pokhara line, which necessitated lengthening it and providing another substation.

Table 2: Appraisal Estimates and Actual Costs vs. Bid Prices (Civil Works)
(%)

Lot	Bid vs. Appraisal	Actual vs. Bid	Actual vs. Appraisal
Lot C1	-27	+25	-9
Lot C2 ^a	-24	-7	-30
Lot C3	0	-8	-8
Totals	-20	+6	-15

^a For example, for Lot 2, the bid was 24% less than the appraisal estimate, the actual was 7% less than the bid, and the actual was 30% less than the appraisal estimate

Source: Independent Evaluation Department.

Table 3: Actual Costs vs. Appraisal Estimates (Electro-mechanical Equipment) (%)

Lot	Actual Costs vs. Appraisal
Lot 4 Hydraulic steel	-16
Lot 5 Electrical equipment	-38
Lot 6 Mechanical equipment	-50
Lot 7 Transmission systems	-3

Source: Independent Evaluation Department.

2. Construction

29. All things considered, construction proceeded fairly normally. There were some notable exceptions: (i) the encounter of unforeseen adverse geological conditions at the desander side slope, headrace tunnel, and surge shaft; (ii) NEA's very slow response time to variation requests and payment approvals; (iii) the problems encountered importing materials and supplies from India, which were exacerbated by NEA's inability or unwillingness to provide timely assistance; and (iv) the militant behavior of some local people, both employed and not. All four situations caused significant delays and added to the cost. The contractor also caused some delay by not scheduling certain activities adequately (e.g., tunnel excavation was delayed because adequate equipment was not on site).

Construction proceeded fairly normally with notable exceptions that caused significant delays and added to the cost

³³ Pers. Comm. Končar Power Transformers Ltd. (a joint venture of Siemens AG and Končar d.d.).

30. Although delayed and affected by various impediments, the result was a mostly well-constructed hydroelectric power plant. Some exceptions were (i) the fish hatchery, and (ii) the possibility of having used concrete mix with insufficient hard aggregate to withstand the severe abrasive nature of the river flow for the life of the project (a small but important sign is the erosion of concrete down to the reinforcing steel at the spillway gate seal plate). The hatchery deficiencies are noted in Appendix 5 together with a recommendation to determine refurbishments and additions. Whether the abrasion-resistant concrete can withstand the test of time and the Kali Gandaki erosive action is not easily determined and much more difficult to correct, if the need to do so is identified.

3. Scheduling

31. Based on lessons learned from previous ADB-funded power sector projects in Nepal, ADB's processing activities were geared to avoid the usual delays caused by conditions of loan effectiveness not being met, consultant selection, and contract awards. Consequently, preliminary activities occurred expeditiously and exactly as planned, from the invitations to bid in April 1996 to the contract awards on 30 December 1996.

Civil works scheduling was based to a large extent on the seasonal flows of the Kali Gandaki

None of the civil, mechanical, and electrical project components were completed as scheduled, delaying final commissioning

32. Scheduling of most of the dam site civil works was based to a large extent on the seasonal flows of the Kali Gandaki.³⁴ Because of the seasonal nature of the river flows, the timing of some activities related particularly to dam construction was highly critical. Consequently, delays encountered for any reason (for example, the second, unplanned river diversion) had significant consequences: (i) either the contractor added necessary equipment and manpower, or (ii) the affected project component was permanently delayed. Which option to choose was often hampered by NEA's inability to endorse its engineer's recommendation. This negated the optimism expressed in the RRP that, although the implementation schedule was tight, it was considered achievable with close project supervision by NEA. Also, unforeseen geotechnical difficulties in implementing the construction schedule for the river diversion works, diversion dam, desander side slopes, headrace tunnel, and surge shaft caused significant delays. Last, the project files refer to the main civil contractor's apparent overoptimistic assumptions on labor and materials requirement, particularly for the headrace tunnel construction. As a result of these general reasons, none of the civil, mechanical, and electrical project components were completed as scheduled, delaying final commissioning by 21 months. The main project schedules, planned and actual, are shown in Appendix 9.

F. Outputs

33. Physical outputs were by and large achieved: a 44 m high concrete gravity diversion dam, a 5.9 km long headrace tunnel, a surge shaft, pressure shaft, tunnel leading to the power station, hydraulic steelwork, electrical and mechanical plant and auxiliaries for the three 48-MW turbo-generating units, and two 132-kV transmission lines of over 105 km length. The details are shown in Table A9 in Appendix 9. ADB helped develop the project and processed the loan before it had adopted design and monitoring frameworks, and so the RRP did not include a design and monitoring framework.

³⁴ The monsoon season is June–October and the dry season, with attendant low river flows, is November–May.

G. Consultants, Contractor, and Suppliers

1. Consultant Recruitment

34. The consultant or engineer was recruited in accordance with ADB's *Guidelines on the Use of Consultants*. NEA negotiated a contract with Kali Gandaki "A" Associates (KGAA) led by Morrison Knudsen International. KGAA was the lead design-phase consultant, appointed in 1992, and was then retained for the project construction phase. The consultants were approved on 23 July 1996.

2. Consultant Performance

35. The project implementation consultant made many staff changes, at least one of which – the change of the team leader – was demanded by NEA. It was reported to the PCR Mission that NEA did not agree with the staff changes that were made; however, the changes were all endorsed by NEA, and NEA had not raised the matter previously with ADB. The relationship between the consultant and NEA was not good, and on 31 August 2000, the consultant indicated to ADB that it would be ceasing operations at the site if its claims, which totalled about \$1.1 million, were not settled immediately by NEA.³⁵

36. The consultant's reports were sometimes as much as 4 months late and were not always in the format requested by ADB. The majority of the problems, however, stemmed from NEA's inaction on submitted documents within the contract period, which eventually forced the consultant to issue variation orders despite the absence of a formal approval from the NEA. Otherwise, there would have been significant negative project impacts for which the consultant might have been held responsible. A timely structured response from NEA would have pre-empted most of these issues.

A timely structured response from NEA would have pre-empted most of the consultant issues

37. Further, as a result of the delays in the civil works and the consequent delays in the mechanical and electrical installations, the construction supervision work also had to be extended beyond the original dates foreseen in the contract. On 22 December 2000, the Ministry of Finance informed ADB that, due to time overruns and the additional scope of works assigned to the consultant, the budgetary allocation under Consulting Services (Category 3) was insufficient to cover additional costs for consulting services. The Ministry of Finance requested ADB to reallocate \$3,167,307 from Loan Category 5: Unallocated, to Loan Category 3: Consulting Services. ADB approved this request. The consultant's total expatriate person-months required to complete the project were estimated to have increased from 512 person-months to 614 person-months, and this increase is assessed as appropriate by the IED Mission due to the technical complexity of the project.

38. There were difficulties in consultant performance, particularly with respect to wrongly reporting claims to ADB for further follow-up action on nonpayment by NEA, frequent changes in personnel, delayed reporting, not adequately highlighting ADB's requirements, and others, consultant performance was considered less than satisfactory in the PCR. In view of the distinct possibility that the consultant erred in the forebay and the desander design, causing accelerated abrasion of turbine parts, and also, in the

³⁵ In respect of the \$1.1 million, \$277,000 had already been approved by NEA, and \$376,679 in payments up to July 2000 were approved in September 2000. This left approximately \$450,000 still to be negotiated and approved. Payment was eventually made in October 2000.

application design for the turbines, causing damaging cavitation, the IED Mission confirms the performance rating.

3. Contractor's Performance

39. According to the IED Mission, the performance of the contractor for Lots C1, C2, and C3 of the project was satisfactory. Most of the delays that occurred in implementation of the project were not directly caused by the contractor.³⁶

40. On 23 August 2000, the contractor notified ADB and OECF that it would (i) reduce gradually all its resources, and (ii) eventually serve a Termination Notice under Clause 69.1 of the contract. This had become necessary due to the failure of NEA to honor its contractual obligations and pay the contractor for the works executed and duly certified by the engineer under lots C1 and C3. This amounted to \$4.8 million. At this stage the project was approximately 65% complete and 17 months behind schedule. ADB fielded a Special Loan Administration Mission to resolve this situation. ADB accepted the variation authorization requests in lieu of the variation orders for withdrawal applications, and on 8 September 2000, payment for the \$4.8 million outstanding to the contractor was made by ADB.

4. Suppliers' Performance

41. The project files do not contain any information on the suppliers and installers of electromechanical equipment of Lots 4–7. The IED Mission observed that all equipment³⁷ appeared well constructed, with minor exceptions of appropriate materials, operating as intended, and reasonably well maintained, particularly in view of the scant operation and maintenance (O&M) budget available.

H. Loan Covenants

42. At the time of project completion, the PCR listed 8 covenants met and 19 partly met or unmet out of a total of 27 covenants. The IED Mission drew similar conclusions. Table 4 lists the status of covenant compliance. The two most telling covenants that were not complied with were (i) tariff increases (finally in 2012 there was an increase), and (ii) reduction of technical and nontechnical system losses. In addition, all nine covenants dealing with social safeguards were either not met or only partially met. Appendix 10 lists all covenants and provides an assessment of the degree of compliance as determined in the PCR and also by the IED Mission.

System loss targets and financial covenants were not complied with

43. System loss³⁸ targets and financial covenants were not complied with, requiring NEA to (i) reduce its overall system loss to a level not exceeding 20%, (ii) adjust tariffs sufficiently to enable a self-financing ratio of 23% (the tariff structure of NEA is shown in Appendix 11), (iii) maintain a debt-service coverage ratio of not less than 1.2, and (iv) keep accounts receivables of within 3 months of energy sales. Improvements were achieved in reducing system losses, although not to the level targeted in the loan

³⁶ Some delays, however, were due to the contractor. Work on contract C1 was commenced late due to a 3-month delay in the import of construction equipment by the civil works contractor. Similarly, C3 was running approximately 3 months late due to delay in the import of cement.

³⁷ Within the time available, the IED Mission was unable to inspect the transmission lines and associated substations and is, therefore, unable to provide an opinion on the serviceability of those components of the project.

³⁸ System loss is expressed as a percentage of the difference between gross energy generated and energy sold to the gross energy generated.

agreement. These factors would affect the sustainability of the project and the feasibility of achieving these covenants in the context of Nepal, and the prevailing environment in the power sector should have been investigated and noted in the RRP.

44. Under the Project Agreement, NEA was also obliged to furnish ADB certified copies of audited financial accounts for its annual operations within 9 months of the close of each fiscal year. For FY1999, audited accounts were due by 16 April 2000. A preliminary audit was received by ADB. Final audited accounts were overdue. The ADB procedures that came into effect in January 2000 as part of ADB's anticorruption policy stated that ADB will, unless there are any exceptional extenuating circumstances, be obliged to stop processing reimbursement requests and commitment letters under its project loans if the audited accounts of the executing agency are not received by ADB within 6 months after the due date. This was made clear to NEA. The audited accounts of previous financial years were often overdue. This covenant was usually not complied with. The IED Mission obtained financial statements for NEA to examine the performance of NEA over recent years. A balance sheet, an income statement, and a source and application of NEA funds for FY1995–FY2002 were obtained. Forecasts of these financial statements were also provided by NEA up to FY2007.

45. In terms of environmental covenants, the Loan Agreement required NEA to establish, within 3 months of the effective date, the KGEMU and to appoint agreed-upon staff. The role of the KGEMU, limited to the construction phase, was to oversee the implementation of the environment and social mitigation plans (environmental management plans and sector development programs). After the loan became effective, the KGEMU should have been established at the latest by 12 March 1997. It was only after the ADB letter of 19 June 1998 that NEA informed ADB by letter dated 30 June 1998 of its intention to fully comply. This resulted in more than a 1-year delay in this covenant being complied with. It is worth noting that ADB Board discussion at the time of approval noted the importance of the capacity of NEA to meet environmental and social requirements and for ADB to comply with its own policies.

Importance of the capacity of NEA to meet environmental and social requirements was noted

Table 4: Covenant Compliance

Project Component	PCR			IED Mission		
	Complied With	Partly Complied With	Not Complied With	Complied With	Partly Complied With	Not Complied With
Project implementation	3	1	-	2	2	-
Environment	1	3	-	2	2	-
Social/resettlement	2	7	-	-	8	1
Financial	1	-	3	-	-	4
Audited project accounts and financial statements	-	1	-	-	1	-
Economic efficiency	-	2	1	1	1	1
Others	1	1	-	1	1	-
Total	8	15	4	6	15	6

IED Mission = Independent Evaluation Mission, PCR = project completion report.

Source: PCR and IED.

I. Policy Framework

1. System Losses

46. At the time of appraisal, NEA was questioning its ability to meet the covenanted 20% system losses target. The IED Mission review confirms that reduction in system losses—targeted at appraisal—was not met.

2. Tariff Increases

47. Also at the time of appraisal, NEA questioned its ability to increase tariffs as requested by ADB in order to ensure financial viability of the project. The current tariff of 7.16 cents was lower than for most other countries in the region, with the exception of India and Bangladesh, where the prevailing tariffs were very low. The target set at appraisal was for an increase in tariff of 90% from 1996 to 2004 to just above NRs9/kilowatt-hour (kWh). However, the actual tariff in 2011 was NRs7.16/kWh.³⁹ The electricity tariffs in Nepal have to be ratified by the tariff commission following recommendation by NEA. In spite of a recent increase in tariff to NRs8.6/kWh, however, tariffs do not reflect the cost of production of electricity including the financing of NEA, which manages and operates all public hydropower stations. This revenue cap has big implications for the financial viability of the NEA.

48. It should be noted that during the management review meeting of 18 March 1996 and Board discussions of 23 July 1996, the tariff increases and loss reduction required to achieve an adequate EIRR were questioned. The Board advised that ADB should strictly enforce its financial covenants.

Tariffs do not reflect the cost of production of electricity including the financing of NEA

³⁹ Tariffs have however been increased by 20% since mid-2012. This is reflected in the FIRR and EIRR calculated for this project from 2012 onwards.

CHAPTER 3

Performance Assessment

A. Overall Assessment

49. The project is rated *successful: relevant, effective, efficient, and likely sustainable* (Appendix 12).

B. Relevance

50. The project is assessed *relevant*. The support was aligned with both country and sector priorities of the government and ADB. Increasing available power is relevant to economic growth, a prime objective of ADB at the time, and still an important agenda at present; however, the design of the project was rated as less than adequate due to intake, power house, and mitigation measures designs.

51. In the context of project design, the needs of the Nepal power sector were adequately assessed, starting in 1979 with the first feasibility study undertaken by SMEC. Hydropower alternative sites to Kali Gandaki "A" and designs were investigated during the SMEC/FINNIDA/UNDP studies between 1979–1992 and the Kali Gandaki "A" site came up and was selected as the most technically and economically feasible.

52. ADB participated equally with OECF to provide a useful intervention. While that intervention could have been more appropriate had its design included more storage to address Nepal's shortage of peak power, the environmental and social conditions associated with ADB financing and political constraints at the time prevented consideration of such design options. This PPER can support the ADB decision to proceed with the project.

53. The only other major donor in Nepal in the energy sector was the World Bank and at the time, it was withdrawing from dams (West Seti, Arun III) due to controversy associated with the environmental and social impacts of these structures. OECF and ADB were useful partners to the Government of Nepal in financing Kali Gandaki "A."

The support was aligned with both country and sector priorities of the government and ADB

C. Effectiveness

54. The project is assessed *effective*. The objectives were (i) to help meet demand for electric power in Nepal at the least cost and in an environmentally and socially acceptable manner, (ii) to promote institutional strengthening, and (iii) to improve NEA's cost recovery. Least cost was not demonstrated; however, significant savings were realized over bids that were already significantly lower than the engineer's estimate.

The delayed commissioning means the project was not as helpful as it could have been in terms of peak power supply

55. To the extent that Kali Gandaki "A" added significantly to Nepal's power grid and improved the living conditions of thousands of rural dwellers, ADB's assistance achieved its objective. However, the RRP noted the problem of load shedding in Nepal which Kali Gandaki "A" was intended to minimize.⁴⁰ Data show that demand for power had outstripped Nepal's cumulative installed capacity even at project commissioning. While the project still helped meet demand as intended, the delayed commissioning of 21 months due to scope changes and difficulties in management with the contractor means the project was not as helpful as it could have been in terms of peak power supply, which was the rationale for constructing Kali Gandaki "A" as noted in the RRP.

56. The scope changes resulted from unforeseen circumstances associated with geology and social response to transmission line alignment. Three general scope changes occurred during implementation:

- (i) Intake design based on POE recommendations: As the design change resulted in questionable performance, it can be said to have reduced the potential effectiveness.
- (ii) Desander basin side slope, tunnel excavation and support, and surge chamber rebore based on geotechnical failures and POE recommendations: Without these scope changes, the project would not have been completed. Nonetheless, again, the potential effectiveness was reduced as compared to what was envisaged in the original design.
- (iii) Transmission line to Pokhara based on proximity to 13 home owners: Since this scope change delayed full evacuation potential and added cost to the project, it reduced the potential effectiveness.

57. As stated in the RRP, environmental sustainability and social responsibility were part of the objectives. Further development gains would have materialized had the environment and social mitigation measures been implemented with higher budget and larger scope. Examples include operational schools, public health center, water supply and sanitation, and a fisheries program. The management of environmental and social programs was carried out in a standard way with an ADB selected panel of expert-type management with a budget essentially limited to the construction phase. ADB carried out frequent missions to the site; however, given the pace of construction and contractors on site working 24 hours/day and 7 days/week, much action was actually missed with supervision missions arriving after the fact. Seriously project-affected families and project-affected families, and Bote families indicated spending about 2%–3% of their income on energy for their homes, implying widespread but not complete connections to the grid. However, mitigation measures did not provide additional long-term benefits to local people because of their limited scope, design and budget. The social survey undertaken as part of this PPER provides insight that much of the social development benefit came from access to electricity as well as the access road to the project site, the latter being a preceding (but related) government project.

There was no full and lasting transfer of technical knowledge

58. The project included two TA operations intended to strengthen NEA's Environment Division and NEA's power system master planning capacity, which were relevant in the context of NEA's institutional needs. The outcome of the product extended to the government, however, is not clear. The TA completion reports rated both TAs as equivalent to *less than successful* to which this PPER agrees. It was evident that there was no full and lasting transfer of technical knowledge because the relationship between NEA and the consultants under the TAs were not smooth, as

⁴⁰ Footnote 1. Section A (Rationale), para 27.

indicated by both TA reports. The implementation of environmental and social protection measures drawn from existing regulations continues to be at a lower scale than should be the case for a country with extensive hydro potential in world heritage setting. Likewise, the assistance provided to NEA for generation and transmission master planning should have been extended to all aspects of its operation, with external agencies such as the Tariff Fixing Commission, Ministry of Finance, Ministry of Energy, Ministry of Environment, and Ministry of Culture, Tourism and Civil Aviation brought into the overall context of the TA. Both TAs appear to have been short-lived, during the Kali Gandaki “A” project construction phase only, as opposed to striving for long-term institutional impacts.

59. Finally, the objective of improving NEA’s cost recovery has not been attained. This was constrained by the failure, for many years, to comply with covenants mandating tariff increases to meet the increasing cost of generating electricity.

The objective of improving NEA’s cost recovery has not been attained

D. Efficiency

60. The project is assessed *efficient*. The recalculated EIRR is 16.05%, which implies that ADB’s support achieved economic benefits for Nepal. The main driver for the EIRR was found to have been a respectable production of energy, averaging 600 GWh/year between 2002 and 2010, and the replacement of costs of kerosene and diesel fuels that the power plant displaced. The calculation took into account the expected refurbishment costs for the intake and power house, and contractor claims settlement.⁴¹ The low price of energy was also included in the analysis, including the 20% price increase of mid-2012. The result shows that the project continues to be of great value to the Nepal economy (Appendix 13). The appraisal estimate was 15% while the PCR estimate was 18.2%. Project files provide no supporting evidence for these figures and so it is not possible to explain the differences. The appraisal estimate, however, seems quite consistent with the current PPER estimate although probably due to optimistic tariff forecast and undervalued replacement costs of alternative energy uses.

ADB’s support achieved economic benefits and continues to be of great value to Nepal

61. There is no doubt that selecting hydropower versus thermal plant in Nepal provided a least-cost intervention given the country’s natural advantage of mountains and rivers and given relatively high costs of alternative energy such as diesel and oil. At the time of the feasibility study, alternatives to the adopted design were investigated but ultimately rejected and it now appears, when factoring in energy production (actual versus planned) down time due to mechanical problems in the turbines, that factoring operational costs into the decision making process may have appropriately changed the design of the plant. The World Bank is proposing a \$20 million project⁴² to be invested in the plant to rectify problems, including intake and desander configurations, cavitation on turbine parts, and vibration in the powerhouse. In addition, procurement requirements, including international bidding, will ensure that the executing agency receives competitive bids. To assure that the lowest evaluated tender represents approximately the least cost, the use of value engineering⁴³ is

⁴¹ The IED Mission understands a settlement of \$8.9 million may have been reached in mid-2012.

⁴² World Bank Resident Mission personal communication.

⁴³ <http://www.mto.gov.on.ca/english/transtek/ve/>. Value engineering, also known as value analysis, is a systematic and function-based approach to improving the value of products, projects, or processes. Value engineering involves a team of people following a structured process. The process helps team members communicate across boundaries, understand different perspectives, innovate, and analyze. Value engineering improves value. On highway projects, improvements to value might include reducing the life cycle cost of an interchange, enhancing safety in a design, or reducing impacts to the public by shortening

The project ended up being delayed indicating that the design and TAs did not filter through into implementation

recommended to determine least costs and that future O&M costs are factored into selection of contractors.⁴⁴

62. In terms of process efficiency, lessons learned discussed in the project formulation include delays in meeting conditions of loan effectiveness, recruiting consultants, and awarding contracts. However, despite noting these potential pitfalls, the project ended up being delayed by almost 2 years due largely to contract management issues indicating that the design and TAs as presented in the RRP did not filter through into implementation.

The project faced problems with the community, and the delay resulted to cost overruns

63. The project faced issues, concerns, and problems with the community and the local people, including project-affected families, during the initial years of the project implementation. These issues mainly emerged due to perceived lower selection of affected people for employment and training. The project was delayed, with corresponding cost overruns, by several strikes; work stoppages; ultimatums by communities; and protests from the local communities that became violent at times, as well as from contractors' employees (KGEMU Synthesis Report 2001). In addition, the transmission line to Pokhara was delayed because the alignment of the line passed through agricultural land that the owners did not want to sell. The new design and alignment bypassed the land. This delayed electricity evacuation via the Pokhara transmission line by several months. Appendix 14 provides more details.

E. Sustainability

The biggest factor affecting sustainability is that electricity tariffs were not increased after 2001

64. The project is assessed currently as *likely sustainable*. Funding for the Kali Gandaki "A" facility was sufficient; in fact, almost all of the seven lots of construction and supply and install contracts were bid for less than the engineer's estimates and were implemented for less. Nonetheless, the biggest factor affecting sustainability is that electricity tariffs were not increased after 2001 as provided for by the loan covenants. After the IED mission, a 20% increase in tariffs approved in mid-2012 must have improved NEA's financial viability. However NEA's inability to reduce its technical and non-technical losses may well continue to contribute to NEA's current insolvency and its continued reliance on funding from the government's general budget. The PPER recalculates the FIRR for the project as 6.05%, which is slightly higher than the weighted average cost of capital of 5.7%. Provided that NEA's financial situation improves due to the recent tariff increase and if the pending refurbishment to Kali Gandaki "A" proceeds, design energy production is likely sustainable in the long term (Appendix 13).

the duration of a construction project. Value engineering uses a combination of creative and analytical techniques to identify alternative ways to achieve objectives. The use of function analysis differentiates value engineering from other problem solving approaches. Value engineering focuses on delivering the product or service at the best price by incorporating those value characteristics deemed most important by the customer.

⁴⁴ It is acknowledged that the cost of unreliability may be difficult to quantify; however, historical data on components and failure rates as well as monte carlo type modeling could provide useful estimates. Such an approach could be investigated.

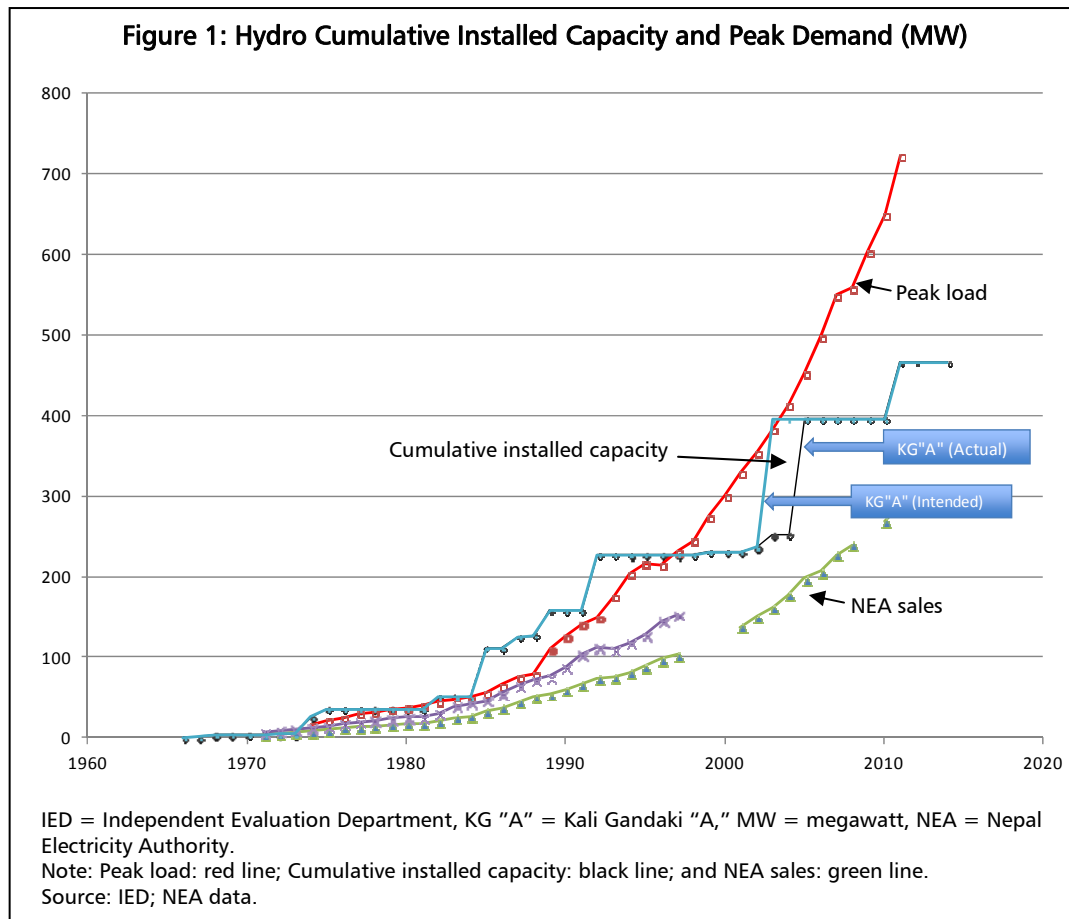
CHAPTER 4

Other Assessments

A. Project Impacts

65. Figure 1 shows the net jump in cumulative installed hydropower capacity due to the commissioning of Kali Gandaki "A" in 2002. In addition to imports from India and thermal plants, NEA had managed to alleviate load shedding in the early years of production from Kali Gandaki "A" until demand once again outgrew production. Kali Gandaki "A" therefore played a significant role in supplying energy for Nepal and the project's benefit to the country is undeniable. Kali Gandaki "A" came on board some 21 months late and, in comparison to peak load, this delay shows a missed opportunity to provide timely service over that period.

Kali Gandaki "A" played a significant role in supplying energy for Nepal



B. Environmental and Social Impacts

The project affected 12 villages, impacted occupation, and generated risks of flood and inundation

66. The Kali Gandaki "A" project affected 12 villages of *Syangja*, *Gulmi*, *Palpa* and *Parbat* districts⁴⁵ and expropriated the assets of 1,468 families from the affected villages. However, resettlement was mainly concentrated in *Syangja* district, especially in *Shree Krishna Gandaki* and *Jagatra Devi* village development committees. Of the total 1,468 families that had impacted assets, 263 were defined as seriously project-affected and 1,205 were project-affected.⁴⁶ The project expropriated altogether approximately 208.68 hectares of land and 90 houses.⁴⁷ The project-affected families include 17 Bote and 2 Magar households, considered to be indigenous peoples. The project also impacted the traditional occupation of some Bote families. Similarly, the project reportedly generated risks of flood and inundation at Seti Beni Bazaar and a religious-cultural site (holy stones [Saligrams]) upstream. The downstream area is affected due to inadequate water flow for performing "holy dips" and other rituals.

67. The main points regarding environmental and social aspects of Kali Gandaki are summarized as follows. More detailed explanation is provided in Appendix 15.

68. The original EIA is no longer available and conclusions are derived from first-hand observations; discussion with concerned agencies in Nepal; and project correspondence, project reports, and the summary EIA paper.

69. While consultations on environmental and social matters involved a wide number of agencies, implementation involved principally two agencies (National Agriculture Research Council and NEA) sharing a focus on disclosure rather than implementation.

70. The environmental and social TA designed to address NEA's capacity to manage environmental and social programs was found to have been in line with practice at the time (and current ADB practice); however, it did not seem to produce results, as most (10 of 13) covenants pertaining to environmental and social matters were delayed or were partially or not complied with.

71. Increased access provided over the years to electricity, roads, water transport, local markets, schools, and water supply was found to have benefitted local people; however, none of such development oriented measures were included in the suite of activities in the RRP proposed as part of the mitigation plans. Rather, they were separately undertaken by the government and the contractors. These development activities were not included as ADB probably saw them as going beyond the objective of mitigation of adverse project impacts, but this report would see them as essential parts of a development oriented approach that a future project with such profound impacts on people and livelihoods should take.

72. The mission reviewed the mitigation measures and concludes that the restoration of livelihood activities undertaken were either (i) undertaken at too small a scale (agriculture, primary health care, and nature reserve) to be of tangible sustained benefit for the local population; or (ii) not successful (trap and haul program,

⁴⁵ ADB. 1996. *Summary Environmental Impact Assessment (SEIA) for the Kali Gandaki "A" Hydroelectric Project in Nepal*. Manila.

⁴⁶ R. P. Thanaju. 2007. Hydro Nepal. *Journal of Water Energy and Environment*. Volume 1, Issue 1, June 5.

⁴⁷ KGEMU. Synthesis Report. 2001.

The TA did not seem to produce results as most covenants pertaining to environmental and social matters were delayed or were partially or not complied with

microcredit, solid waste and spoil disposal, riparian release for fisheries migration, and the fisheries program as a form of income).

73. An example of questionable design and implementation of safeguard measures was the fisheries mitigation implemented by the KGEMU. First, the socioeconomic surveys at the time showed that 1% of the people derived income from fisheries in the project area, while 36% derived income from agriculture; yet the mitigation budget spent on fisheries was 29% of the total \$5.34 million but only 0.7% was on agriculture. (The department's view was that the environmental condition of fisheries was more directly in the impact sphere of the project, and hence needed more mitigation.) Second, the environmental impact assessment (EIA) identified major impacts on fisheries as a result of "water development projects, pollution, improper harvest methods (dynamite and toxins), and the absence of fisheries laws and poor enforcement of existing laws." However, Kali Gandaki "A" mitigation measures did not address any of those issues but concentrated instead on mitigating direct project impacts, which were loss of downstream flow and fish passage. In the context of these other fisheries sector problems, the mitigation measures made little difference to the downward trend in fish catch. Of a total of 57 species listed in the EIA in the area of the project, 10 have been domesticated for propagation so far by the fish hatchery. This is an excellent result for Nepal Agriculture Research Council staff who continue the work in the fish hatchery; however, the design of the mitigation measure should have included a wider perspective of the fisheries sector and created an associated development fund to address other problems faced, and created (dynamite and toxins), by the fishermen. This would have brought development value to the mitigation measures and ensured sustainable benefits for local people in addition to the nonmitigation measures, i.e., the access road and electricity.

74. Other programs were either not part of the mitigation measures or not undertaken by the KGEMU (job training and primary school).

75. Similarly, although employment opportunities for about 200 persons in the Kali Gandaki "A"/NEA and fish hatchery have been provided due to Kali Gandaki "A" and/or NEA, at least as many project-affected and severely project-affected families have not benefitted from employment and all those employed at fish hatchery have temporary jobs the future of which is uncertain due to funding restrictions from NEA.

76. Thus, the mitigation measures undertaken as part of the project have not added development opportunities to the area, and have not been very effective at mitigating negative environmental impacts either. However, some opportunities created outside the project have worked out well since the project, as was mentioned in para. 71. The preproject access road to the project site in particular is thought to have contributed huge development benefits to the region, providing all-year access for trading agricultural goods in and out of the area. The socioeconomic survey undertaken for this PPER (Appendix 1) also indicated that the sources of income of the sample households had changed considerably. About 82% of households agree that the project contributed to improved household incomes. Although agriculture and livestock outputs had declined, other forms of employment were availed of by some affected households. Similarly, the number of households having businesses, pensions, and other remittances as sources of income had also increased, although this was not attributed to Kali Gandaki "A." Of the total sampled households, about 97% considered that the area had been developed due to the project. The livelihoods of all the sampled households had been rehabilitated.

Mitigation measures have not added development opportunities to the area, and have not been very effective at mitigating negative environmental impacts either

77. At the time of project design in 1996, ADB did not have an indigenous peoples policy. The policy was approved in 1998. Nevertheless, the project did relatively well to differentiate indigenous peoples and recognize their needs. However, the mission noted some problems:

- (i) Counterpart records of resettlement data, including of indigenous peoples, were difficult to obtain.
- (ii) Final engineering designs and construction method documents are needed for final resettlement and indigenous peoples plans to be appropriately designed. Engineering designs and construction methods for project lands are very important for this purpose. These were not included in the involuntary resettlement policy documents. Involuntary resettlement and indigenous peoples plans should be implemented before construction starts. This requires contracts and financing arrangements to be structured appropriately. In Kali Gandaki "A," indigenous peoples from the Bote group (at least 10 of the 19 indigenous peoples families, per records available) were resettled successively up to three times after construction had started. At the time of the PCR in 2004, some Bote families (no definite number was specified) were still being moved into new locations.
- (iii) Finding livelihood opportunities for minority groups within the resettled population was not optimized in Kali Gandaki "A." For example, for the Bote, promoting boat transport in the river when dammed⁴⁸ needed proactive development-focused designs derived from the impact assessment. These were not available. Further follow-up during the operational phase was also needed, pointing to the need for much longer time frames for mitigation measures. In Kali Gandaki "A," budgets were focused primarily on the construction phase.
- (iv) A number of other opportunities to benefit resettled communities, especially the Bote group, were not maximized including water supply, schooling, health center, electricity access, and navigation.
- (v) Physical cultural resources, mainly the Seti Beni, were respected by limiting the reservoir's maximum level. However frequent peak flows from tributaries have resulted in its being flooded periodically.

C. Impact on Institutions

78. Based on the TA completion reports (TCRs) of the TAs on institutional strengthening of NEA's environmental division⁴⁹ and on the power system master plan for Nepal,⁵⁰ and on IED Mission findings, the institutional impact of the project is assessed *moderate*. The training focusing on NEA staff had aimed at equipping them with additional knowledge and experience to handle power development projects in the country. However, this was assessed as limited. The dissolution of the KGEMU 2 years after project completion also questions the soundness of requiring NEA to institutionalize a project-specific environmental monitoring unit overlapping with the responsibilities of the National Environment Protection Authority. Currently, the focus of NEA's Environmental and Social Studies Department (ESSD—which was supposed to

⁴⁸ The dam formed a reservoir on the Kali Gandaki river. This reservoir has provided for water transport for local communities instead of walking, as required before the reservoir was formed. This is a benefit for the local economy. However, no project activity was envisaged to promote boat transport because the project focused on mitigation rather than development.

⁴⁹ ADB. 2000. *Technical Assistance Completion Report: Institutional Strengthening of NEA's Environment Division*. Manila.

⁵⁰ Footnote 7. Appendix 10, page 36.

take over the functions of the defunct KGEMU) is on planned and ongoing projects, essentially acting as a consultant to undertake EIAs of hydropower. The IED Mission is of the opinion that project management of environmental and social impact and mitigation measures in coordination with other government agencies would be a better role for NEA's ESSD, with the technical EIA work outsourced to consulting firms.

79. The impacts of the TAs were to impart (i) power master planning capability, and (ii) environmental and social impact assessment capability. Power master planning was rightly NEA's mandate although limited success at this task was evidenced in 2012 due to power shortages in Nepal, while environmental and social impact assessment responsibility is not NEA's mandate and so would have been better allocated to the environmental protection agency if it existed at the time, or equivalently mandated government agency.

80. The outcomes of the TAs are likely not sustainable as (i) institutionally, NEA has not changed significantly due to the project, and (ii) the KGEMU no longer exists since project completion. However, some staff members of the old KGEMU have been with NEA's ESSD since the project started operations.

81. The extent to which ADB's best practices on safeguards are being incorporated into other hydropower project designs in Nepal is not known. Certainly, Nepal has its own environmental and social standards and these are applied according to Nepal's own best practices and regulatory system. One of the key issues for hydropower relates to the need for peak energy and hence hydropower designs that require reservoirs. The outputs of environmental TAs associated with hydropower projects have not been internalized in the government regulatory system, with the result that projects financed by the private sector do not have sufficient mitigation requirements imposed on them. The issue is the usability of the safeguards outside ADB-supported projects in addition to those that ADB does support, to ensure best practice for the whole sector. NEA's capacity to undertake EIAs as a consultant to the hydropower sector is questionable given the conflict of interest. The implementation of remedial measures required of NEA projects should not fall on NEA either, even though this is standard "polluter pays" practice for ADB. Rather, remediation should be outsourced to competent national and international consultants and nongovernment organizations (NGOs) as well as to relevant ministries and departments such as agriculture, rural development, water supply, livestock, land management, and irrigation.

D. Performance of the Borrower and the Executing Agency

82. The executing agency's performance was *less than satisfactory*. The project files indicate that ADB had noted for some time that there were important shortcomings with respect to the focus of attention on technical, contractual, and management requirements of project implementation, and, consequently, decision making in a timely manner. ADB had in the past assisted NEA with the settlement of management issues. Despite these efforts, the situation deteriorated. This finding suggests the TA for NEA did not have the desired impact. But this is not surprising as the TAs were underfunded and of limited scope, as noted earlier.

The TA for NEA did not have the desired impact as the TAs were underfunded and of limited scope

83. NEA senior project staff members were heavily engaged on numerous occasions in matters that required their presence in Kathmandu. NEA management attention to the project, its decision making capability, and its presence at the site were

inadequate. The presence on the site of the NEA project director⁵¹ was insufficient and there were indications that NEA was not able to resolve various issues. There was a lack of attention and focus on day-to-day requirements for project implementation. Major decisions were passed on by the project manager to NEA's Board. The Board, however, had no directors with technical background and hence did not understand the problems related to the design or construction of large engineering projects. A project director was finally relocated to the project site on a permanent basis on 10 October 2000.

84. NEA was not able to resolve contractual issues in a timely manner. ADB assisted in establishing action plans and proposed in March 1999 the establishment of a dispute review board to assist in resolving matters between the concerned parties. The proposal was not followed up. When decisions were delayed by NEA, the contractor was placed in the position where he had to commit resources without assurance that he would be adequately compensated.

85. NEA's appointment and contract extension policy concerning the KGEMU was based on periodic contract extensions of up to 6 months, which were generally provided at the last moment. ADB was of the opinion that this sort of temporary employment practice was detrimental to the ability of KGEMU staff members to perform to the fullest of their capability because the continuity of work was not assured. Despite numerous ADB interventions to change the hiring practice of KGEMU staff, NEA continued to (i) extend contracts of staff members only for durations of up to 6 months, but generally even less, (ii) leave affected staff members uncertain whether their contracts would be extended at all, and (iii) reach decisions on contract extensions only at the last moment.

86. NEA's operational and financial performance was not adequate as it did not comply with two major covenants: it did not increase tariffs and it did not improve on its technical and nontechnical losses, thereby failing to secure sufficient funds for adequate O&M and ultimately leading to corporate insolvency.

87. The contractors and consultants performed less than satisfactorily overall. Some issues with consultants performing the power master plan were noted in the files but corrected at the consultants own expense to provide a satisfactory report. The main reason given for the consultants' underperformance was their unwillingness to include NEA staff in their work. This may have been because NEA was reportedly late in responding to many project issues and the consultants were typically on a tight time schedule. NEA (and therefore the project) performance suffered due to NEA's internal management structure and this impacted the project and caused delays. The TAs could have focused on strengthening NEA more formally instead of requiring "understandings" as written in the RRP.

88. There were plenty of feedback loops (through faxes, early e-mail system, on-site owner's engineer, regular visits of POEs, etc.) but they did not ensure early resolution of implementation problems, mainly due to NEA's inability to respond in a timely manner. The IED Mission recognizes that NEA was hampered by the vertical structure of its own management and of involved government departments and agencies.

⁵¹ There were four different project directors during the implementation of the project (one was appointed twice).

*NEA's
operational and
financial
performance was
not adequate —
did not increase
tariffs and did
not improve on
its technical and
nontechnical
losses*

E. Technical Assistance

89. ADB included two TA grants in the project: (i) Institutional Strengthening of NEA's Environmental Division (footnote 20),⁵² and (ii) Power System Master Plan for Nepal (footnote 21).⁵³

90. **TA on Institutional Strengthening of NEA's Environmental Division.** The consultants⁵⁴ engaged for this TA commenced work in May 1997 and completed the study in August 1999.⁵⁵ The TA's objective was to build NEA's capacity to ensure that environmental and social issues were adequately addressed in the design, construction, operation, and monitoring of power development projects in Nepal. Specifically, the TA was to assist NEA (i) to formulate an environmental and social management framework with special emphasis on environmental guidelines, social assessment, and public participation; (ii) identify and participate in appropriate in-country and external staff-training programs; (iii) develop an environmental management information system; and (iv) acquire essential logistic support and reference documents. The relevant TCR was circulated in January 2000 (footnote 49). The TCR found that the TA was *partially successful*. Although the external training was rated highly by NEA staff and the in-house training programs were well attended, there was a limited input from counterpart staff outside of the training programs, which limited the TA's impact concerning on-the-job training and capacity building.

91. The TA related to environment and social management capacity strengthening for NEA was not discussed and rated in the PCR. Based on many references in the project files and the IED Mission's brief interaction with various NEA staff members in Kathmandu and on site, the IED Mission endorses the "partly successful" assessment of the institutional strengthening TA in the TCR as equivalent to *less than successful* in IED's current terminology.

IED Mission endorses the TCR's assessment of the TA as less than successful

92. **TA on Power System Master Plan for Nepal.** The consultants⁵⁶ engaged for this TA commenced work on 4 August 1997 and completed the study in August 1998. The TA was to (i) prepare a new power system master plan for Nepal, including a new load forecast, generation expansion plan, and transmission master plan; and (ii) conduct on-the-job training of the engineering staff of the NEA in power system planning.

93. One of the major tasks of the TA was to produce a generation plan.⁵⁷ The plan the consultants prepared had a number of serious deficiencies and required substantial revision. One of the most serious problems was the consultant's assessment of the prospect of surplus hydro generation to India. The result was a recommended power system expansion plan that assumed that, after a few years, NEA would sell more energy for surplus power exports to India than for all electricity sales in Nepal. The plan also predicted that the revenues from surplus power exports would pay for all generation expansion costs and there would be no residual cost, but even a credit or profit, for the net cost of generation expansion to supply loads in Nepal. Numerous

⁵² On actual closing on 9 August 1999 (2 years late), total TA amount utilized was \$441,879.

⁵³ On actual closing in August 1999 (4 months late), total TA amount utilized was \$596,903.

⁵⁴ The contract with Hassall & Associates Pty. Ltd. was signed in April 1997.

⁵⁵ The TA was due to be completed in March 1998 but the final report was delayed due to a long unscheduled hiatus by the team leader, and to accommodate scheduling of training activities, and final adjustment of eligible costs.

⁵⁶ The contract with Norconsult International A.S. was signed on 10 April 1997.

⁵⁷ The tasks were to produce (i) a load forecast report for 1998–2020, (ii) a generation expansion plan for 2003–2017, (iii) a report on the long-run marginal cost of power supply, and (iv) a transmission master plan and final report.

*IED Mission
concurs with the
less than
successful rating
of the TA*

other problems were identified. Most of the consultant's misunderstandings were the result of inadequate communication between the consultant and NEA staff members and other consultants working in Nepal on hydro power projects. Approximately 75% of the TA time was to be spent in Nepal in order to ensure close interaction with the NEA. The consultants, however, seemed unwilling to involve NEA staff in a meaningful way to carry out the study, or in discussing assumptions and results with NEA. The consultants needed considerable extra time to change the work they had undertaken and eventually the final report was completed to a satisfactory standard. Although there was a large cost over-run—approximately 30%—much of this was absorbed by the consultant. A contract variation was prepared to utilize all of the uncommitted funds. The PCR rated the TA as *partially satisfactory* (footnote 50), which, in the current IED terminology, is equivalent to *less than successful*, a rating with which the IED Mission concurs.

CHAPTER 5

Issues, Lessons, and Follow-up Actions

A. Issues

94. **Tariffs.** Peak and off-peak tariffs are applied only to high-voltage consumers; consideration should be given to extending this also to domestic consumers. In line with lifeline tariff levels used in other countries, consideration should be given to narrowing down the lifeline tariff block. However, NEA's capacity to conduct a comprehensive review of power tariffs and implement price adjustments in the face of likely opposition from consumer groups and NGOs is not yet proven.

95. **Load shedding.** Load shedding has been common in Nepal. At the time of appraisal, load shedding was primarily due to the lack of peak-power generating capacity. Many industrial and commercial companies have decided to purchase their own captive generation plant in response to the poor reliability of supplies from NEA. Exact information on how much capacity or generation is available in captive plants is not available, but personal communication with NEA suggests that it is more than 1,800 MW. The only way to stem the load shedding crisis is to construct hydroelectric projects that include storage. This development would increase consumer satisfaction, paving the way to much-needed tariff increases, and respond to the vast Indian demand for peak power.

96. The daily cyclic outages throughout the country are a major burden on the people and economy of Nepal. The government is doing its best to encourage private sector participation, but the current global economic crisis and mismanagement of the domestic bidding process has not resulted in any major independent power producer contracts in recent times. ADB and development partners are presently in the process of funding major new peaking plants, but there is a severe shortage of additional peak-load capacity that can only be satisfied by hydroelectric projects with large storage (or nuclear or fossil-fuel power plants). ADB will need to consider financing large storage hydroelectric projects.

97. **Regional cooperation.** For various reasons, regional cooperation on power issues has not made much headway in South Asia. The current power crisis in Nepal provides an opportunity for ADB's regional cooperation initiative in South Asia⁵⁸ to facilitate discussions on assisting Nepal out of its current difficulties. Neighboring India is capable of supplying power to Bangladesh, and in return, Bangladesh may be able to offer or sell an equivalent amount of gas or pay in cash. Should such negotiations

The only way to stem the load shedding crisis is to construct hydroelectric projects that include storage

ADB will need to consider financing large storage hydroelectric projects

⁵⁸ ADB. 2008. *Regional Cooperation Operations Business Plan, South Asia 2009–2010*. Manila.

prove fruitful, this could lead to clean hydropower being wheeled from Bhutan or Nepal.

B. Lessons and Recommendations

98. The RRP listed as a lesson learned from ADB-funded projects in Nepal's power sector that delays occurred frequently in meeting conditions of loan effectiveness, recruiting consultants, and awarding contracts. Processing was successful in avoiding those delays. This lesson should be observed.

Involve the Nepal Resident Mission to a greater degree so that problems may be diffused sooner

99. The RRP noted that once contracts were awarded, implementation proceeded smoothly. Unfortunately, implementation of Kali Gandaki "A" did not proceed smoothly. Relations between NEA, its engineer, and the civil works contractor deteriorated to such a degree that on at least one occasion, ADB considered stopping the loan. The lesson that may be apparent is to involve the Nepal Resident Mission to a greater degree so that problems may be diffused sooner, rather than relying on ADB review missions to react to them later.

Loan covenants should be more strictly enforced

100. Another lesson highlighted in the RRP was that a previous TA for institutional assistance to NEA was not as successful as expected. The reason cited was lack of NEA staff motivation. To address this problem, the RRP included as a remedy that NEA would be required under the project to introduce results-oriented incentive schemes. While this may be a laudable idea, the IED Mission saw no evidence that it was implemented. For this to be implemented, a specific loan covenant must be included and strictly enforced. This lesson pertains to the whole subject of loan covenants: they should be more strictly enforced. During ADB Board of Directors' meeting on 18 March 1996, the Board expressed a similar opinion.

Future projects should have sufficient storage capacity to better address load shedding

101. The IED Mission recommends that future projects in Nepal consider projects with sufficient storage capacity to better address load shedding, which continues to affect economic growth and living standards. To consider such projects, greater knowledge of technical aspects, including geology, hydrology (including extreme events), and sedimentation, should be developed by financing agencies and/or developers. Future projects will also need greatly improved environmental and social impact assessment and implementation, bearing in mind that much of the development of future hydro projects may be undertaken by the private sector or as public-private partnerships, which will require far more streamlined approaches to addressing environmental and social impacts. The IED Mission found that the elaboration of mitigation measures needs to be more stringent than was done in the 1990s for the project elaborated (Safeguard Policy Statement [2009])⁵⁹ and that these measures are best implemented with an area development focus as opposed to relying on a mitigation focus, as is done in industrialized countries. In an area development approach, the mitigation measures should be formulated comprehensively, to ensure that the "do good" principle in addition to the "do no harm" principle is applied. To provide the impacted population with the greatest benefit, the suite of mitigation measures typically derived from the EIA process should be designed to promote rural development as well as biodiversity and environmental sustainability. The Safeguard Policy Statement (2009)⁶⁰ provides information to operations on how to do this.

Future projects need greatly improved environmental and social impact assessment and implementation

⁵⁹ Appendix 1, D.1. Environmental Assessment and Annex to Appendix 1; broadly Appendix 2 and Annexes; broadly Appendix 3 and Annexes. (Industry practice is that all social and environmental matters should be included in an EIA.)

⁶⁰ Page 17, item 10.

102. ADB should consider promoting complementary rural development initiatives in project-impacted areas with indicators of outcome derived from the impact assessment process. Agencies to be involved in implementing these initiatives should be preferably located at the district or village level.⁶¹ ADB should not rely on the “polluter pays” principle or on compliance mechanisms to implement its safeguards. Where feasible and government support exists, safeguards should be integrated in development initiatives in the same way that rural development projects are approached except that the design basis of these initiatives should be from an impact assessment perspective.

103. There is no doubt that selecting hydro versus thermal power in Nepal provided a least-cost intervention given the country’s topography and relatively high costs of alternative energy such as diesel and oil. At feasibility study time, alternatives to the adopted design were investigated but ultimately rejected and it now appears when factoring in energy production (actual versus planned), down time due to mechanical problems in the turbines, that including considerations of operational costs into decision making process may have changed the design of the plant. Reference is made to \$20 million to be invested into the plant to rectify problems (para. 61) including intake and desander configurations, cavitation on turbine parts, and vibrations in the powerhouse. In addition, procurement requirements, including international bidding will ensure that the executing agency receives competitive bids. For the lowest evaluated tender to represent approximately the least cost, value engineering (footnote 43) should be used to formally determine the least cost if it is such a concern.

For the lowest evaluated tender to represent approximately the least cost, value engineering should be used

C. Follow-up Actions

104. The IED Mission recommends that ADB consider designing and funding three TAs to enhance the sustainability of the Kali Gandaki “A” Hydroelectric facility. The subjects of these three TAs are: (i) vibrations in the powerhouse and cavitation of turbine parts, (ii) fish hatchery remediation, and (iii) SCADA system deficiencies. The objectives are to restore and augment plant and equipment and its operation to suit its purpose more effectively, as briefly described in Appendix 5.

105. The IED Mission further recommends disseminating its major findings about the physical condition of the project to the South Asia Department: i.e., (i) the intake and desanding facilities, to highlight the utility of physical model studies and in particular, the local capability through HydroLab in Kathmandu; (ii) the vibrations and cavitation problems in the powerhouse, to draw attention to the fundamentals of hydraulic design; and (iii) the lack of technical expertise in the electronics/controls field, particularly in remote areas, to underline the absence of reliable plant operating data.

106. Nam Theun 2 environmental and social mitigation measures were designed in the standard EIA-based approach; however, during the 5-year construction period, their implementation changed over time and became development programs. Perhaps due to the large budget available, this approach seems to have worked. However, not all projects have large environmental and social budgets, so that more cost effective approaches to environmental and social programs need to be developed if Nam Theun 2 lessons are to be replicated elsewhere.

⁶¹ For example, refer to Appendix 4 of this PPER, which shows the many agencies consulted at the time of design. During implementation, mainly NEA was involved.

Appendixes

APPENDIX 1: HIGHLIGHTS OF THE SOCIOECONOMIC STUDY

A. Background

1. This socioeconomic study has been undertaken as part of the ex-post evaluation of the Kali Gandaki “A” Hydroelectric Project conducted by the Independent Evaluation Department (IED) of the Asian Development Bank (ADB). The assessment of the project’s overall socioeconomic impact on the project affected families (PAFs) was revisited and compared with the preproject situation. Some of the major issues concerning the current status of the families are major focus of the survey conducted.

2. The Kali Gandaki “A” project has affected 12 villages of Syangja, Gulmi, Palpa, and Parbat districts¹ and expropriated the assets of 1,468 families from the affected villages. However, resettlement was mainly concentrated in Syangja district especially in Shree Krishna Gandaki and Jagatra Devi village development committees. Of the total 1,468 families that had assets impacted, 263 were defined as seriously project-affected families (SPAFs) and 1205 were PAFs.² The project expropriated altogether approximately 208.68 hectares (ha) of land and 90 houses.³ The PAF total includes 17 Bote and 2 Magar households in the dam site area. The project has also brought impacts on and/or changes to the traditional occupation of some Bote families. The project also reportedly generated risks of flood and inundation at Seti Beni Bazaar and a religious–cultural site (holy stones [Saligrams]) upstream. The downstream area is also affected due to inadequate water flow for performing “holy dips” and other rituals.

B. Methodology

3. A combination of desk research, a survey, key informant interviews, and focus group discussions was used in this study. The study team reviewed relevant project documents from ADB, the Nepal Electricity Authority (NEA)—the executing agency, the project site, and other secondary sources. Interviews and focus group discussions were conducted in affected villages. For the survey, random sampling was used to determine the sample households from the complete list of PAFs as of project completion. Collectively, 119 households of PAFs, SPAFs, and Bote-SPAFs in the project locations (dam site, access road, and power house) were selected as the sample for the study. The sample size is about 12% of all PAFs and includes 50 SPAFs, 50 PAFs and all 19 project-affected Bote households (indigenous peoples).⁴ Quantitative information was collected in November 2011 from the sample households by administering a semi-structured questionnaire (in Nepali) that was developed, pretested, and translated in the local language to facilitate the interview process, which was carried out by 15 enumerators and 2 supervisors. Qualitative data were culled through group discussions, key informant interviews, and site visits to triangulate key findings. Data entry and processing were done in Kathmandu. Based on individual sample group data a combined summary table representing all sampled groups was prepared for analysis and interpretation in the report.

C. Study Limitations

4. The study has two major limitations: (i) key secondary information, such as an updated acquisition, compensation, and rehabilitation program containing the final information on compensation and mitigation cost, entitlement matrix, and the environment and social technical audit report were unavailable; and (ii) the time lag between project completion and post evaluation was

¹ ADB. 1996. *Summary Environmental Impact Assessment (SEIA) for the Kali Gandaki “A” Hydroelectric Project in Nepal*. Manila.

² R. P. Thanaju. 2007. Hydro Nepal. *Journal of Water Energy and Environment*. Volume 1, Issue 1, June 5.

³ KGEMU. Synthesis Report, 2001.

⁴ Of the total 19 households rehabilitated by the projects, 2 belong to the Magar community (a disadvantaged group) and thus have also been incorporated in the sample for the study.

considerable as socioeconomic changes such as migration and mortality among household heads were significant and hence may have affected over-all results.

D. Household Characteristics

5. **Gender, ethnicity, and literacy.** The sampled households comprised 736 people: 51% were males and 49% females. In terms of caste and ethnic distribution, about 79% of the households belong to Brahmin/Chhetries caste groups, 14% are Bote, and 7% are Magars. The literacy rate of the population above 5 years old is 85%. Altogether, 14 households from the sample groups have been identified as having distinct social categories (e.g., being headed by single women or men, or aged couples separated from their family).

6. **Sources of employment and migration.** About 70% of the sampled population are in the economically active age group.⁵ About 55% of such people are involved in income-generating activities. Most of the sampled households have more than one source of income. Agriculture, livestock products, remittances, wage labor service, and business are their main sources of income.⁶ Migration for employment contributes to incomes—42 family members from 36 households across all categories are reported to have migrated to India or other countries for employment.

E. Socioeconomic and Cultural Impacts

7. **Reduction in total cultivated land led to lower overall agricultural output.** The cultivable lands of the sampled households have been reduced by about 50% due to expropriation by Kali Gandaki “A.” On average, 0.54 ha of private lands and lands donated by the state or individuals for the purpose of religious or charitable institutions (Guthi lands) were expropriated among the sample households. In effect, farmers estimated that there is a corresponding reduction in total agricultural production, including the estimated production from fruit trees. Before the project, the average landholding of the sampled households was about 1.027 ha.⁷ This has been reduced to 0.53 ha after the project.⁸

8. All the sampled households reported that they had received compensation for both private and Guthi land, and private structures (such as residences and cattle sheds) expropriated by the project. Similarly, 19 Bote-SPAF households have been found rehabilitated by the project. Table A1 provides a breakdown of the type of compensation received by the studied households. The households, however, did not report that they received compensation for the affected trees and plants. Based on discussion with the NEA officials involved in the Acquisition Compensation and Rehabilitation Program, compensation was not paid for the affected trees/plants in the access road and project site as an understanding was made between affected households and the project that the tree owners would clear and take the trees themselves. Accordingly, the PAFs themselves cleared the trees and took them away.

⁵ In Nepal, people aged 10–60 are considered to be economically active population.

⁶ Note that fisheries does not feature.

⁷ In Nepal, land area calculation: 1 ropani= 508.74 square meters, 1 ropani=16 ana, 1 paisa= 4 dam. 1 Ana = 31.796 square meters, 1 paisa= 9.949 square meters, and 1dam=1.987 square meters, 10-11-0-1 means 10 dopani, 11 ana, 0 paisa, and 1 dam. Hence, this is equivalent to about (20-3-0-1) or 20 ropani -3 anna-0 paisa-1 dam in Nepali measurement units.

⁸ Equivalent to 10-7-0-1 in Nepali measurement units.

Table A1: Number of Sampled Households who Received Compensation and Assistance

S.N.	Type of Impact	PAF		SPAF		Bote		Total	
		HH/ No.	%	HH/ No.	%	HH/ No.	%	HH/ No.	%
1	Compensation for land with legal ownership/tenancy	46	92	50	100	1	5	97	81.51
2	Compensation for land donated by the state or individuals for the purpose of religious or charitable institutions	6	12	4	8	12	63	22	18.49
3	Compensation for residence/cattle shed	1	2	25	50	4	21	30	25.21
4	Rehabilitation/reconstruction of affected house by project		0			19	100	19	15.97
5	Households having more than one type of impact	3	-	29	-	17		49	-
Total/Overall		50	100	50	100	19	100	119	100.00

HH = household, PAF = project-affected families, S.N. = Sample Number, SPAF = seriously project-affected families.
Source: IED.

9. In terms of livestock production, the study did not notice a significant change in the number of the households domesticating cattle between project completion and at post-evaluation. Of the total sampled households, 109 households have been found domesticating cattle and pigs, nearly the same number (111) as preproject. However, the average number of livestock after the project has declined compared to the preproject phase. Major reasons are reduction of the sources of grass (land and fodder trees) due to land expropriation and family member's involvement in other sources of income. The latter was probably partly driven by land loss.

10. **Disturbance of religious site and activities.** After the dam construction as part of the project, the cultural heritage site with the holy stone (Saligram) at the confluence of Kali Gandaki and Seti Khola in the upstream area and the settlement with a local market at Seti Beni have been encountering problems due to flood and inundation. The IED Mission observed actual video footage of inundation that affected religious activities. Burial sites have been relocated away from the water level.

11. **Potential fishing incomes and livelihoods are threatened.** Only 10 of the 57 species available prior to the project are currently in the river, which is impacting the Bote, the fishing and boating community in the upstream area at dam site. They have been facing difficulties with fishing due to the increased water level attributable to the dam. They have considered navigational opportunities in the river as a potential source of income. However, the unavailability of funds to invest in passenger boats (e.g., a steamer) is a problem, while other communities that have with funds are getting involved in the riverboat business, cognizant of its financial benefits.

12. **Employment opportunities were created but the sustainability of training-acquired skills is negligible.** The project has also brought several beneficial impacts to the PAFs and local communities. Survey results indicated that about 81% of the total sampled household's family members were employed during the construction phase. The estimated average total household earnings were NRs161,999 per family involved. Employment opportunities for the PAFs and local communities, even during the operation phase, comprise another positive impact of the project. Based on information received from the Kali Gandaki "A" office at the project site, members of about 106 PAF and SPAF households and about 100 local persons are employed at the Kali Gandaki "A" office.

13. During the construction phase, the project conducted skills and livelihood improvement trainings for the affected families. The socioeconomic study identified 34 households who enrolled

their family members in different types of such trainings. However, the reported number of households involved is low compared to the households involved in construction works. Thus, the Kali Gandaki Environmental Monitoring Unit (KGEMU) report also notes that the contractor failed to implement an adequate and quality training program for PAFs and SPAFs.⁹ This is because ADB failed to require such quality program. The socioeconomic survey also revealed that several PAF and SPAF households who participated in the training were not involved in any work at the time of the survey.

14. Finally, the project enabled economic diversification and transformation by increasing employment opportunities for local people in different sectors and improved their living conditions. The majority of households also perceive that the project¹⁰ provided employment opportunities to the local people (91%), increased the sources of employment in local area (90%), and fostered development of market areas (98%). Such benefits, however, largely come from secondary impacts and outside project inputs, thus questioning the design of the mitigation measures and the cost-benefit of the expenditure.

15. **Social cohesion and tourism opportunities exist.** Family members of all categories of sampled households have been found affiliated with different types of local level institutions (e.g., mothers' groups, farmer organizations, and microcredit groups). Recently, the Bote community has established a fishing and boating group for the welfare of their community and to regulate the ferry transport between the dam site to Seti Beni. Recently, a nongovernment organization—Kali Gandaki Paryatakiya Gaun—has also started tourism promotion activities at the dam site. The organization has also received some financial support to improve the boat station and to construct public toilets for the regular passengers and tourists (footnote 10).

16. **A number of benefits were derived from electrification.** All the sampled households except two (one PAF and one SPAF) are now enjoying the benefits of electricity. The electrified households have been found acquiring benefits from electrification, such as reading, writing, safe mobility during night time, operation of private enterprises, food processing, and banking. The project installed electrical wiring for the 17 rehabilitated Bote households. Of the two unelectrified households, the SPAF household cited affordability as the reason of nonelectrification and the PAF household has applied for electricity but is waiting for NEA to install a meter.

17. **Travel time and the flow and volume of goods have improved.** After the construction of dam, the water level of the Kali Gandaki River rose in the reservoir and upstream areas, opening scope for navigation by boats. This resulted in a substantial reduction of the travel time between the reservoir and Seti Beni. The navigation facility has been beneficial to the local people and traders of Seti Beni, as travel time to and from Seti Beni was reduced from at least a 3-hour walk to 45 minutes. The operation of riverboats also significantly reduced the transport cost for goods from/to Seti Beni and widened the source of earning for the Bote community, either by investing in partnerships or working as riverboat operators. According to local riverboat operators, currently 8 riverboats are operating, given the increasing flow of passenger in this route. The current fare for passenger is NRs50 per person for one-way travel and the charge for carrying goods is NRs0.50 per kilogram. The average number of daily passenger ranges from 400 to 500. The number of passengers increases during religious-cultural festivals and winter season. However, riverboats cannot be operated during peak monsoon (June–July). Currently, communities other than Bote are also involved in this business because the Bote lack capital.

18. **Household incomes have increased.** Compared to the before-project situation, the sources of income of the sample households have changed considerably. About 82% of households agree that the

⁹ Kali Gandaki Project Impact and Mitigation, Synthesis Report on Social Aspects, 2001.

¹⁰ Focus group discussion, Andhimuhan, Kali Gandaki dam site, November 2011.

project¹¹ contributed to improving household incomes compared to the preproject phase. Although a number of households reported that agriculture and livestock outputs have declined compared to preproject situation, other forms of employment were availed of by some PAFs and SPAFs, including those connected with Kali Gandaki "A" and NEA and the fish hatchery. Similarly, the number of households having businesses, pensions, and other remittances as sources of income has also increased over the preproject situation, although this is not attributed to Kali Gandaki "A." Social awareness and enhanced economic opportunities in the project area followed by additional/supplementary sources of income emerged after the project.

19. Change in the annual household income is one of the major indicators. It provides a firm basis for confirming improved socioeconomic conditions of the studied population and also signifies changes in other socioeconomic indicators. The average annual income of the households before the project was collected using the approach of overall retrospective calculation made by the respondents. Data showed that the average annual income before the project ranged from less than NRs10,000 to NRs200,000 with the average income at NRs48,462. At the time of the survey, the average annual income of the sample households had increased to NRs222,951, which is more than four times (4.6 times in nominal terms) higher than the before-project average. The increasing trend of foreign migration for employment, employment opportunities from the project, and entrepreneurship have been identified as some of the major reasons contributing to the increase. Meanwhile, the average annual expenditure has been estimated at NRs155,320, indicating an average saving of NRs67,613.45 in each sample household.

20. **In general, living conditions have improved.** The project's impact on the local economy has contributed to improving the living conditions of the project affected households and local communities. Of the total sampled households, about 97% consider that the area has been developed due to the project. All the sample households in this study had been rehabilitated. The households requiring relocation at Andhimuhan village near the dam site had been relocated and rehabilitated by the project.¹² None of the PAF, SPAF, and Bote families are homeless. Compared to the preproject phase, although the average landholding of the studied households has been decreased by about 50%, the living conditions of the studied households have improved compared to preproject stage. This is attributed to better infrastructure facilities (e.g., access road, electricity, and local market) and scope of local-level employment/economic opportunities outside agriculture. All the sample households except one SPAF and 15 Bote households have private lands. Some of them have their own business and motorbikes, and three of the Bote families have invested in the riverboat business.

21. The survey revealed that households have been residing in better houses (permanent type) compared to their expropriated houses before the project (temporary or thatched type).¹³ Currently, 102 studied households have toilet facilities, whereas only 48 had toilets before the project. Similarly, 80 households have televisions, against only 1 before the project. More families have also accumulated assets such as motorbikes and have been operating their own businesses. There is also a tremendous change on the communication facilities available, as households acquire telephones and mobile phones. The value of major assets and amenities owned by the sample households has been estimated at NRs1,130,784 per household.

22. **The local economy is better integrated with the national economy.** The development of basic infrastructure and the opening of employment opportunities as a result of the road have brought significant changes to the local economy. The subsistence rural economy with poor intersectional

¹¹ Local households interviewed view the project as an entity including the access roads, water supply, schools, etc. while the IED Mission restricts the definition of the project to what was financed by ADB and the activities and goods and services procured under the loan.

¹² Although not initially included in the mitigation measures.

¹³ Previously almost all houses were thatched; only about 15% houses were roofed with iron sheet: KGMEU Synthesis Report, 2001.

forward and backward linkages was transformed with more modern links with Butwal, Kathmandu, and Pokhara. The road connecting Mirmi and Butwal supplies essential commodities to the adjoining hilly region. Locally produced commodities are now sold at market centers. Consequently, the commodity flow pattern, mode of transport, and transport cost has changed for the better. Local unemployed and agricultural laborers found employment opportunities in technology intensive occupations. Trade and commerce boomed during the project construction period and income, expenditure, and consumption patterns changed.¹⁴

23. Positive externalities outside the project scope benefited the communities. The project contractors also contributed several development works and infrastructure development activities. The IED Mission believes these contributions should have been included in the environmental and social mitigation measures provided by ADB in line with its mandate as a development bank. Based on the KGMEU Synthesis Report (2001), some of the key contributions the contractors made and that are outside the project include:

- (i) The Shree Krishna Gandaki Primary School, focusing on the Bote children, was found to be operating at Andhimuhan near the dam site. Based on discussion with the Bote community, the school has played a vital role in providing primary education to Bote and other community children in the area. Currently, the school is staffed by five teachers with 31 children attending regularly.
- (ii) Financial support worth NRs1,200,500 allowed the construction of a 1.5 kilometer road for Mirmi village.
- (iii) Financial support worth NRs250,000 was provided to purchase water sources in another village for the construction of government supported drinking water project at Mirmi. About 80% of the sample households have access to piped water at present.¹⁵
- (iv) The contractor contributed 500 hours of bulldozer and excavator use, worth NRs23,51,500, to construct a rural road to link Birgha village development committee with the project road at Mirmi.
- (v) The contractor supported the infrastructure improvement of a local school, including construction of a 3-room building for Bhagwati Higher Secondary School; 9 classrooms for 2 buildings with fencing, library, and furniture for Kali Gandaki English (Primary) school, Mirmi; an 8 classroom building for Birendra High School, Gurungdi and Deurali Lower Secondary School at Imsil; a 2-storey building for a local nongovernment organization, named the Jagatra Devi Library and Educational Center, Batuwa of Jagatradevi; distribution of 10,000 exercise books for about 5,500 students at different local schools; and construction of a 3-room school for Bote and Andhimuhan.
- (vi) Several cultural mitigation/development activities were also carried out by the project. These included construction/renovation of 3 temples, construction of 3 cremation sheds, and construction of a walkway in Seti Beni.¹⁶

¹⁴ Kali Gandaki Project Impact and Mitigation: KGMEU Synthesis Report, 2001.

¹⁵ 18% tap in their own house and 62% tap outside the house.

¹⁶ Nogendra Sapkota, Kali Gandaki "A" Resettlement: Evolution of Employment and Cash Income – Flow to SPAF/PAF, KGMEU, August 2001.

APPENDIX 2: DESIGN AND MONITORING FRAMEWORK

Formulated for the Evaluation

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
Impact Improved living standards Increased economic growth	Incomes of project area people including project affected people Incomes of population GDP	NEA, trade statistics, department statistics	Assumptions Tariffs are affordable but economical for NEA. Risks Peak energy generated is not sufficient to meet both domestic and export demands. Project implementation delays and reform failures.
Outcomes Help meet the demand for power, in particular peak demand in Nepal, in an environmentally sustainable, socially acceptable, and least-cost manner. Institutional and financial strengthening of NEA. Promote cost recovery to efficiency in power consumption.	Number of new electrified households Electricity and connection costs are affordable Environmental and social programs meet required standards as specified in EIA Tariffs are increased and system losses are reduced as per covenant	Database of NEA on consumers (household and commercial) Environmental and social database Rate of disbursement	Assumptions NEA is capable of and committed to implementing the project with minimal environmental and social impacts. Risks Project implementation delays and resistance from affected parties and stakeholders.
Outputs Physical Investments: A. Main Civil Works (1) a 44-m high concrete gravity diversion weir with gated spillway, intake and desanding basin (Lot C1); (2) a 5.9-km long headrace tunnel with 7.4-m diameter (Lot C2); (3) surge and pressure shafts, including steel liners, a tunnel leading to the power station, and the power station (Lot C3). B. Hydraulic Steelworks: gates for spillway, desander, headrace tunnel, power station, and steel liners for the intake undersluices (Lot 4).	Physical investments: 1) Construction completed by 2001 2) Equipment procured and installed as planned Institutional: 3) NEA operating as financially sustainable commercial entity by 2001 4) KGEMU is operational by 1996	Contract awards Progress reports Project administration missions NEA's financial statements	Assumptions NEA is capable and committed. Government clearances and approvals on time. Risks Timely consultant recruitment and contract awards; delays in procurement.

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<p>C. Electrical (Lot 5).</p> <p>D. Mechanical (Lot 6): plant and auxiliaries for the three 48-MW turbo-generating units, transformers, and switchgear.</p> <p>E. Two 13-kV transmission lines (Lot 7)—one to Pokhara (65.5 km) 3 and the other to Butwal (39.1 km)—and a substation at Pokhara.</p> <p>Institutional: Institutional strengthening reforms.</p>			<p>Assumptions NEA recognizes the usefulness of institutional strengthening. NEA agrees that institutional reforms are beneficial.</p> <p>Risks Inability of TA consultant to bring NEA staff on board.</p>
<p>Activities with Milestones Physical investments:</p> <p>1.0 Main civil works</p> <p>1.1 Preconstruction activities and designs completed and approved by 1996</p> <p>1.2 Construction started in 1997</p> <p>2.0 Hydraulic steel works</p> <p>2.1 Excavation starts by 1996</p> <p>2.2 Procure materials (no milestones specified)</p> <p>3.0 Electrical</p> <p>3.1 Procure equipment (no milestones specified)</p> <p>4.0 Mechanical</p> <p>4.1 Procure equipment (no milestones specified)</p> <p>5.0 Transmission lines</p> <p>5.1 Construction started in 1998</p> <p>Institutional reforms:</p> <p>6.0 Strengthening NEA safeguards capability</p> <p>7.0 Preparation of a new master plan for the power system of Nepal</p> <p>7.1 A new load forecast, generation expansion plan, and transmission master plan; and</p> <p>7.2 Conduct on-the-job training of NEA's engineering staff in power system planning</p>			<p>Inputs Loan 1452 Government and NEA (\$132.8 million equivalent) ADB (\$160.0 million loan) OECF (\$160 million loan) TA 2613-NEP \$534,000 TA 2614-NEP \$600,000</p>

ADB = Asian Development Bank, EIA = environmental impact assessment, GDP = gross domestic product, KGEMU = Kali Gandaki Environmental Monitoring Unit, km = kilometer, kV = kilovolt, m = meter, MW = megawatt, NEA = Nepal Electricity Authority, NEP = Nepal, OECF = Overseas Economic Cooperation Fund, TA = technical assistance.
Source: IED.

APPENDIX 3: CHRONOLOGY OF SIGNIFICANT EVENTS

Date	Event
1979	Pre-feasibility Study of Kali Gandaki "A" by SMEC
<i>1990</i>	<i>Communist Party is formed in Nepal¹</i>
1992	Feasibility Study by KGAA, funded by UNDP, FINNIDA, and ADB
May 1993	POE established
<i>1994</i>	<i>Unified Communist Party of Nepal (Maoist), aka UCPN(M), founded – it became the ruling party in the Nepali Parliament in 2008</i>
May–Jun 1994	Completion of Final Project Formulation Report and draft Engineering Design
12 Jul 1994	Advance procurement action for civil works approved during the MRM
Aug 1994	Acquisition, Compensation, Rehabilitation Program (ACRP), and Mitigation, Management, Monitoring Plan (MMMP)
Feb 1995	Draft EIA
<i>13 Feb 1996</i>	<i>Communist Party of Nepal (Unity Centre) declared the Nepali Civil War (aka as The Nepali Peoples' War)</i>
Mar 1996	EIA for Kali Gandaki "A" (summary)
14 Jul 1996	Bids for civil works opened under advance procurement action
23 Jul 1996	ADB approves a loan of \$160 million equivalent
02 Aug 1996	Administration of TA 2613-NEP: Institutional Strengthening of NEA's Environment Division, one of the two TAs attached to the Loan transferred to Environment Division
27 Aug 1996	Loan and Project Agreements signed in Kathmandu, Nepal
24 Sep 1996	TA letters for TA 2613-NEP: Institutional Strengthening of NEA's Environment Division, and TA 2614-NEP: Power System Master Plan signed
14 Oct 1996	Loan Agreement between Overseas Economic Cooperation Fund of Japan and the Government of Nepal for \$160 million equivalent, signed
12 Nov 1996	Cofinancing of \$160 million with JBIC for the Kali Gandaki Project became effective
12 Dec 1996	Loan became effective
3 Mar 1997	ADB proposed for NEA's consideration for appointment a list of candidates for sociologist/anthropologist for the Panel of Experts for Social and Environmental Aspects of the Kali Gandaki Project
18 Jun 1997	Two letters received from NGOs were forwarded to NEA for their comments on various issues raised
22 June 1997	NEA advised ADB that they met and discussed with the NGOs issues raised by them. Details of the meeting were provided to ADB
30 Jun–11 Jul 1997	Inception Mission fielded
2 Aug 1997	ADB responded to Rural Development Palpa and CENCORD's letters concerning lack of access to information, compensation and resettlement, and involvement of the local people in the planning and implementation of the project
23 Sep 1997	ADB approved NEA's request that the loan agreement be amended to allow disbursement of foreign currency requirement to 89% from 82% as assumed during appraisal
24 Sep 1997	ADB wrote to NEA about its concern for the slow progress in staffing NEA's KGEMU
6 Oct 1997	NEA replied that KGEMU staffing had commenced
1 – 14 Dec 1997	First meeting of Panel of Experts was held in Kathmandu

¹ Some key dates of the Maoist insurgency are included (in italics) to illustrate the context of political instability during which Kali Gandaki "A" was conceived, designed, implemented. The Project operated from 2002 to 2005 under the real threat of terrorist action.

Date	Event
3 – 9 Dec 1997	First review mission noted that the project was 3–5 months delayed and that the relationship between NEA, the Engineer, and the Contractor needed improvement. Project Director was partly at fault and was replaced.
24 Feb –15 Mar 98	Review mission fielded. Problems with desander slope. Specialists to investigate the problem and proposed remedial measures were implemented.
31 Mar 1998	NEA advised of the work stoppage at the Kali Gandaki site. An agreement was reached between the Contractor and the worker's union and work resumed
17 Jun 1998	The Senior Environment Specialist met with NEA Project Director to get an update on the Kali Gandaki "A" environmental and social matters. KGEMU still not fully staffed and operational.
19 Jun 1998	ADB communicated to NEA its concern on operation of KGEMU and indicated 30 June deadline.
30 Jun 1998	NEA responded that they were discussing with the Consultants the arrangement of the funds required, organization structure, and TOR for KGEMU.
18 Aug 1998	KGEMU manager and community liaison officer appointed to work under the Consultant.
26 Aug – 5 Sep 98	Review Mission fielded. The Mission reiterated its recommendation of its Feb-Mar 1998 mission that ADB assists NEA in disseminating in a professional manner its efforts to a larger public, and particularly to concerned NGOs.
4 Sep 1998	NEA advised on the status of microcredit revolving fund and the fish hatchery program.
29 Oct 1999	ADB conveyed its concern to NEA regarding its temporary employment practice that is detrimental to the ability of the KGEMU staff members to perform to the fullest since the continuity of their work is not assured.
21 – 29 Jan 2000	Review Mission fielded. Lack of permanent staff of KGEMU, in spite of numerous follow-ups. This is due to NEA's appointment and contract extension policy that is based on periodic extensions of contracts up to 6 months. The contract of the KGEMU Manager was not extended and therefore KGEMU is now without a manager. There is a possible shortfall of funds under the ADB loan due to numerous unforeseen conditions compounded by a substantial decrease in overall loan value due to exchange rate fluctuations.
4 May 2000	ADB forwarded to NEA a letter from a village district council, which was addressed to the President of ADB, commenting on the concerns raised with respect to the socioeconomic measures for local people, particularly indigenous Bote people.
14 May 2000	NEA responded to ADB letter of 4 May 2000 and stated that it was giving due consideration to acquisition and compensation of the displaced families. Microcredit has already been disbursed for pig farming, chicken raising, etc. Some Bote families are already employed in the Project. Periodic public consultation meetings have been held and will continue to be held. Public documents and information are available at the Project site and NEA Central Office in Kathmandu.
22 May 2000	ADB responded to village district council on 14 May 2000 letter from NEA
3 Jun 2000	Copy of the Panel of Experts' letter to NEA was provided to ADB. Several important environmental and social issues raised by the Panel.
3 – 13 Sep 2000	Review Mission fielded. It reported about the various strikes, triggered by a fatal accident, and civil unrest in the Contractor's camp. A police force was deployed to prevent a repetition of such incidents.
6–20 Sep 2000	Special Loan Administration Mission fielded to discuss the operations of the KGEMU and contractual issues affecting the implementation of the project.

Date	Event
14 Nov-4 Dec 2000	Review Mission fielded. A memorandum concerning the implementation of a work plan for KGEMU was prepared by the POE.
2001	<i>Civil War fighting escalated and continued until 2005.</i>
14 Feb 2001	ADB sent a fax to NEA outlining all the social and environmental issues and recommendations that NEA needs to carry out.
2 Mar 2001	NEA sent its responses to the various issues raised by ADB.
23–10 May 2001	Review Mission fielded to review (i) environmental and social aspects, and (ii) financial and construction implementation issues. The visit coincided with the visit of the Panel of Experts.
25 Jun 2001	At the request of the Government of Nepal, ADB approved extension of loan closing date from 15 July 2001 by 2 years to 15 July 2003.
Jun 2001	ADB approved NEA's request to allow two of its senior staff to visit Washington D.C. for a meeting with the hydraulic expert to discuss the requirement of further simulation studies of the behavior of the delta under formation upstream of the dam and of flood levels with high floods in the vicinity of the holy stone (Saligram) and Seti Beni Bazaar village next to the holy stone.
16–25 Nov 2001	Review Mission fielded.
31 Mar 2002	The first 48-MW generating unit was commissioned.
19 Apr 2002	The second generating unit was commissioned.
25 May 2002	The final unit was commissioned.
31 Jul 2002	ADB approved NEA's request to engage an Advisor/Consultant in establishing the sediment monitoring laboratory at the Project site.
Sep 2002	Discussions on housing for the Bote community, which had still not been constructed.
16 Aug 2002	Transmission line to Pokhara functional, which marks the beginning of full commercial operations.
2–11 Oct 2002	Review Mission fielded. NEA and the Contractor have agreed to a plan to construct housing for the remaining 10 Bote families.
23 Oct 2002	Agreement that the Contractor would construct houses for 4 Bote families, and NEA would construct houses for 6 families.
2003	<i>Reportedly, NEA offices were bombed by Maoist insurgents.</i>
03 Feb 2003	ADB sent a fax to NEA inquiring about the progress in the construction of building houses for the remaining 10 Bote families.
27 Apr 2003	Newspaper article indicated that, with the arrival of monsoon, residents of Seti Beni bazaar are worried about flooding by the river. Over 100 houses are at risk.
27 May 2003	ADB sent a follow-up fax to NEA highlighting the findings pertaining to the recommendations of the Project's Social and Environmental Panel of Expert's Report No. 8.
9–24 Sep 2003	Special Loan Administration Mission fielded to assess the implementation performance of the project covering financial, economic, technical, environmental, and social aspects.
2005	<i>Civil War fighting subsided.</i>
21 Nov 2006	<i>Monitoring of the Comprehensive Peace Accord by UN Mission in Nepal began.</i>
28 Dec 2007	<i>The Interim Parliament passes a bill to declare Nepal a Federal Democratic Republic.</i>

ADB = Asian Development Bank, EIA = environmental impact assessment, FINNIDA = Finnish International Development Agency, JBIC = Japan Bank for International Cooperation, KGAA = Kali Gandaki "A" Associates, KGEMU = Kali Gandaki Environmental Monitoring Unit, MRM = Management Review Meeting, NEA = Nepal Electricity Authority, NEP = Nepal, NGO = nongovernment organization, SMEC = Snowy Mountain Engineering Corporation, TA = technical assistance, TOR = terms of reference, UN = United Nations, UNDP = United Nations Development Programme.

Source: Various project documents.

APPENDIX 4: LIST OF AGENCIES AT THE TIME OF CONSULTATION, IMPLEMENTATION (CONSTRUCTION AND OPERATION), AND EVALUATION

At the Time of Consultation	At the Time of Implementation	At the Time of Evaluation
<u>HMG and Local Institutions</u> <ol style="list-style-type: none"> 1. Department of Agriculture Development (DAD) 2. Department of Forestry (DOF) 3. Department of National Parks and Wildlife Conservation (DNPWC) 4. Fisheries Development Division (FDD) 5. Department of Soils Conservation (DSC) 6. Department of Archaeology (DoA) 7. Department of Water Supply and Sanitation (DWSS) 8. Ministry of Tourism and Civil Aviation (MTCA) 9. Village Development Committees (VDCs) 10. District Development Committees (DDCs) Villages 11. Timber Corporation of Nepal (TCN) 12. Nepal Agricultural Development Bank (AgDB) 13. Small Farmers' Development Program (SFDP) 14. Department of Cottage and Small- Scale Industries (DCSSI) 15. Ministry of Local Development (MLD) 16. NEA Environmental Division (NEAED) 17. Ministry of Population and Environment (MPE) 18. Electrical Development Center (EDC) <u>Preliminary List of NGOs, INGOs</u> <ol style="list-style-type: none"> 1. Nepal Association of Rafting Agents (NARA) 2. Upper Andhi Khola Watershed Management Project (UAKWMP) 3. Andhi Khola Project (AKP) 4. Rural Development Services Centre (RDSC) 5. Gramin Bikash Samiti (GBS) 6. Poverty Alleviation Programme (PA) United Nations Development Programme (UNDP) 7. World Conservation Union (IUCN) 8. Alliance for Energy 9. Energy Intermediate Technologies Group (EIT) <u>Others</u> <ol style="list-style-type: none"> 1. ADB-NEA Environmental Unit/Institutional Strengthening 2. Project 3. United Nations Development Programme <u>Reviewers</u> <ol style="list-style-type: none"> 1. Panel of Experts 2. Donor Missions 3. MPE 4. EDC 	<ol style="list-style-type: none"> 1. Nepal Electricity Authority (NEA) 2. Kali Gandaki "A" Project (KGA) Working Committee 3. Panel of Experts <u>Consultant</u> <ol style="list-style-type: none"> 1. Team Leader 2. Chief Engineer 3. Project (Resident) Engineer 4. Environmental Advisor 5. KGEMU <u>Contractors for Lots 1-7</u> <ol style="list-style-type: none"> 1. Environmental Monitor 2. Forester/Bio-engineering 3. Health Clinic Staff 	<ol style="list-style-type: none"> 1. NEA 2. Asian Development Bank (ADB), World Bank (WB), other lending institutions 3. NEA Project Director (PD) 4. Chief Engineer 5. Project (Resident) Engineer 6. Kali Gandaki "A" Environmental Management Unit (KGEMU) 7. FDD 8. VDCs 9. NEAED 10. Nepal Independent Power Producer Association

Source: Nepal Electricity Authority.

APPENDIX 5: OUTLINE OF RECOMMENDED TECHNICAL ASSISTANCE

1. Three technical assistance (TA) projects are recommended to enhance the sustainability of the Kali Gandaki “A” Hydroelectric facility, to address (i) vibrations in the powerhouse and cavitation of turbine parts, (ii) fish hatchery remedials, and (iii) SCADA system deficiencies.

A. Vibrations in the Powerhouse and Cavitation in Turbine Parts

2. The following are based on site visits to Kali Gandaki “A” powerhouse on 19–24 November 2011 with National Electricity Authority (NEA) staff members for (Kali Gandaki “A”) Anand Khatri Chatrie, Om Darlami, Kedar Pd. Dhital, Durlav Nepal, Prahlad Raut, Madan Timsina, and Ram Dular Yadav.

3. **Brief overview.** Mr. Yadav noted that the turbines are usually operated at less than 35 megawatts (MW) as experience has indicated the vibrations increase at over 35 MW.

4. While in the power house, occasional relatively severe vibrations were noted that produced tremors in the building, accompanied by relatively loud low frequency noise. The Independent Evaluation Department (IED) Mission was advised that these vibrations were noted during commissioning and have occurred ever since.

5. Kali Gandaki “A” staff noted that the greatest source of the vibrations appears to emanate from the draft tubes. A cursory survey indicated that the vibrations increased in magnitude from No. 1 to No. 3 unit, No. 3 being the farthest along the penstock manifold. Perhaps coincidentally, the largest and deepest cavitation pits were observed on the bottom of the blades of the disassembled runner for unit 3, about 35 millimeters (mm) diameter and 20 mm deep.

6. According to calculations by Kali Gandaki “A” staff, the vibrations and noise are the result of cavitation in the turbine and surrounding conduits that are partly the cause of accelerated wear in the turbine parts (runners, wearing rings, and wicket gates) and indirectly in the inlet butterfly valves. The calculations indicate that the tailrace elevation is set 1 meters (m) too low; i.e., 392 m instead of 393 m, such that the available net positive suction head may be 1 m less than assumed for the design of the turbine or that the required net positive suction head is 1 m more than provided by the tailrace elevation. It is difficult to understand how such an error could occur as this is a fundamental calculation in sizing turbines and associated conduits and is not difficult; i.e., if shown to be correct, this must be regarded as a major design error. There is no provision in the plant design to adjust the tailrace elevation.

7. In addition to noting that the turbines are usually operated at less than 35 MW due to vibrations increasing above that, plant staff also noted that the programmable logic controllers that indicate and control the turbine and generator operation and performance are adversely affected by the vibration and that they sometimes fail, blanking out the man-machine interfaces. Apparently, they have a self-restoring feature as the screens return to normal automatically.

8. **Technical assistance.** A TA should be established to review the operation of the powerhouse with a view to (i) determine the risk of failure due to the severe vibrations, (ii) the cause(s) of the vibrations, and (iii) the cause(s) of the severe cavitation. The TA should also recommend necessary remedials to restore and augment the facility to suit its purpose more effectively and efficiently.

9. **Suggested level of effort.** One suitably qualified international engineer with hydroelectric power plant design experience and post-graduate hydraulics credentials is needed lead the investigation (hydroelectric/hydraulics engineer inputs: 8 weeks; duration: 12 weeks).

10. Suggested schedule and output.

Week 1	Inception report (3 pages)
Week 8	Draft survey report including risk assessment and detailed and costed recommendations for alterations and additions
Week 12	Final survey report incorporating NEA and Asian Development Bank comments

B. Fish Hatchery Remedials

11. The following are based on site visits to Kali Gandaki “A” fish hatchery on 20 and 24 November 2011 with Nepal Agriculture Research Council (NARC) staff, Hare Ram Devkota and Arum Prasad Beidya.

12. **Brief overview.** The hatchery is essentially a joint venture between NEA and NARC and is operated by 9 Bote fishers and 3 technical staff. Of the 57 species of fish identified in the Kali Gandaki, NARC has collected 30 species, successfully domesticated 15 species, and successfully bred 10 species (considered a good fraction). No species were on government or international lists (e.g., Convention on International Trade in Endangered Species of Wild Flora and Fauna [CITES]). In 2002–2005, two species of fish were released. In 2007, 10 species of fingerlings were released. No fingerlings were sold to the public for grow-out. NARC staff suggested adding 10 basins to the nursery to increase the hatchery capacity.

13. Activities of the fish hatchery include limnological study of river water, monitoring of fish fauna and catch-trend in the river, growth study of *Tor putitora* (endangered fish species as per the International Union for Conservation of Nature [IUCN] red book) along with other fish species in captivity, research and development of appropriate feed for indigenous fish species, trapping and hauling of fish during spawning seasons, and training and awareness programs against destructive fishing.

14. The hatchery is an impressive compound of tanks and buildings that are purposefully designed and generally well-constructed. This hatchery should be a model for such facilities at other hydropower projects (not only in Nepal), where appropriate. There are, however, several important deficiencies.

15. **Design.** The hatchery is above the river, from which turbinized water is pumped at considerable cost. It is unlikely that an alternative source of water at less cost is available.

16. **Deficiencies.** The water is discharged into two sequential settling tanks, which are apparently too small and have poorly located inlet and discharge piping. Because of the elevated solids content and inadequate settling tank design, the existing facility cannot produce water that is sufficiently clear to support breeding the Himalayan salmon (Golden Maheer), which would otherwise require a fish ladder. It can only be hoped that once the desander basin inlet configuration is corrected as a result of the current model study, water quality at the hatchery will be improved; otherwise, in conjunction with NARC staff, the minimum water flow for the present operation should be determined and the present sedimentation tanks expanded on what appears to be an adjacent, unused piece of land within the project area. In addition, the inlet and outlet should be optimized to permit maximum efficiency for removing sediment. Alternatively, a side stream treatment consisting of, say, 50 micro filters or similar could be provided to facilitate propagation of the desirable species.

17. Leaks in some of the concrete fish tanks need to be repaired.

18. All laboratory and office equipment need to be reviewed with a view to replacing faulty equipment and updating where appropriate.

19. The hatchery roof should be insulated to reduce the heat and consideration should be given to provide air conditioners or at least sizeable fans.

20. **Technical assistance.** A TA should be established to review the operation and condition of the hatchery and recommend necessary remediation to restore and augment the facility to suit its purpose more effectively.

21. **Suggested level of effort.** One suitably qualified national consultant with civil engineering credentials is needed to lead the investigation, with input from a national ichthyologist (civil engineer: 4 weeks, ichthyologist: 1 week, duration: 6 weeks).

22. **Suggested schedule and output.**

Week 1	Inception report (2 pages)
Week 4	Draft survey report including detailed and costed recommendations for alterations and additions
Week 6	Final survey report incorporating NEA, NARC, and ADB comments

C. SCADA System Deficiencies

23. The following are based on site visits to Kali Gandaki "A" fish hatchery on 20 and 24 November 2011 with NEA (Kali Gandaki "A") staff.

24. **Brief overview.** The computer in the sedimentation laboratory was installed in late 2007 and is operated based on a program developed specifically for Kali Gandaki "A" by H₂O Consult and Research Centre Pvt. Ltd. in Kathmandu. Various databases are kept up-to-date by transferring computed or observed values into spread sheets, including suspended solids content and riparian and holy day minimum discharges.

25. Solid contents in the water are determined differently during the wet season when concentrations are high and the dry season when they are low. Samples are taken across the reservoir about 100 m upstream, at the inlet and outlet of the sedimentation basins, and in from the penstock conduit in the powerhouse. In the wet season, samples are passed through a 63 micro screen, dried, and weighed and the concentrations computed in two parts, sand and silt. In the dry season, turbidity is measured and interpreted as parts per million (ppm, approximately milligrams per liter) of silt. The liquid is then filtered, evaporated, and weighed as the sand portion. There are several steps in this procedure that appear to compromise the accuracy of the recorded results.

26. Kali Gandaki "A" staff observed that the plant lacks trained personnel in general and electronic technicians in particular. This is noticeable as neither the main control room in the powerhouse nor the computer in the dam site sedimentation laboratory function as intended, nor do some monitoring devices (e.g., the transmitter of the forebay level). The powerhouse control room is adequately equipped with computers, mimic screens, data storage, and events printers.

27. **Technical assistance.** A TA should be established to review the operation and condition of the Kali Gandaki "A" SCADA system and recommend necessary remediation to restore and augment the equipment and its operation to suit its purpose more effectively.

28. **Suggested level of effort.** One suitably qualified international consultant with electronics/control engineering credentials is needed to conduct the investigation (control engineer: 4 week, duration, 6 weeks).

29. **Suggested schedule and output.**

Week 1	Inception report (2 pages)
Week 4	Draft survey report including detailed and costed recommendations for alterations, additions, and training requirements
Week 6	Final survey report incorporating NEA and Asian Development Bank comments

APPENDIX 6: PROJECT DESIGN FEATURES AND DESIGN CHANGES

A. Project Design Features

1. The project is composed of the following physical components:
 - (i) Main civil works, comprising
 - (a) Lot C1, financed by Asian Development Bank (ADB): a 44-meter (m) high concrete gravity dam with 3–15 m wide spillway bays and 19 m high radial gates, and an adjacent intake to twin desanding basins;
 - (b) Lot C2, financed by Overseas Economic Cooperation Fund (OECF): a 5.9-kilometer (km) long, 7.4 m diameter, concrete-lined headrace tunnel; and
 - (c) Lot C3,¹ financed by ADB: surge and pressure shafts,² including steel liners, a tunnel leading to the power house, and the power house;
 - (ii) Lot 4, financed by OECF: design, supply, and installation of hydraulic steelwork comprising gates for the spillway, desander basins, headrace tunnel, and power station, and steel liners for the intake undersluices;
 - (iii) Lots 5 and 6, financed by OECF: design, supply, and installation of electrical (Lot 5) and mechanical (Lot 6) plant and auxiliaries for the three Francis-type, 48-megawatt (MW), 300 revolutions per minute (rpm) turbo-generating units operating at 11-kilovolt (kV) and 50-hertz (Hz), three main transformers plus one spare unit, and SF6 switchgear; and
 - (iv) Lot 7, financed by OECF: two 132-kV transmission lines, one single circuit line to Pokhara (61.4 km)³ including towers and the other a single-circuit line on double circuit towers to Butwal (44.3 km), and a substation at Pokhara.
2. The project also provided for construction engineering services; project management services; a system loss reduction component;⁴ a panel of experts (POE) for safety and technical aspects (POE S&T, also known as PoSTE); a panel of experts for environmental and social advisory aspects (POE E&S); and a Kali Gandaki Environmental Monitoring Unit to be established within 3 months of loan effectiveness for the duration of the construction period.
3. The POE S&T reviewed, and advised on, the design and construction of the project. The POE E&S monitored the environmental and social safeguard aspects, including resettlement. As stipulated in

¹ What turned out to be a very valuable environmental and social mitigation for the loss of fishery, the fish hatchery, was constructed as part of Lot 3 also.

² Originally, these steel liners were included in Lot 4.

³ Thirteen transmission towers near Pokhara would have been located such that the line passes over private lands, where land owners refused compensation offered. To avoid a lengthy arbitration procedure, the route for this line was changed, extending the length to nearly 70 km. (ADB. Back-to-Office Report [BTOR], 7 Jun 2001. Unpublished.)

⁴ The consultants, National Rural Electric Cooperative Association (NRECA), USA, were appointed on 27 February 1998 and commenced work in March 1998. The final report was submitted in March 1999 with an action plan. The impact of the loss reduction program has not significantly reduced losses even though all of the equipment under the program was installed. The reasons given by National Electricity Authority (NEA) were that there were still high levels of electricity theft, that it was not possible to form user groups without any special policy incentives, and that the plan was not implemented. Legislation to address electricity theft has been promulgated via the Electricity Theft Control Act, 2058. It remains to be seen if the Act is effective in reducing NEA's significant losses in revenue; in any case, success will depend entirely on the government's willingness to vigorously enforce the Act.

the loan agreement between ADB and the Ministry of Finance, the engineer was to cooperate fully in providing these panels with information and documents, and, subject to approval by the National Electricity Authority (NEA), the engineer was to adopt the recommendations made by the panels.

4. A change in the scope of the project was deemed necessary by the POE. The project utilizes a river that carries very large sediment⁵ loads, which required large desanding basins to remove most of the sediment⁶ before the water passes through the turbines. To complicate matters, the valley is particularly constricted at the dam site, which is desirable from a point of view of constructing the dam; however, less desirable in view of the requirement of accommodating a major desanding facility. In order to create space for the desanders, the slope on the left⁷ flank of the valley had to be flattened. Due to the very difficult geological conditions, some of which became known only as the slope was being cut, the slope became unstable and had to be flattened twice. In addition, there was a major collapse at the surge tank during excavation of the shaft, which was also caused by unforeseeable geological conditions. Similarly, conditions in the headrace tunnel excavation were at times very difficult resulting in further major delays. Because of these changes in the scope and various other delays in project implementation, the consulting services of the project had to be increased accordingly. There was a further change in the scope of the project caused by rerouting and extension of the 132 kV transmission line to Pokhara in order to avoid houses being located under the line.

5. The project completion report notes that, as envisaged at appraisal, all the components were installed and commissioned. The first 48-MW generating unit was commissioned on 31 March 2002, the second unit on 19 April 2002, and the third and final unit on 25 May 2002. The 132-kV transmission line from the project site to Butwal was commissioned on 24 February 2002, and the transmission line to Pokhara, which was delayed due to land access problems, was completed on 15 June 2002 but not finally commissioned until 16 August 2002. Two exceptions were noted by the Independent Evaluation Department (IED) Mission: the crane for the installation of downstream spillway stop logs, and the bascule (flap) gate of spillway gate no. 1, were not commissioned as neither was operable. Both were, however, accepted by the engineer and the NEA in nonoperational condition. The IED Mission believes that since these features were designed and purchased, they should be functioning.

B. Design Changes

6. The only design change documented in the project files relate to civil works, except for Lot 7. It is unclear whether and how those changes affected the design of the electromechanical contracts. Lot 7, the 132-kV transmission line to Pokhara was realigned to miss some properties whose owners were unwilling to accept the compensation offered under the project. The effects were quite significant: (i) the length was increased by some 4 km from 61.4 km, (ii) the Pokhara substation was changed, and (iii) the completion date of 16 August 2002 was postponed full commercial operations by several months.

7. **Dam.** The operating level of the pond was lowered 2 m at significant financial cost⁸ to avoid flooding the Seti Beni holy stone (Saligram) due to sedimentation of the riverbed,⁹ which serves what is said to be the starting point of a 3,000 year old Hindu pilgrimage.

8. **Intake and desanders.** The POE proposed a revised design for the intake and desanding basins.¹⁰ The changes included (i) adding a forebay in front of the intakes, (ii) adding a 4 m wide

⁵ The average annual concentration of solids is 3,750 milligrams per liter (mg/L) and the total sediment transport at the dam site was estimated to be about 50 million tons per year (roughly 10 times the excavated volume of the project).

⁶ The specifications for the desander basins included the requirement to remove 100% of particles >0.2 mm diameter and 85% of particles >0.15 mm diameter.

⁷ Left and right refer to the orientation looking downstream.

⁸ 1 m is approximately equal to 1 MW.

⁹ Anecdotal evidence suggests that the Stone was submerged occasionally during extreme flood events prior to the project.

undersluice bay next to the spillway, and (iii) adding an overflow weir at the head of the forebay. Changes to the desanding basins were not specified. The reason for the POE's recommendation was reportedly because model tests had demonstrated that the then current design did not function efficiently. The new design was expected to "...greatly enhance the efficiency of the sediment removal." The POE advised ADB that physical model testing of the proposed changes would not be useful and further advised that the design changes should be subjected to mathematical modeling. Evidently, that was a major error and the IED Mission believes that it caused the withdrawal of Norconsult from the Project.¹¹ The evidence was dramatically demonstrated in HydroLab's facility in Kathmandu where Kali Gandaki "A" dam site is under model testing as part of a World Bank-funded rehabilitation program that will include a feasible solution to improve the poor hydraulic performance of the intake and desanding facilities.

9. **Desander side slope.** Due to unforeseen geotechnical conditions that were only discovered during construction, the side slope of the desander basins was flattened twice to stabilize it, resulting in delays and significant cost increase. It also produced significantly more spoil to be disposed of.

10. **Sill plates.** During one of the visits to the dam site, the IED Mission was advised by one of the professional plant staff who had been on site since commissioning that the sill plates that were installed were not as thick as designed. Whether this was a factor in the failure of the concrete surrounding the sill plate on spillway gate No.1 is unclear. Similarly, the sill plate foundation at the upstream stop logs that must be repaired may also have been thinner than designed.

11. **Surge tank geometry.** Based on the advice of the POE, the surge shaft and orifice diameters were changed to improve the effectiveness of the surge tank.

12. **Headrace tunnel.** Due to unforeseen geotechnical conditions that were only discovered during construction and attempts to compensate for delays, the construction methods and the design of tunnel support system were changed.

13. Figure A9 in Appendix 9 shows the planned and actual schedule.

C. Environment and Social Aspects

14. The funding for the environmental and social program was too low to ensure not only impact mitigation but long-term benefits to project-affected people. The budget for the mitigation was \$5.38 million¹² with an estimated project cost at the time of \$452 million or 1.2%. International best practice requires 10%–15% of project cost should be invested in environmental and social programs, although this standard is seldom achieved.¹³ Moreover, the funding for the associated technical assistance (TA) was insufficient to have long-term national-level impacts.

15. The IED Mission found that the project mitigation measures did not bring sufficient long-term benefits to the local population despite electricity connection. Despite processes such as compensation and consultations being followed, mitigation measure outcomes did not materialize. Board discussion records show that such concerns were raised during deliberation. The Board recommended that the project strengthen local institutions (e.g., village development committees) capacity for planning and implementation of accompanying environmental and social development programs. The IED Mission

¹⁰ Annex 4 to ADB Background Paper, 7 August 1995.

¹¹ Pers. Comm. HydroLab staff. Norconsult staff members participated in the earlier design as well as the physical model testing performed in Norway. The same staff members also provided guidance in the design of the HydroLab facilities currently located in Kathmandu.

¹² The RRP total (Appendix 16) was \$5.34 million; however, adding the budget cost of the individual mitigation measures comes to \$5.38 million.

¹³ The budget for Nam Theun 2 was about 7%.

finds that had this approach been adopted to guide environmental and social mitigation measures, sustained benefits would have been conferred on the local population.

16. The environment and social interventions have not been sustained. For a start, the impact on fisheries biodiversity was quite big with, so far, only 10 out of 57 identified species having been domesticated by the fisheries program. Of 19 mitigation measures, 17 were funded and designed to be implemented only during construction. None of the mitigation measures were linked to form a comprehensive rural development intervention. The emphasis of the design was on mitigation of impacts based on a “do no harm” principle. This is the standard ADB safeguards approach and so the project designers and those implementing/monitoring them, including the POEs, produced the best effort possible with respect to this current approach. The IED Mission evaluated this approach based on socioeconomic survey, environmental and social impacts, list of agencies for consultation and implementation, IED Mission assessment of EIA with onsite visits, loan covenants review, report and recommendation of the President appendixes, project completion report review in terms of its outcomes (rather than in terms of compliance to a policy) for the intended beneficiaries (severely project-affected families, etc.). The IED Mission found the mitigation measures to have been either not implemented or partly implemented and, consequently, the impact of the interventions have not been sustained. Chapter 4 and Appendix 15 elaborate this.

17. Two mitigation measures were related to catchment management. These were tree planting (\$40,000, during construction) and the revegetation nursery (\$43,416, during construction). These measures were strictly related to environmental engineering approaches to address erosion impacts of limited tree cutting on the slopes in the project area where civil works were taking place. The initiatives were not per se catchment management to ensure sustainable watershed management of the contributing rivers.

D. Financial Aspects

18. Electricity tariffs were not increased since 2001, although required by the loan covenants. The consequence of this decade-long loss of revenue country-wide is that NEA is essentially insolvent and must rely on government funding from general revenues to meet its operation and maintenance (O&M) costs. The importance of the Kali Gandaki “A” hydroelectric power generating plant to the national power demand and, in effect, Nepal’s economic sustainability, essentially ensures the sustainability of Kali Gandaki “A.”

19. The recalculated financial internal rate of return is 5.55%, which, compared to the weighted average cost of capital of 5.7%,¹⁴ implies that the assets are less than likely sustainable. The physical sustainability of the assets is unlikely unless the proposed refurbishment of the infrastructure materializes.¹⁵ These refurbishment costs were included in the current analysis. No matter how relatively low the tariffs will be and how high technical and nontechnical losses contribute to the shortfall in adequate funding, O&M will continue to make the project produce power, no matter how inefficiently.

E. Hydropower Structure, and Operation and Maintenance

20. Three major issues affect operational performance and sustainability. One is the design of the intake facilities to the desander basins. The second is the basins themselves. A third is the hydraulics of the turbines. The intake was redesigned to produce a more efficient and effective flow to the desander basins. A World Bank-funded model study currently under way at HydroLab in Kathmandu has

¹⁴ RRP value.

¹⁵ The proposed refurbishment is to be funded by the World Bank. However at the time of the project performance evaluation report, there have been major issues on the proposed project.

demonstrated conclusively that the intake facilities are not doing their job, particularly under wet weather flow conditions, as they (i) do not distribute flow evenly into the desander basins, which causes inefficient solids removal; and (ii) cause inordinately large amounts of floating debris to accumulate at the screens protecting the intakes to the desander basins, with which the crane-mounted mechanical rake cannot cope and that then affects the flow distribution to the desander basins. An added bonus derived from the intake modifications would be that the addition of another crane-mounted rake, as currently planned under World Bank-funded Kali Gandaki "A" remediation works, would be unnecessary.

21. The width to length ratio of the two desander basins, which is an empirical indicator of basin performance, is about 0.25 as compared to about 0.10 for the originally designed five underground basins. Hence, it is reasonable to assume that the original design would have performed significantly better than the present design. It would be possible to enhance the solids settling performance of the basins by constructing two additional longitudinal walls, bringing the width to length ratio to about 0.13.

22. Turbine parts are prematurely eroded because of the inefficient performance of the desander basins. Modifications to the intake and desander basins would greatly reduce the accelerated wear on the turbine parts due to abrasion. However, another phenomenon is causing even greater damage and is responsible for major turbine overhauls at far greater frequency than would normally be expected. That phenomenon is cavitation. The IED Mission believes it is due to incorrect setting of the turbine with respect to the tailwater elevation or the absence of a weir that would control the tailwater elevation, causing insufficient available net positive suction head (NPSH). It is highly unlikely that the problem is caused by incorrect turbine design, although theoretically possible. Another phenomenon that is very noticeable is vibration emanating from the draft tubes. Whether these two phenomena are related or caused by the same malady is unclear; however, one or both cause very noticeable shocks that shake the building, similar to an earthquake. The situation is regarded as serious and TA to investigate the causes, to estimate the risk of failure, and to recommend solutions is recommended in this project performance evaluation report.

23. Plant records indicate, and the IED Mission observed, that the units do not operate at their design capacity, which translates into significant loss of revenue for the cash-strapped NEA.

24. Another, less debilitating factor affecting performance is the almost total failure of the SCADA system in the control room. The programmable logic controllers (PLCs) that control the functions of the turbines and generators appear to function quite well, although the vibrations and occasional tremors may have adverse effects. However, the equipment in the control room comprising three cathode ray tubes (CRTs) and two events printers plus associated computers does not function as intended and as necessary for modern hydroelectric power plant operation.

25. The figures for energy production from 1992 to the present indicate stable but lower-than-anticipated at design stage production from Kali Gandaki "A" with fluctuations that could be attributed to political, business, or environmental changes.

26. The Kali Gandaki "A" hydroelectric plant is found to operate well although at somewhat reduced production capacity due to inordinate wear on the turbine parts. Except for some spalling paint and surface rust on conduits in the powerhouse and some minor rust in the dam gallery, all main components were found in good condition attesting to their excellent material quality, construction, and apparently cost-effective maintenance. With limited O&M budget, NEA staff on site is able to respond to energy requirements as directed from NEA's control center in Kathmandu.

APPENDIX 7: SUMMARY OF ADB CONTRACTS FUNDED

PCSS No.	Contractor/Supplier	Description	Contract Amount	\$ Equivalent
I. Category 01 – Civil Works (Lots C1 & C3)				
0001	Impregilo S.P.A., Italy	Civil Works	\$81,831,247	81,831,247
			LIT59,466,715,083	31,146,541
			DM15,556,716	8,117,559
		Total		121,095,347
II. Category 02 – Equipment (Loss Reduction Component)				
0005	ABB T&D Co, U.S.A.	Solid State Meters	\$318,998	318,998
0006	Trishakti Cable, Nepal	ACSR Conductor	\$79,500	79,500
0007	Mudbhary & Joshi Trade	HT/CT Metering Unit	\$199,950	199,950
0008	Zhejiang Tech., PRC	Current Transformers	\$68,436	68,436
0010	Crystal Cable, India	ABC Cable	\$125,603	125,603
0011	Milsoft Integrated Solutions	Software	\$64,400	64,400
0012	Sicamex, France	Line Hardware	FF698,278	98,827
0013	Lapworth Export, U.S.A.	Ammeters	\$71,444	71,444
0014	Digitech, Nepal	Photovoltaic Relay	NRs3,419,500	46,876
0015	Lapworth Export, UK	Meter Test Eqpt.	L17,184	25,514
8801	Various	Vehicles	Y10,157,167	87,874
	Various		\$49,530	49,530
8803	Lapworth Export, UK	Seal Pliers	L22,874	34,709
		Total		1,271,661
III. Category 03 – Consulting Services				
0002	Morrison Knudsen, U.S.A.	Consulting Services	\$16,915,377	16,915,377
			NKR4,787,614	637,804
			FMK7,118,812	1,190,301
0003	Panel of Experts		\$851,600	851,600
0004	NRECA, U.S.A.		\$406,657	406,657
			NRs5,066,985	72,380
0009	Dr. Every Hoek	Geotech. Expert	\$21,323	21,323
8802	Mr. Klaus Mussger, Austria	NATM Consultant	S137,244	10,711
		Total		20,106,153
Total Contracts Financed under the Loan				143,473,161

PCSS = Procurement Contract Summary Sheet.

Source of basic data: Project documents.

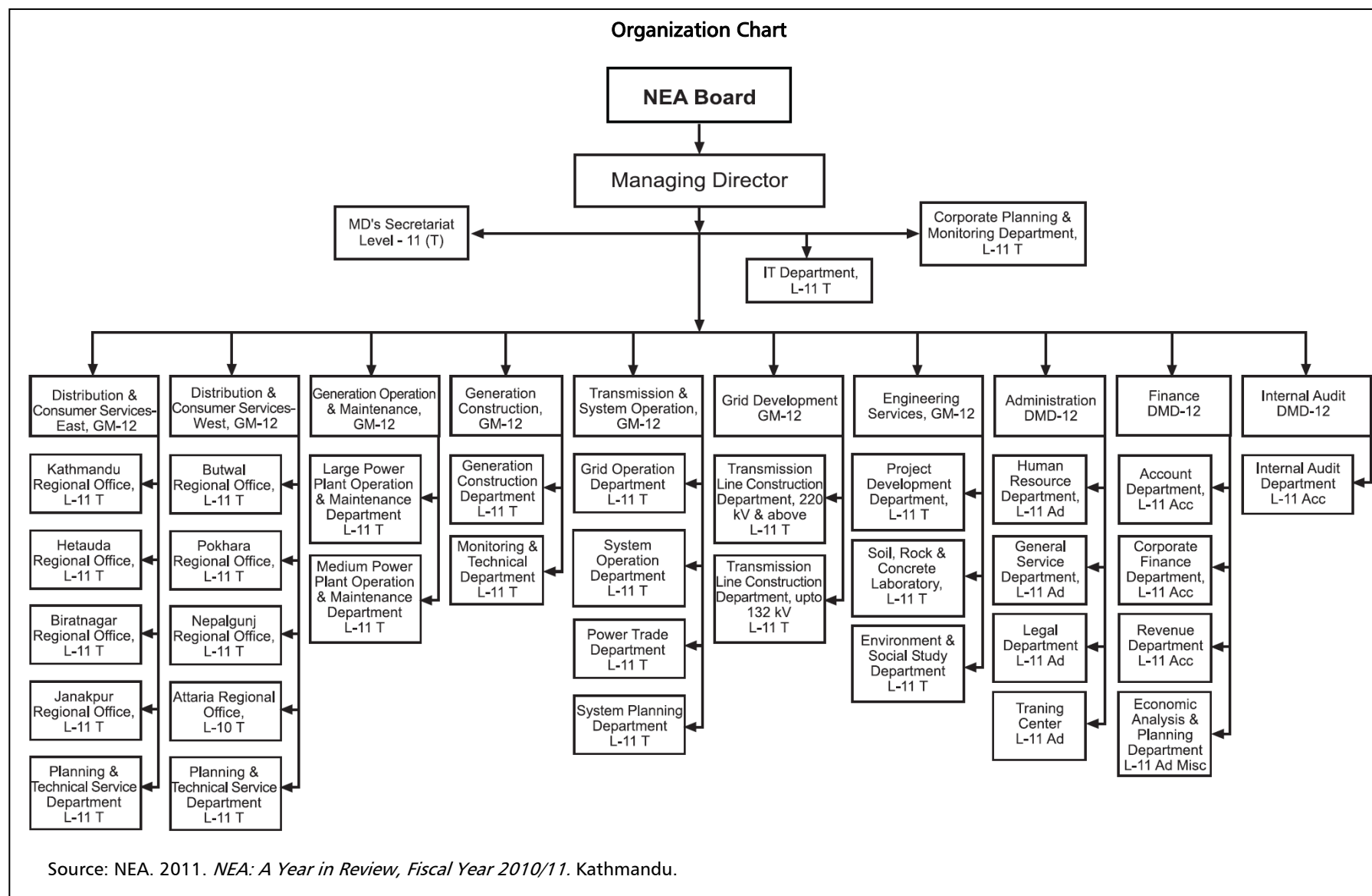
Table A7: Projected and Actual Disbursements of ADB Loan Portion
(\$ million)

Year	Projected	Actual
1997	13.714	29.262
1998	54.023	22.690
1999	31.036	27.028
2000	37.047	31.354
2001	24.180	22.704
2002		7.100
2003		0.301
Total	160.000	140.439

ADB = Asian Development Bank.

Source of basic data: Project documents.

APPENDIX 8: CORPORATE STRUCTURE OF THE NEPAL ELECTRICITY AUTHORITY



APPENDIX 9: ACTIVITY SCHEDULE AND OUTPUTS

Figure A9: Planned and Actual Project Schedule

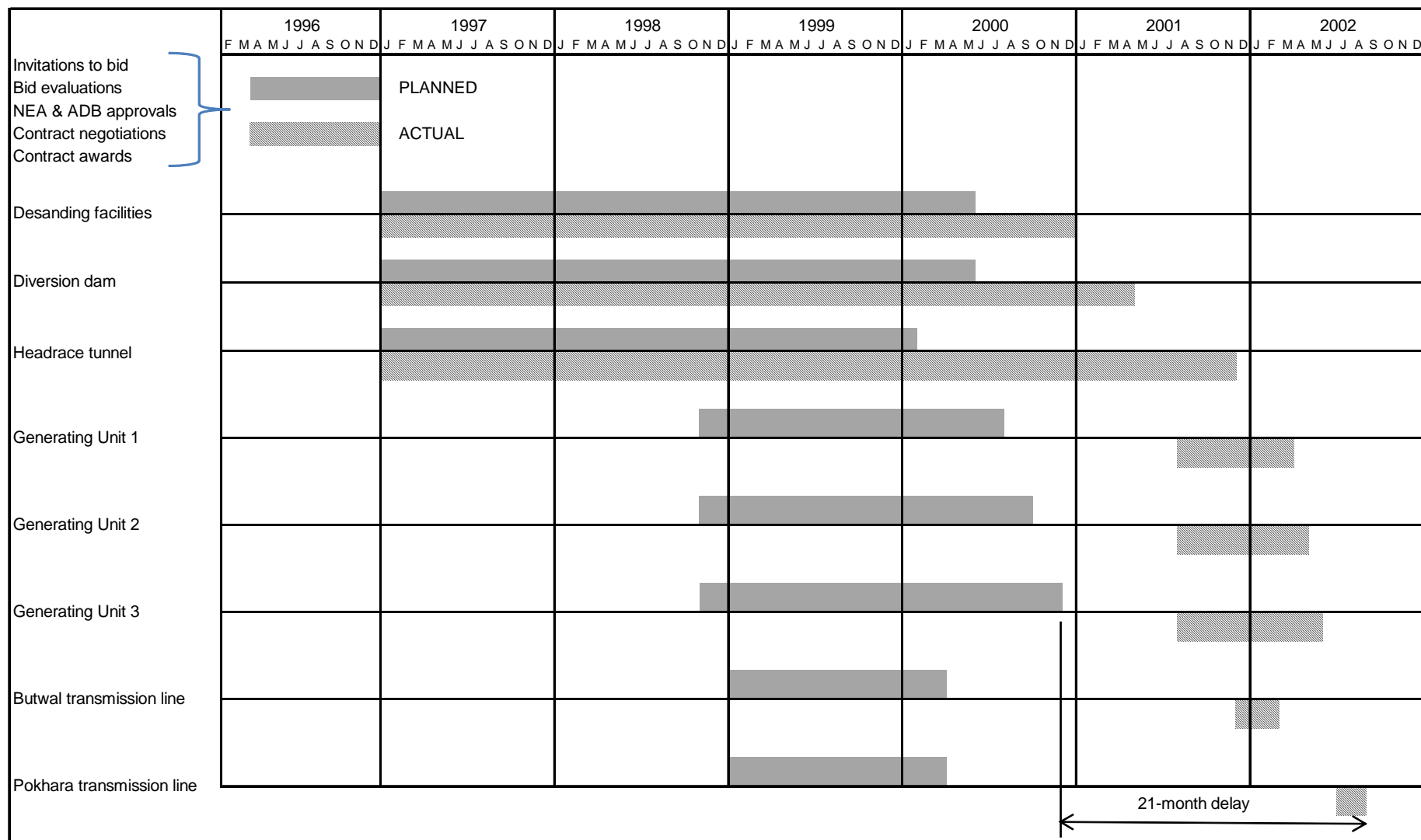


Table A9: Planned and Actual Project Outputs

Planned	Actual
Engineering	
44 m high concrete gravity diversion dam and gated spillway, and an adjacent intake and desanding basin	As planned, with the addition of an undersluice and gate and significantly changed desander side slope due to unexpected site conditions.
5.9 km long concrete-lined headrace tunnel with a diameter of 7.4 m	As planned, except that construction techniques were changed based on unexpected site conditions.
A surge shaft, pressure shaft, tunnel leading to the power station and the power station	As planned, except that the surge shaft was excavated twice due to unexpected site conditions and its orifice diameter was changed to enhance its effectiveness based on POE recommendations.
Hydraulic steelwork (gates for the spillway, desander, headrace tunnel, and power station, as well as steel liners for the pressure tunnel)	As planned; however, for unknown reasons, the downstream stoplog crane and flap gate were not commissioned as they were both nonfunctional.
Electrical and mechanical plant and auxiliaries for the three 48-MW turbo-generating units, transformers and switchgear to be installed at the power station and two 132-kV transmission lines, one to Pokhara (61.4 km) and the other to Butwal (44.3 km)	As planned, except that the Pokhara line was significantly relocated because of the unwillingness of several landowners to accept the alignment, resulting in delay and additional cost. This has implications for the quality of appraisal and the EIA process.
TA 1: Institutional Strengthening of NEA's Environment Division	
Environment and social management framework in Nepal with 5-year operational program, organization, staff capability, EIA procedure, guidelines, manuals, reference library	Results of IED Mission interviews with the Environmental and Social Studies Department (ESSD) of the NEA indicate ongoing involvement in the impact assessment of hydropower. No environmental regulation at the time of the EIA. ADB emphasis was on impact assessment, meeting safeguards requirements followed by construction phase activities and then minimal follow up during operation phase (e.g., KGEMU only operational during construction). Currently, the ESSD acts as consultants for IPP EIAs. The EIAs are then reviewed by Ministry of Environment. IED Mission was advised that the department needs more professional staff in engineering and forestry. It is questionable whether NEA should continue to undertake EIAs or outsource this to consulting firms. However it is currently a source of revenue for NEA ESSD.
TA 2: Power System Master Plan	See annual report.
Load Forecast	
Generation expansion plan	As planned, but hardly incorporated into the design of the project since some of the premises were not based on reality (e.g., surplus peak power export to India to finance the expansion plan when there was, and is, a shortage of peak power).
Transmission Master Plan	
On-the-job training for NEA staff	As planned, but with questionable residual value since many staff have moved on.

ADB = Asian Development Bank, EIA = environmental impact assessment, IED = Independent Evaluation Department, IPP = independent power producer, KGEMU = Kali Gandaki Environmental Monitoring Unit, km = kilometer, kV = kilovolt, m = meter, MW = megawatt, NEA = Nepal Electricity Authority, POE = panel of experts, TA = technical assistance.

Source: PCR and IED evaluation.

APPENDIX 10: LOAN COVENANT STATUS

Summary Table
(As of November 2011)

Covenant	Status as of PCR	Status as of PPER
Project Implementation		
1. Appointment of a project director who shall be responsible in all matters related to project implementation. (Loan Agreement, Schedule 6, para. 1.)	Complied with.	Partially complied with (late and dubious commitment).
2. Borrower shall furnish quarterly reports on carrying out the Project. (Loan Agreement, Schedule 6, para 1.)	Complied with. Monthly reports were submitted regularly.	Same as project completion report (PCR).
3. Appointment of panel of international experts within 3 months of the effective date. (Loan Agreement, Schedule 6, para. 2.)	Complied with. Last panel of experts' meeting was in January 2002.	Same as PCR.
4. Promptly implement the recommendations made by the panel of international experts in a manner satisfactory to the Asian Development Bank (ADB). (Loan Agreement, Schedule 6, para. 2)	Partially complied with. Monitoring of environmental and social mitigation measures were phased out too early.	Same as PCR.
Environment		
5. Establish Kali Gandaki Environmental Monitoring Unit (KGEMU) within 3 months of the effective date. (Loan Agreement, Schedule 6, para. 3.)	Delayed compliance. KGEMU was established in March 1997 with several staff. The unit manager was not appointed until August 1998.	Delayed compliance. The unit was fully functional some 2 years after project construction started and has been dissolved at project completion. At least 3 members of the unit were absorbed as employees of Environmental and Social Studies Department (ESSD), Nepal Electricity Authority (NEA).
6. Release of 4 cubic meters per second (m ³ /s) of water during the dry season from the dam to mitigate the loss to riverine, primarily in the first 13 kilometers (km) immediately after the dam.	Delayed compliance after the September 2003 Special Loan Administration Mission.	Complied with. Records of releases provided. Current release is discharged via a hole in the spillway, augmented by calculated flow through an undersluice gate, of the no. 1 flood gate and not through the riparian release mechanism as intended. While the volume discharged is similar, the current release does not allow fish migration downstream from the upstream areas as designed [fish could conceivably pass through the 100 millimeter (mm) slot created by opening the undersluice gate].
7. NEA to coordinate or cause to coordinate the recommendations contained in Acquisition, Compensation and Resettlement Plan, Environmental Impact Assessment and Mitigative Measures Monitoring Plan as well as relevant contractual provisions between NEA and contractors. (Loan Agreement Schedule 6 para. 8)	Complied with.	Same as PCR.

Covenant	Status as of PCR	Status as of PPER
8. NEA shall carry out post construction environmental and social impact audit within 3 months of project completion, and furnish to ADB a copy of such audit within 4 months of the completion of the project. (Loan Agreement Schedule 6 para. 10.)	Delayed compliance. Final audit report received by ADB on 26 February 2004.	Same as PCR.
9. During project implementation, the Borrower and NEA will carry out an environmental monitoring program, satisfactory to ADB, and will submit the reports to ADB, on a quarterly basis, within 30 days from the end of each quarter. The primary objective of the monitoring program will be to identify problem areas in sufficient time to initiate viable solutions. (Loan Agreement, Schedule 6 para. 9.)	Complied with.	Partially complied with. The unit was fully functional some 2 years after project construction start and has been dissolved at project completion.
Social/Resettlement		
10. The project director to ensure satisfactory implementation of agreed upon environmental mitigation measures and to provide an employment opportunity for at least one person from each seriously project-affected family (SPAF) living in the project area, and further opportunities for the women living in the project area to establish small handicrafts, trading, and manufacturing enterprises. (Loan Agreement, Schedule 6, para. 1.)	Partially complied with. Employment opportunity for SPAFs was mostly complied with. Occasionally concerns were raised about the contractor not fully complying with hiring in priority order as prescribed in the report and recommendation of the President (RRP). But considering NEA and KGEMU together, there was compliance on providing employment to SPAFs, project-affected families (PAFs), and local residents during construction. Furthering opportunities specific to women was partially complied with.	Partially complied with. Based on discussions with the community in project affected area, employment priority to SPAF family members during construction was not fully complied with. SPAFs recall that employment opportunities were also given to the family members other than SPAF households without ensuring opportunities to SPAF family members. The findings of a socioeconomic study carried out during post project evaluation shows no significant difference between the number of persons involved in construction activities among the PAF and SPAF households (30 persons and 34 persons respectively) out of the total households selected for socioeconomic survey (50 households for each category). Likewise, opportunities specific to women in terms of their involvement in construction-related activities have also been found negligible compare to the involvement of male family members. This is a common requirement of construction projects (including all kinds of environmental engineering requirements) which are seldom realistically included as a cost item against which contractors can bid with sensible time allocation. In order for a contractor to hire SPAFs preferentially, usually low or zero skilled workers including women, allowances need to be made in the bidding documents that the contractor will be expected to do this (i.e., take on a "development" function).

Covenant	Status as of PCR	Status as of PPER
		ADB should not assume this will happen automatically because it is not the contractors' job to promote development. This is ADB's job.
11. Carry out the Acquisition, Compensation and Resettlement Plan, Environmental Impact Assessment and Mitigative Measures Monitoring Plan in accordance with the principle, objectives and provisions thereof. In carrying out these plans, NEA shall promptly implement the recommendations made by the panel of experts for environmental and social aspects and KGEMU in a manner satisfactory to ADB. (Loan Agreement, Schedule 6, para. 7.)	Partially complied with. The project has made considerable progress on the various elements of the resettlement and mitigation process for the Bote Community.	Delayed compliance. The PAFs and the significantly affected Bote families in the dam site area have been found rehabilitated by the project in nearby location. However, 12 Bote families in the dam site area have been rehabilitated only after the completion of project.
12. With respect to Acquisition, Compensation and Resettlement Plan, the Borrower shall take or cause to be taken all necessary measures to ensure that all the population adversely affected by the project shall generally (i) improve or at least regain their prior standard of living; (ii) be relocated, if necessary, in accordance with their preferences and be fully integrated into the community in which they move; and (iii) be provided with appropriate agreed upon compensation and required physical rehabilitation of infrastructure, community facilities, including rehabilitation grants, services skills training and employment opportunities. (Loan Agreement, Schedule 6, para. 7.)	Partially complied with. Land was acquired several times between 1992 and 2003. Many families were affected more than twice by land acquisition and some households had to be relocated twice due to the same project. This is an important lesson learned.	<p>Partially complied with. Based on discussion with the PAF and SPAF household members and local community in different project locations, adversely affected households including the Bote households have regained/improved their standard of living. However, noted improvements in living standards are not attributed to the project mitigation measures other than electricity connection. This is because despite the loan covenant requirement to "improve" PAFs' standard of living, the design and financial means of the mitigation measures, did not enable the project managers to achieve this.</p> <p>Although not in the mitigation measures, the Bote families in the dam site area have also been provided a primary school, which has been found very effective on schooling the children. Similarly, drinking water facilities has been provided to the population in the dam site area and at Mirmi bazaar.</p> <p>The project has also provided skill trainings to the family members of PAF/SPAF households in the area on project-related works (e.g., electrician training, drilling, etc), animal husbandry, agriculture, literacy, sewing cutting, and fish hatchery.</p> <p>However, communities in the project locations are concerned about the lack of health care facility and drinking water services in other unserved areas. Had the design and budget allowed a development vision for the social protection measures, education, health care, water supply sanitation in the broader area of the project would have been included and would have been functional during operation. That these weren't</p>

Covenant	Status as of PCR	Status as of PPER
		implemented has to do with ADB's safeguards policy and the way it is commonly applied to projects.
13. Public Participation: The Borrower and NEA shall, through the Project Information Centers (PIC) in Kathmandu and in the project area staffed with full-time NEA personnel, carry out agreed upon public participation and consultation activities and provide annual reports on the progress of carrying out such activities no later than 30 June of each year beginning within 1 year of the effective date. The Borrower shall cause NEA to continue to utilize the informal Project Village Advisory Groups, recognized by NEA, as a vehicle for communication between project-affected families and NEA on any matter of mutual interest concerning the project. (Loan Agreement, Schedule 6, para. 11.).	Partially complied with. No separate report was submitted on public participation. However, NEA has continued to hold consultations with PAFs through the Village Advisory Groups.	Partially complied with (during construction phase). Environmental and social project design and budget allocation (non-objected to by ADB) did not allow for continuation of the PIC and its functions beyond the end of the construction phase. Such advisory groups have been reported to be passive after the project construction and there is also no communication between PAFs and NEA.
14. NEA shall cause the engineer to engage at least 1,000 person-months of Nepalese local technical personnel during the project construction phase. (Loan Agreement, Schedule 6, para. 12.)	Partially complied with. The required numbers of Nepalese local technical persons were often unavailable.	Same as PCR. Unavailability of technical labor is to be expected in such a remote region and if skill transfer is to be a desired development impact of the project, such stipulations need to be in writing in the contract with the contractors and costed and with time allocation. However, the contracts were not available to the IED Mission in country or in ADB archives so the extent to which this requirement was costed and itemized has not been verified. Partial compliance may well have been the best outcome feasible. ADB's due diligence process should account for this.
15. NEA shall install an early warning system for flood by 31 March 1999 and operate and maintain such system satisfactory to ADB. (Loan Agreement, Schedule 6, para. 13.)	Partially complied with. Additional sirens were installed after September 2003 Special Loan Administration Mission.	Partially complied with. One additional siren was installed for a total of two sirens by September 2003. Both sirens were tested and found to be effective. NEA provided communications to local villagers as to the purpose of the sirens.
16. NEA shall continue to evaluate the risk of floods and to take adequate measures to mitigate such risks. (Loan Agreement, Schedule 6, para. 13.)	Complied with. Additional simulation studies completed in March 2004 and report received on 6 April 2004.	Not complied with. No evidence that risk evaluation has taken place. No adequate measures were observed, other than gabions at Seti Beni, which have been ineffective in guarding against high floods as reported by local community during mission visit and demonstrated through a video presentation of a recent flood event. However, it is not conclusive that higher flood levels are caused solely by the Kali Gandaki "A" dam.
17. The project director shall ensure environmental and socioeconomic conditions are monitored during project operation with reference to Acquisition, Compensation and	Delayed compliance. During transition of phasing out of KGEMU and resumption of its work by	Delayed compliance. Currently, NEA's Environmental and Social Studies Department is not continuing the work of KGEMU. It is concentrated on the

Covenant	Status as of PCR	Status as of PPER
Resettlement Plan, Environmental Impact Assessment and Mitigative Measures Monitoring Plan. (Loan Agreement, Schedule 6, para. 16a.)	NEA, institutional communication was lacking. NEA has instituted an Environmental and Social Studies Department to continue the work of KGEMU.	environmental and social activities related to planned and ongoing projects. The mitigation measures were not designed to have ongoing impact conferred on the local population. Budget and institutional set up were not promoting the achievement of this covenant. However, NEA has provided finance up to now to the Nepal Agriculture Research Council (NARC) to implement the fish hatchery program which continues to maintain some fish biodiversity and some migration and this is monitored by the fish hatchery.
18. NEA shall continue to invest at least 1% of NEA's net revenue generated from the existing hydropower plants in the rural electrification in and near such NEA hydropower plants. As soon as the dam and the power station are commissioned, NEA shall invest 1% of net revenue generated from the power station in rural electrification in areas directly affected by the dam and power station. (Loan Agreement, Schedule 6, Para 32)	Complied with. About 4,142 households in the vicinity of the project site have been provided with electrification.	Not complied with. 1. NEA net revenue is negative: NRs-50.96 million for fiscal year (FY) 2001 NRs-860.68 million for FY2002 NRs-1,953.67 million for FY2003 NRs-1,760.33 million for FY2004 NRs-1,312.84 million for FY2005 NRs-1,267.75 million for FY2006 NRs240.60 million for FY2007 NRs-2,315.47 million for FY2008 NRs-4,758.03 million for FY2009 NRs-6,540.77 million for FY2010 NRs-6,128.10 million for FY2011 2. NEA data show that about 4,142 domestic and 104 industry connections have been made in the project area since Kali Gandaki "A" operation including in Shreekrishna Gandaki, Jagtra Devi, other project areas Birgha, Nibuwakharka, Pindikhol, Alam Devi, Chandi Bhanjyang, Harmichaur, Arbeni, Yamgha, Saligram were connected by the Butwal Power Company; in total 2,764 connections 3. Data on Kali Gandaki "A" cumulative energy sales (2002–2011) and specific expenditure for 4,142 domestic and 104 industry connections in project area are not available. ADB should ensure that monitoring systems and budget and capacity are in place so that its requirements can be assessed, if compliance is sought.
Financial		
19. NEA shall adjust its tariffs at least annually to achieve an annual rate of return (ROR) of not less than 6% on revalued fixed assets starting FY1998; and thereafter. (Project Agreement, Section 2.16.)	Not complied with. No tariff increase after 2001. ROR was	Not complied with. No tariff increase after 2001. ROR was

Covenant	Status as of PCR	Status as of PPER
	0.4% for FY1998 0.3% for FY1999 2.2% for FY2000 -0.1% for FY2001 1.3% for FY2002 2.4% for FY2003	3.17% for FY2001 0.36% for FY2002 4.14% for FY2003 3.60% for FY2004 3.81% for FY2005 2.87% for FY2006 5.12% for FY2007 -0.48% for FY2008 -2.71% for FY2009 -3.50% for FY2010 -2.96% for FY2011
20. NEA's tariff shall be adequate to achieve a self-financing ratio (SFR) of: FY1997 – 18%; FY1998 – 20%; and FY1999 and thereafter – 23%.	Not complied with. SFR was 6.5% for FY1997 6.5% for FY1998 9.0% for FY1999 22.1% for FY2000 10.3% for FY2001 6.2% for FY2002 13.0% for FY2003	Partly complied with SFR was 41.63% for FY2005 14.19% for FY2006 36.01% for FY2007 39.77% for FY2008 4.26% for FY2009 -15.12% for FY2010 -2.47% for FY2011
21. NEA shall achieve a debt service ratio (DSR) of not less than 1.2. (PA, Section 2.17)	Complied with. DSR was 2.1 for FY1998 1.6 for FY1999 2.0 for FY2000 1.8 for FY2001 2.0 for FY2002 1.6 for FY2003	Not Complied with (except 2007). DSR was 1.09 for FY2003 0.91 for FY2004 0.96 for FY2005 0.83 for FY2006 1.32 for FY2007 1.19 for FY2008 0.59 for FY2009 0.33 for FY2010 0.39 for FY2011
22. NEA's accounts receivable should not exceed the equivalent of NEA's sales revenue for 3 months. (Loan Agreement, Schedule 6, para. 20(a).)	Not complied with. Accounts receivable were 3.9 months for FY1998 4.2 months for FY1999 2.5 months for FY2001 3.3 months for FY2002 3.6 months for FY2003	Not complied with. Accounts receivable were 3.66 for FY2003 3.60 for FY2004 3.54 for FY2005 3.50 for FY2006 3.84 for FY2007 4.34 for FY2008 4.40 for FY2009 3.83 for FY2010

Covenant	Status as of PCR	Status as of PPER
		4.52 for FY2011
Audited Project Accounts and Financial Statements		
23. NEA to provide ADB audited project accounts and financial statements not later than 9 months after the close of fiscal year. (PA. Article II, Section 2.09(a).)	Complied with late. Audited project accounts for FY2002, due on 30 April 2003, received in February 2004 and audited financial statements received late in June 2003 as in past years.	Same as PCR.
Economic Efficiency		
24. NEA will achieve a ratio of at least 75 consumers per employee by FY2000. (Loan Agreement, Schedule 6, para. 24.)	Delayed compliance. The ratio for FY2002 was 83.7	Complied with for years with data: 77 for FY2001 90 for FY2002 98 for FY2003 109 for FY2004 119 for FY2005 134 for FY2006 151 for FY2007 2007–2011 data not provided.
25. NEA will provide each year for ADB's review a draft corporate plan setting forth NEA's strategic plans at least 90 days prior to the start of each fiscal year, covering the subsequent 3 years. NEA will take account of the ADB's comments in finalization of the plan. (Loan Agreement, Schedule 6, para. 28.)	Delayed compliance. The Development Corporate Plan for FY2003 to FY2007 was only received on 17 September 2003.	Same as PCR. Further reports required not available.
26. Loss Reduction: NEA shall reduce system losses to: FY1997 – 23%; FY1998 – 22%; FY1999 – 21%; Thereafter – 20%. (Loan Agreement, Schedule 6, para. 25.)	Not complied with. The system losses were 21.5% for FY1998 22.8% for FY1999 23.8% for FY2000 24.2% for FY2001 24.8% for FY2002 23.6% for FY2003	Not complied with. The system losses were 23.6% for FY2001 24.56% for FY2002 23.66% for FY2003 23.01 for FY2004 24.83% for FY2005 25.12% for FY2006 26.71% for FY2007 26.52% for FY2008 25.27% for FY2009 28.91% for FY2010 27.47% for FY2011 FY2001 means the year ending 15 July 2001.
Others		
27. NEA will (a) provide ADB within 6 months of loan becoming effective with a draft of its Commercialization	Complied with. Final Report on NEA's	Complied with. Commercialization Study Report submitted. Annual reports on

Covenant	Status as of PCR	Status as of PPER
Study Report, (b) take account of ADB's comments in finalizing the report's recommendations, (c) submit a satisfactory implementation plan, and (d) implement the plan and each year report on progress achieved.	Commercialization Study received in February 1998.	implementation included in NEA's Annual Report.
28. NEA shall establish a fish hatchery and implement a fish trapping and hauling program.	Partially complied with. Construction of fish hatchery was completed and is now being operated by the NARC. The capacity of this hatchery is about 30 million eggs, 10 million fry and 2 million fingerlings. Fish trapping and hauling not complied with.	Partially complied. Fish trapping and hauling program aiming to provide fish transport to upstream Kali Gandaki and its tributaries could not be implemented. However, the fish hatchery program is being implemented by the NARC with a capacity of 800,000 fingerlings per year.

PCR = project completion report, PPER = project performance evaluation report.

Source: PCR and IED.

APPENDIX 11: TARIFF STRUCTURE

Table A11.1: Tariff Rates
(Billing Effective since 17 September 2001 up to mid-2012)

1: Domestic Consumers			
A Minimum Monthly Charge: Meter Capacity	Minimum Charge (NRs)	Exempt (kWh)	
Up to 5 Amperes	80.00	20	
15 Amperes	299.00	50	
30 Amperes	664.00	100	
60 Amperes	1394.00	200	
Three phase supply	3244.00	400	
B Energy Charge:			
Up to 20 units	NRs4.00 per unit		
21 - 250 units	NRs7.30 per unit		
Over 250 units	NRs9.90 per unit		
2: Temples			
Energy Charge	NRs5.10 per unit		
3: Street Lights			
A With Energy Meter	NRs5.10 per unit		
B Without Energy Meter	NRs1860.00 per kVA		
4: Temporary Supply			
Energy Charge	NRs13.50 per unit		
5: Community Wholesale Consumer			
Energy Charge	NRs3.50 per unit		
6: Industrial	Monthly Demand Charge (NRs/kVA)	Energy Charge (NRs/unit)	
A Low Voltage (400/230 V)			
(a) Rural and Cottage	45.00	5.45	
(b) Small Industry	90.00	6.60	
B Medium Voltage (11 kV)	190.00	5.90	
C Medium Voltage (33 kV)	190.00	5.80	
D High Voltage (66 kV and above)	175.00	4.60	
7: Commercial			
A Low Voltage (400/230 V)	225.00	7.70	
B Medium Voltage (11 kV)	216.00	7.60	
C Medium Voltage (33 kV)	216.00	7.40	
8: Non-Commercial			
A Low Voltage (400/230 V)	160.00	8.25	
B Medium Voltage (11 kV)	180.00	7.90	
C Medium Voltage (33 kV)	180.00	7.80	
9: Irrigation			
A Low Voltage (400/230 V)	-	3.60	
B Medium Voltage (11 kV)	47.00	3.50	
C Medium Voltage (33 kV)	47.00	3.45	
10: Water Supply			
A Low Voltage (400/230 V)	140.00	4.30	
B Medium Voltage (11 kV)	150.00	4.15	
C Medium Voltage (33 kV)	150.00	4.00	
11: Transportation			
A Medium Voltage (11 kV)	180.00	4.30	
B Medium Voltage (33 kV)	180.00	4.25	

kV = kilovolt, kVA = kilovolt-ampere, kWh = kilowatt-hour, V = volt.

Source: NEA. 2011. *NEA: A Year in Review, Fiscal Year 2010/11*. Kathmandu.

Table A11.2: Time of Day Tariff Rates

Consumer Category and Supply Level		Monthly Demand Charge (NRs/kVA)	Energy Charge (NRs/unit)		
			Peak Time 18:00–23:00	Off-Peak 23:00–6:00	Normal 6:00–18:00
A:	High Voltage (66 kV and Above)				
1	Industrial	175.00	5.20	3.15	4.55
B:	Medium Voltage (33 kV)				
1	Industrial	190.00	6.55	4.00	5.75
2	Commercial	216.00	8.50	5.15	7.35
3	Non-Commercial	180.00	8.85	5.35	7.70
4	Irrigation	47.00	3.85	2.35	3.40
5	Water Supply	150.00	4.55	2.75	3.95
6	Transportation	180.00	4.70	2.95	4.15
7	Street Light	52.00	5.70	1.90	2.85
C:	Medium Voltage (11 kV)				
1	Industrial	190.00	6.70	4.10	5.85
2	Commercial	216.00	8.65	5.25	7.55
3	Non-Commercial	180.00	9.00	5.45	7.85
4	Irrigation	47.00	3.95	2.40	3.45
5	Water Supply	150.00	4.60	2.80	4.10
6	Transportation	180.00	4.80	3.00	4.25
7	Street Light	52.00	6.00	2.00	3.00

kV = kilovolt, kVA = kilovolt-ampere.

Note:

a) If demand meter reads kilowatts (kW) then kVA = kW/0.8.

b) 10% discount in the total bill amount will be given to the Government of Nepal approved Industrial District.

c) 25% discount in the total bill amount will be given to the Nepal Government Hospital and Health Centers (except residential complex).

Source: NEA. 2011. *NEA: A Year in Review, Fiscal Year 2010/11*. Kathmandu.

APPENDIX 12: QUANTITATIVE ASSESSMENT OF OVERALL PROJECT PERFORMANCE

Table A12: Overall Rating

Criterion	Assessment	Rating	Weight (%)	Weighted Rating
Relevance	Relevant	2.08	25	0.52
Effectiveness	Effective	2.10	25	0.53
Efficiency	Efficient	2.00	25	0.50
Sustainability	Likely Sustainable	1.23	25	0.31
Overall Rating	Successful			1.86

Note:

Relevance: Project objectives and outputs were relevant to strategic objectives of the government and the ADB.

Effectiveness: Project achieved its targets and objectives.

Efficiency: Project achieved objectives in an efficient manner

Sustainability: Project benefits and development impacts are sustainable

Overall ratings: Highly successful, successful, less than successful, and unsuccessful.

Highly successful: Overall weighted average is greater than or equal to 2.7.

Successful: Overall weighted average is greater than or equal to 1.6 and less than 2.7.

Less than successful: Overall weighted average is greater than or equal to 0.8 and less than 1.6.

Unsuccessful: Overall weighted average is less than 0.8.

Source: Independent Evaluation Mission.

APPENDIX 13: ECONOMIC AND FINANCIAL ANALYSIS

1. The economic financial analysis of the original project design and that of the project completion report (PCR) were no longer available for the project performance evaluation report and so following confirmation of this from relevant departments in Manila and concerned staff in the Nepal Resident Mission, the project performance evaluation report team proceeded to reconstruct a financial and economic analysis using researched data derived from the Nepal Electricity Authority (NEA) as well as data collected on site from government agencies, surveys, and from Asian Development Bank headquarters.

2. The approach adopted for the economic financial analysis is consistent with that for similar projects in remote rural areas in low-income countries, including the Lao People's Democratic Republic, where for the economic component, the benefits consist of the export revenue, the diverted market revenue, and the generated market revenue. The costs include civil, electromechanical, hydromechanical, transmissions and operations and maintenance (O&M), distribution, engineering, and environmental and social costs. The calculations are shown below.

3. NEA will incur additional costs to refurbish the hydropower station due to engineering design problems of the intake and at the power house and well as the flood spillway. Additionally, an unsettled claim from the contractor has been included in the analysis. Actual tariffs, O&M costs, production figures, etc. were used to reflect the performance of Kali Gandaki "A."

A. Financial Analysis

1. General

4. The project was reevaluated for a period of 50 years, which was the life of the project assumed while preparing the appraisal and PCR. All costs and benefits in the analyses were based on constant 2011 prices. The Manufacturing Unit Value Index, published by the International Monetary Fund, was used for converting costs and benefits into 2011 prices.

2. Costs

5. The main project costs were based on the actual costs up to project completion. The main project costs included land acquisition, civil works, equipment, incremental O&M costs, generation costs, and distribution cost. Taxes and duties were included, but interest during construction was excluded. Actual O&M costs and distribution cost have been used in the analysis. The transmission cost was estimated at 0.5% of the capital cost for transmission. Of claims owing to the contractor that were settled in 2012, \$8.9 million were included as additional cost as were refurbishment costs of \$20 million.

3. Financial Benefits

6. The financial benefits for the project were measured on the basis of incremental electricity volumes made possible by the expansion of the generation facilities. The revenue from exports and domestic sales are calculated separately with their respective annual average tariffs, and combined later to make a total.

4. FIRR

7. The financial internal rate of return (FIRR) for the project is estimated as 6.5%. Compared to the FIRR of the appraisal report and the PCR, the estimated FIRR is low. This is for two main reasons: first,

there has been only an increase in electricity tariff in 2012. This is contrary to the expectation made at the time of appraisal and PCR preparation. Second, the annual net sales of electricity are much lower than the projected ones. Thus, both the price and the quantity sold were below the projected level, which resulted in a low FIRR. In addition, the financial analysis reflects additional costs to be incurred for rehabilitation of the Kali Gandaki "A" facility as well as settlement to Kali Gandaki "A" main contractor resolved in 2012 although once this is done, the project is expected to be sustainable.

Table A13.1: Financial Internal Rate of Return
(costs and revenues in \$ million in 2011 constant price)

Year	Costs			Benefits		Net Cash Flow
	Generation Cost ^a	O&M Cost ^b	Total Cost	Net Sales (GWh)	Total Revenue	Benefits-Costs
1997	76.30	0.00	76.30	0.00	0.00	(76.30)
1998	61.26	0.00	61.26	0.00	0.00	(61.26)
1999	71.79	0.00	71.79	0.00	0.00	(71.79)
2000	118.38	0.00	118.38	0.00	0.00	(118.38)
2001	83.51	0.00	83.51	0.00	0.00	(83.51)
2002	26.98	0.00	76.30	90.29	8.87	(22.38)
2003	14.56	0.89	61.26	400.82	39.58	14.02
2004		1.12	71.79	421.36	44.90	32.68
2005		1.64	118.38	421.86	43.69	30.76
2006		2.34	83.51	467.10	47.91	33.59
2007		2.84	26.98	524.57	54.66	38.52
2008		3.01	15.45	563.15	61.64	43.67
2009		1.95	1.12	543.46	53.47	38.90
2010		2.35	1.64	547.50	53.92	38.76
2011		1.56	2.34	560.70	55.82	40.72
2012	20.34	21.56	2.84	560.70	54.64	(0.80)
2013	4.70	1.58	3.01	560.70	54.64	34.81
2014	4.80	1.61	1.95	560.70	54.64	34.69
2015		1.63	2.35	560.70	54.64	39.47
2016		1.66	1.56	560.70	54.64	39.44
2017		1.68	41.89	560.70	54.64	39.42
2018		1.71	6.29	560.70	54.64	39.39
2019		1.73	6.41	560.70	54.64	39.37
2020		1.76	1.63	560.70	54.64	39.34
2021		1.78	1.66	560.70	54.64	39.31
2022		1.81	1.68	560.70	54.64	39.29
2023		1.84	1.71	560.70	54.64	39.26
2024		1.87	1.73	560.70	54.64	39.23
2025		1.89	1.76	560.70	54.64	39.20
2026		1.92	1.78	560.70	54.64	39.18
2027		1.95	1.81	560.70	54.64	39.15
2028		1.98	1.84	560.70	54.64	39.12
2029		2.01	1.87	560.70	54.64	39.09
2030		2.04	1.89	560.70	54.64	39.06
2031		2.07	1.92	560.70	54.64	39.03
2032		2.10	1.95	560.70	54.64	39.00
2033		2.13	1.98	560.70	54.64	38.96
2034		2.16	2.01	560.70	54.64	38.93
2035		2.20	2.04	560.70	54.64	38.90
2036		2.23	2.07	560.70	54.64	38.87
2037		2.26	2.10	560.70	54.64	38.83
2038		2.30	2.13	560.70	54.64	38.80
2039		2.33	2.16	560.70	54.64	38.77

Year	Costs			Benefits		Net Cash Flow
	Generation Cost ^a	O&M Cost ^b	Total Cost	Net Sales (GWh)	Total Revenue	Benefits-Costs
2040		2.37	2.20	560.70	54.64	38.73
2041		2.40	2.23	560.70	54.64	38.69
2042		2.44	2.26	560.70	54.64	38.66
2043		2.47	2.30	560.70	54.64	38.62
2044		2.51	2.33	560.70	54.64	38.58
2045		2.55	2.37	560.70	54.64	38.55
2046		2.59	2.40	560.70	54.64	38.51
2047		2.63	2.44	560.70	54.64	38.47
2048		2.67	2.47	560.70	54.64	38.43
2049		2.71	2.51	560.70	54.64	38.39
2050		2.75	2.55	560.70	54.64	38.35
2051		2.79	2.59	560.70	54.64	38.31
2052		2.83	2.63	560.70	54.64	38.27
2053		2.87	2.67	560.70	54.64	38.22
					NPV:	(\$130.43)
					FIRR:	6.49%

() = negative, FIRR = financial internal rate of return, O&M = operation and maintenance, NPV = net present value.

^a Includes system transmission and distribution capital cost.

^b Includes system transmission and distribution cost.

Source: NEA and IED.

B. Economic Analysis

1. General

8. The economic analysis was conducted using 2011 world prices. The Manufacturing Unit Value Index was used for converting costs and benefits into 2011 prices. The costs and benefits of the nontraded components were converted to the world price numeraire by using a standard conversion factor of 0.90 and expressed in 2011 constant prices.

2. Costs

9. The actual project costs, consistent with those reported in the PCR, were used (Table 1 of this report). In economic analysis, interest during construction and taxes are excluded. Furthermore, a \$20 million investment in the Kali Gandaki "A" will be made in 2012–2014 for refurbishment. So this has been included as a cost in these years. The actual O&M and distribution costs, as provided by NEA, have been used. In case of transmission cost, 0.5% of the capital cost has been used, as in the PCR. An outstanding debt settled in 2012 with the main civil works contractor of \$25 million is also included in the analysis to reflect actual costs to NEA and Nepal from the project. Financial costs were converted to economic costs using a standard conversion factor of 0.9.

3. Benefits

a. Diverted and Generated Market Benefit

10. "Diverted market" refers to the market that used substitute fuels to electricity (kerosene, diesel, etc.) but constitutes the market for electricity sales for the power plant under consideration after its commencement of operation. To ascertain the amount of consumer's surplus from shifting from other fuels to electricity, it is first necessary to determine the size of the diverted market by obtaining the ratio of the additional consumption to additional sales for a period of time and then calculate avoided cost benefits. The calculated factor apportioning diverted market benefits is 19% and generated market

benefits is $1-19\% = 81\%$). The assumptions employed to calculate the factor for apportioning diverted market share are as follows:

11. It is assumed that all the new domestic electricity consumers used alternative fuels before they subscribed to electricity connection. These consumers' levels of electricity consumption vary by the area (urban, suburban, or rural) where they live and the income strata to which they belong. Since 2002, the Government of Nepal was promoting rural electrification and so various rural electrification projects were being implemented.¹ This helps to assure that many new consumers of the project are from rural or suburban areas. But there has been an increasing tendency for people to migrate to the urban areas due to deteriorating security in the rural areas. So, out of the total of new domestic consumers, the assumption is that 15% are urban and 85% rural. Among the rural consumers, the assumption is that 25% are from the poor, 60% from the lower middle income, and 15% from the middle income groups. It is further assumed that urban consumers use on average 50 kilowatt-hours (kWh) per month whereas, in the rural area, the poor, lower middle income, and middle income consumers on average consume 10 kWh, 15 kWh, and 20 kWh per month, respectively.

12. In the case of diverted market of commercial, noncommercial, and industrial consumers, it is assumed that almost all these major electricity consumers start their business when the electricity is available. Only very few of them run their business with alternative fuels.² Generally, agro-processing activities are run with alternative fuels. Therefore, it has been assumed that only 5% of commercial and noncommercial and 1% of industrial consumers associate with the diverted market. For calculating the factor apportioning the diverted market, the reference of new electricity consumers and sales data were taken for the period 2002–2005. From 2006, the country again was confronted with load shedding problems.

13. The generated market benefits represent the sale of energy to consumers derived from NEA data times the price plus the replacement cost (which was assumed to represent willingness to pay) times the apportioning factor in economic terms.

4. Results of Economic Analysis

14. The economic internal rate of return (EIRR) of the project was calculated for a project life of 50 years from the completion of the project. The EIRR of the project was calculated to be 15.9%.

¹ During the period, the government has given priority to rural electrification and launched /continued many rural electrification projects including the

- (i) Asian Development Bank-funded Rural Electrification, Distribution and Transmission Project;
- (ii) Danida-funded Kailali Kanchanpur Rural Electrification Project (KKREP), which added more than 50,000 households during 1999–2008;
- (iii) World Bank-funded Distribution and Rural Electrification Project in Bagmati Zone;
- (iv) Danida-funded Kailali- Kanchanpur Rural Eelectrification Project in Mahakali Zone;
- (v) government- funded Sindhu-Dolakha Rural Electrification Project;
- (vi) government-supported community electrification program; and
- (vii) NEA-operated and leased out small hydro program.

² In the project area for example, following commissioning of Kali Gandaki "A" Associates, the socioeconomic survey shows that 104 new connections were for businesses.

Table A13.2: Economic Internal Rate of Return (Using Extended Method)
(costs and revenues in \$ million in 2011 constant price)

Year	Costs			Benefits		Net Cash Flow Benefits- Costs
	Investment Cost ^a	O&M Cost	Total Cost	Diverted Market Benefits	Generated Market Benefits	
1997	58.804		58.804			(58.804)
1998	46.633		46.633			(46.633)
1999	54.068		54.068			(54.068)
2000	90.500		90.500			(90.500)
2001	63.375		63.375			(63.375)
2002	20.665		20.665	2.8801	12.84551	(7.700)
2003	3.492	0.805	4.298	12.2552	55.31588	59.266
2004		1.010	1.010	13.0932	61.83978	67.934
2005		1.480	1.480	13.8588	62.89709	67.946
2006		2.104	2.104	15.6377	70.11833	75.893
2007		2.554	2.554	17.6771	80.39436	85.885
2008		2.706	2.706	18.7094	88.38837	93.333
2009		1.756	1.756	19.2799	83.40297	91.549
2010		2.111	2.111	19.29	82.97219	91.259
2011		1.402	1.402	20.0991	87.38997	95.111
2012	18.000	11.302	29.604	20.1587	87.26284	65.977
2013		5.475	5.475	20.1587	87.26284	90.106
2014		5.496	5.496	20.1587	87.26284	90.085
2015		1.468	1.468	20.1587	87.26284	94.113
2016		1.490	1.490	20.1587	87.26284	94.091
2017		1.513	1.513	20.1587	87.26284	94.069
2018		1.535	1.535	20.1587	87.26284	94.046
2019		1.558	1.558	20.1587	87.26284	94.023
2020		1.582	1.582	20.1587	87.26284	94.000
2021		1.605	1.605	20.1587	87.26284	93.976
2022		1.629	1.629	20.1587	87.26284	93.952
2023		1.654	1.654	20.1587	87.26284	93.927
2024		1.679	1.679	20.1587	87.26284	93.903
2025		1.704	1.704	20.1587	87.26284	93.877
2026		1.729	1.729	20.1587	87.26284	93.852
2027		1.755	1.755	20.1587	87.26284	93.826
2028		1.782	1.782	20.1587	87.26284	93.800
2029		1.808	1.808	20.1587	87.26284	93.773
2030		1.836	1.836	20.1587	87.26284	93.746
2031		1.863	1.863	20.1587	87.26284	93.718
2032		1.891	1.891	20.1587	87.26284	93.690
2033		1.919	1.919	20.1587	87.26284	93.662
2034		1.948	1.948	20.1587	87.26284	93.633
2035		1.977	1.977	20.1587	87.26284	93.604
2036		2.007	2.007	20.1587	87.26284	93.574
2037		2.037	2.037	20.1587	87.26284	93.544
2038		2.068	2.068	20.1587	87.26284	93.514
2039		2.099	2.099	20.1587	87.26284	93.483
2040		2.130	2.130	20.1587	87.26284	93.451
2041		2.162	2.162	20.1587	87.26284	93.419
2042		2.195	2.195	20.1587	87.26284	93.387
2043		2.227	2.227	20.1587	87.26284	93.354
2044		2.261	2.261	20.1587	87.26284	93.320
2045		2.295	2.295	20.1587	87.26284	93.286
2046		2.329	2.329	20.1587	87.26284	93.252
2047		2.364	2.364	20.1587	87.26284	93.217
2048		2.400	2.400	20.1587	87.26284	93.182

Year	Investment Cost ^a	Costs		Benefits		Net Cash Flow Benefits-Costs
		O&M Cost	Total Cost	Diverted Market Benefits	Generated Market Benefits	
2049		2.436	2.436	20.1587	87.26284	93.146
2050		2.472	2.472	20.1587	87.26284	93.109
2051		2.509	2.509	20.1587	87.26284	93.072
2052		2.547	2.547	20.1587	87.26284	93.034
2053		2.585	2.585	20.1587	87.26284	92.996
					NPV:	\$228.36
					EIRR:	16.05%

() = negative, EIRR = economic internal rate of return, O&M = operation and maintenance, NPV = net present value.

Note: After 2012, the Independent Evaluation Department increased O&M costs by 1.5% per year.

^a Includes system transmission and distribution capital cost.

Source: NEA and IED.

APPENDIX 14: PROJECT IMPLEMENTATION DIFFICULTIES

1. Several problems during project implementation resulted in the project completion being delayed. The Project was to be operational by 15 January 2001. The delays that occurred to the Project were both technical and non-technical. The technical delays, most of which were unforeseeable, were mostly attributable to four major causes, namely, (i) desander backslope redesign, (ii) second diversion of the river through the desander, (iii) adverse rock conditions in the headrace tunnel, and (iv) geotechnical rock condition at the surge tank. These delays are described below.

A. Technical - Unforeseen Delays

2. Four categories of delays are as follows:

- (i) In the slope behind the desander, originally under excavation at an angle of 1H:1V,¹ minor cracks developed in February 1998 in the shotcrete protection layer over the phyllite on the benches at elevations 605 meters (m) and 590 m, resulting in suspension of further trimming works. In an attempt to stabilize the berms, long dowels were installed above the berms at elevations 590 m and 605 m. When some time later additional cracks developed at the top of the slope it was decided to unload the slope by cutting it back in the phyllite above elevation 570 m to 1.5H:1V.² During further excavation of the desander to temporary profile, various new geological conditions were encountered and it was found that the contact between the overlying phyllite and the underlying dolomite was generally at a lower elevation than had been projected. In order to allow for a margin of safety it was decided to realign the slope all the way from the road at elevation 526 m up to the top at an angle of 1.8H:1V. The final design for the realigned road and the revised slope configuration was issued to the contractor on 27 August 2000 and on 2 September 2000, respectively.³
- (ii) The first river diversion through the desander basin lasted from November 1998 to June 1999. The requirement for a second diversion of the river through the desander came about principally due to sedimentation that had occurred in the dam blocks during the 1999 monsoon. The dam blocks needed to be excavated to depths of up to 7–8 m in order to allow the work of both contractors under Lot C1 and Lot 4 to proceed. The river was finally diverted through the dam on 18 April 2000. The delays that occurred were also due to the Nepal Electricity Authority (NEA) not giving a timely decision to the engineer to undertake the work. This factor also resulted in an increase in the cost of the diversion.
- (iii) In view of the geological conditions encountered in the headrace tunnel after commencement of construction, the actually implemented rock support classifications were modified and thus eventually differed substantially from those estimated originally in the Bill of Quantities. The number of steel ribs and quantities of shotcrete had to be increased substantially compared with those in the tender documents. As a consequence, the excavation of the tunnel and its concrete lining were delayed substantially.⁴ An increase of 334 working days was required to excavate the headrace

¹ 1H : 1V stands for one unit vertical distance over one unit horizontal distance.

² At the time the geological contact between the phyllite and dolomite had been exposed on part of the slope at an elevation around 573 m and it was believed that the flattened slope would intercept this contact above elevation 570 m along the majority of the excavated slope.

³ A further effect of the length of time in finishing the excavation of the desander backslope had a significant impact on the completion of the headworks.

⁴ There were also initial delays in the startup of the tunneling work of approximately 4 months at the upstream adit and approximately 7 months at the downstream adit. This was principally due to the late mobilization of equipment to the site by

tunnel. This had the effect of moving the wet test date for the tunnel from June 2000 to September 2001.

- (iv) During the excavation of the surge tank, a collapse occurred at the left wall of the tank on 25 June 1999 when the surge tank had been excavated to about 16 m depth. To stabilize the wall and prevent further collapses, the surge tank was then refilled with muck excavated from the headrace tunnel. The design was subsequently revised with ring beams installed around the wall of the surge tank and the shaft then re-excavated. Only after these major repair works were completed could excavation of the surge tank be continued down to its bottom. This unforeseen event had the effect of delaying the wet testing of the works at the powerhouse from July 2000 to July 2001, a delay of 12 months.

B. Nontechnical Delays

3. The nontechnical delays were caused by the relationship between NEA, the consultant, and the contractor. Although the Asian Development Bank tried to assist NEA in resolving issues through drawing up action plans⁵ the problems became worse as the project progressed. Some of the problems are listed below:

- (i) NEA senior project staff on numerous occasions were heavily engaged in matters that required its presence in Kathmandu rather than at the Project site.
- (ii) Major decisions were passed on by the Project Manager to NEA's Board rather than being taken by the project director who had the responsibility for running the project.
- (iii) A project director was finally relocated to the project site on a permanent basis on 10 October 2000. There were a total of four different project directors over the implementation of the project, one of whom was appointed twice.
- (iv) From when the contractor submitted an extension of time for project completion on 14 October 1998 it took more than 1 year until the authorization from NEA to issue a determination to the contractor on 19 October 1999.
- (v) Schedule 6, paragraph 3, of the Loan Agreement required the NEA to establish, within 3 months of the effective date of the Loan the Kali Gandaki Environmental Monitoring Unit (KGEMU) and appoint agreed staff. The KGEMU should have been established at the latest by 12 March 1997. NEA did not comply until 19 August 1998. Repeated ADB and Panel of Experts requests to fully implement the KGEMU component were substantially ignored by NEA for more than 1 year and the KGEMU operated with only half of its intended staff complement.
- (vi) All agreements were verbal and no written response was sent from the NEA on the agreement between contractor and NEA.
- (vii) NEA significantly delayed approving the engineer's staffing variations.

the contractor. Additionally, the equipment resourcing of the contractor was not very efficient under the conditions encountered and it became apparent that the equipment selection was not appropriate for the size of the tunnel and the contractor had to revised the methodology to improve progress.

⁵ Virtually none of the agreements reached by Asian Development Bank and NEA during the Special Loan Administration Mission of September 2000 concerning institutional arrangements of the project administration were fulfilled by NEA, or where they were fulfilled, they were no longer effective.

APPENDIX 15: ENVIRONMENTAL AND SOCIOCULTURAL IMPACTS

1. The following sections on environmental and land acquisition and resettlement issues are in part extracted from the Special Loan Administration Mission conducted on 10–24 September 2003. They represent an examination of the major problems that were encountered during the implementation of the project at the time. Further comments made by the Independent Evaluation Department (IED) Mission in November 2011 are indicated as well as agreements that have been reached with the Nepal Electricity Authority (NEA) to mitigate the outstanding issues.

A. Environmental Issues

2. The Kali Gandaki Environmental Management Unit (KGEMU) was established as a subcontract under the management of Morrison Knudsen International (USA). The KGEMU was supposed to monitor the implementation of the environmental impacts and mitigating measures during construction; however, it did not start working until the end of 1997, about 1 year after loan effectiveness. Soon after this, a two-member panel of experts¹ (POE) for environmental and social aspects started training the KGEMU staff in social and environmental aspects and subsequently conducted field visits to verify the KGEMU reports. The POE also advised the NEA and the consultants on critical aspects of the implementation of the mitigating measures. Some mitigating measures, mostly environment engineering and employment conditions, were integrated in the tender documents and specifications of various civil works contract packages. The contractor had the main responsibility for implementing the mitigation measures, under the supervision of the consultants and the KGEMU. The consultants certified and reported to the NEA and Asian Development Bank (ADB) on the progress and completion of the implementation of the mitigating measures together with the overall progress of the entire project.

3. The monitoring and evaluation by the KGEMU and POE focused on the project environmental impacts during construction and the implementation of the mitigating measures needed during operation. The IED Mission notes the project environmental impacts during construction were normally short-term impacts and difficult to verify once the construction had been completed. The implementation of mitigating measures during construction was documented (i) by photographs; (ii) by quantitative measurements of the air, water, and noise quality; (iii) in regular reports by KGEMU through the consultants; and (iv) by field visits, reviews, and reports by the POE. In addition, ADB fielded regular missions to review the overall implementation of the project, including of the environmental mitigating measures.

4. The IED Mission notes that in spite of the rigorous review and enforcement of the mitigating measures related to the construction activities there were a number of environmental concerns that the NEA and the contractors have yet to satisfactorily address. The major concerns are (i) disposal of surplus construction materials and solid waste, some of which could be considered hazardous or potentially hazardous; and (ii) improvement in the drainage system and slope stabilization in a number of sections along the access road constructed under the project.² The IED Mission noted during the site visit a large number of used tires, stacks of polyethylene plastic bags used to package cement, and other plastic-based household and construction items such as air conditioner casing, and portable toilets are stored in an open area. While the tires, polyethylene bags, and other plastic-based materials are biologically inert, they are highly inflammable and in an open fire could generate partially unburned hydrocarbons that are known carcinogens.

¹ The IED Mission, before leaving Manila for Kathmandu, consulted separately with Donald Graybill, Environmental Expert, and Michael Cernea, Social and Resettlement Expert via teleconferencing.

² This is not the access road built by the government prior to the project starting.

5. The IED Mission recommended that the used tires, polyethylene bags and other plastic-based materials be buried in a landfill. If those materials are sold, NEA should ascertain from the buyer an environmentally friendly use of the waste materials such as reuse and that the waste materials are not used as fuel. The IED Mission also noted that a large area is contaminated with used oil and lubricants. The contaminated soil must be properly removed and stored in the empty barrels, and placed in a secured place until such time as a toxic and hazardous waste facility is operational in Nepal. The IED Mission further recommended that NEA segregate the empty containers previously used to pack potentially toxic substances and store those containers in a secured place until such time as a facility is available in Nepal for final disposal. Containers used to pack substances that are not toxic or hazardous are best sold at auction or buried in a landfill with the plastic materials and used tires. The landfill and secured storage area must be properly marked and fenced and appropriate warning signs posted. The IED Mission notes these environmental management measures are common in large construction sites and it is curious that toxic waste disposal procedures and appropriate landfill (engineered to benefit the community post construction) were not included in the mitigation measures in the environmental impact assessment (EIA).

6. During the public consultation on 15 September 2003 at the Sri Birenda Secondary School, the participants raised the issue of drainage and erosion along a particular section of the access road, which could potentially affect their properties. Although the issue was related to about a 100-meter (m) section of the access road, the IED Mission notes that it would also be advantageous for the project if a survey is conducted on the entire length of the access road and proper repairs are carried out rather than waiting for complaints. It would be advantageous for representatives of the local community to be invited during the survey to assure them of the integrity of the access road.

7. Old wooden suspension bridges across the Kali Gandaki and Andhi Khola rivers were replaced with galvanized steel types under the project. During the field visit, the IED Mission found that the Andhi Khola River suspension bridge lacked regular maintenance and there was silting and scouring of riverbanks upstream from the dam site. The IED Mission recommended immediate maintenance of the Andhi Khola suspension bridge, strengthening of the bridge foundation, control of riverbank erosion, and more frequent and smaller flushing of the reservoir to prevent build-up and excessive erosion.

8. The IED Mission concurs with the project completion report in that almost 75% of the mitigating measures required during construction were complied with, with 13% partially complied with and 12% not complied with by the contractor, as reported by KGEMU.³ The mitigating measures that were partially complied with by the contractor were (i) late submission of the muck disposal plan; (ii) insufficient provision of toilets and sanitation facilities at construction sites; (iii) approval was not requested from KGEMU for the removal of the topsoil; (iv) tree counts or plans for tree felling were not submitted during 1997–1999; and (v) land temporarily leased was not fully restored. The mitigating measures that were not complied with by the contractor were (i) photo documentation of the preconstruction condition was not submitted; (ii) some spoils were dumped outside of the authorized areas; (iii) no provision for its own monitoring staff; (iv) waste water from the concrete batching plant was discharged directly to the river; (v) no record was maintained of the hazardous and toxic wastes; (vi) no flagging was done of existing spring and water supply; and (vi) lax control of workers fishing in the river.

9. The IED Mission found the main mitigating measures required during project operation that are not being complied with include (i) trapping and hauling of fish across the dam, (ii) development of 35 hectares (ha) forest reserve and vegetation rehabilitation along the transmission line right-of-ways, (iii) continuous release during the dry season of 4 cubic meters per second (m³/sec) of water from the dam and 6m³/sec on religious holidays, (iv) installation of additional sirens downstream of the dam and

³ KGEMU and Morrison Knudsen International. 2000. *Annual Report 2000 on the Environmental and Social Aspects of the Kali Gandaki Project*. Kathmandu.

powerhouse to warn the public of sudden changes in releases of water, and (v) operation of the fish hatchery.

10. Fish trapping and hauling was tried in 1998, but capturing the fish proved to be difficult and generally impractical during construction and therefore was never tried on a large scale due to high water discharges. The IED Mission questions why the mitigation measure was designed and included without testing its feasibility. However, this condition does not hold true during operation of the dam in the dry season when the water flow rate is limited to 4 m³/sec and occasionally to 6 m³/sec. The IED Mission recommended that NEA implement the fish trapping and hauling, especially at the peak of the fish migration season. The IED Mission discussed with the power plant director the need to release 4 m³/sec on ordinary days and 6 m³/sec on religious holidays during the dry season. The IED Mission was assured that the water release would be done and NEA agreed to calibrate and paint marks on the water release channel to show the required quantity of water released. NEA has assured the IED Mission that it will take immediate measures to install adequate sirens downstream of the dam and powerhouse, inform ADB as soon as they are installed, and confirm that local residents have been provided with information and guidance regarding safety.

11. The EIA in March 1996 proposed establishment of a “nature reserve or protected zone” in the upstream area from the dam site to mitigate the permanent and temporary disturbance caused by the project of approximately 200 ha of terrestrial and aquatic habitats and ecosystems. During the field visit and discussions with NEA, it became known that the “nature reserve” was not established due to the small size of the area (less than 50 ha). Similarly, the large patches of tree plantation in the transmission line project area did not take place in spite of NEA initiation and discussion with the Department of Forestry. The IED Mission recommended that the NEA provide necessary support to users of the community forest currently in the proposed nature reserve of the Khabhar forest area with plantation and management, and make arrangements with the Department of Forestry or District Forest Offices and the local community for planting trees in the transmission line project area.

12. The IED Mission reviewed with NEA the tender documents for the fish hatchery and noted that the water treatment facility that is required in the tender documents was deleted. The Mission requested the contractor and NEA to provide ADB a copy of the communication leading to the deletion of the water treatment facility, a copy of the documentation on the location of the fish hatchery, the design calculations for the fish hatchery, and the operation manual. The IED Mission was concerned about the sustainable operation of the fish hatchery. At present the fish hatchery is operated by the Nepal Agriculture Research Council, whose main interest is fish propagation research rather than meeting the targets laid out in the EIA.⁴ The socioeconomic study confirms that project-impacted families derive no income from fisheries after closure of the dam. The IED Mission further recommended that NEA evaluate and optimize the operation of the hatchery. The present operation is energy intensive, requiring large amounts of water to be pumped from the powerhouse tailrace discharge up to the hatchery ponds.

13. The IED Mission is concerned about the sustainability of this arrangement, having NEA in charge technically and financially for the entire operation of the Kali Gandaki “A” fisheries facility, which is essentially not their core strength or concern. The “polluter pays” principle is used here to justify NEA being responsible, but it may be much more fruitful to hand over the fish hatchery to the Nepal Agriculture Research Council (which should have been in charge in the first place) along with the budget and needed capacity building, and let them manage and operate the fish hatchery as a development program.

⁴ Although at the time of report and recommendation of the President, these could have easily been matched.

B. Land Acquisition and Resettlement Issues

14. As the KGEMU was established as a subcontract under the Morrison Knudsen International (USA) consultant, it was disbanded when the civil works were completed. However, the NEA established an Environmental and Social Studies Department (ESSD), which consists of a multi-disciplinary team that is also supposed to carry on the activities left behind by the KGEMU. Some ESSD staff had earlier worked in the KGEMU during the construction phase.

15. According to the KGEMU Synthesis Report of 2001, there are 1,468 project-affected families (PAFs), including 263 severely project-affected families (SPAfs). From discussions with the SPAfs and PAFs in groups of 2–65 persons during the IED Mission and reading the several reports written on resettlement, it appears that most SPAfs and PAFs had no grievance regarding the compensation they received for lost assets and financial assistance to cover registration costs and other transaction cost. In fact, SPAfs and PAFs seemed to have utilized their funds in a manner typical of many large projects where substantial compensation payments are made. The project paid out funds according to market rates, enabling SPAfs and PAFs to purchase alternate land (some in the more fertile terai plains, several hundred kilometers away from where their original lands were located); improve their houses; build second homes; and establish small businesses. However, some paid off their debts and did not replace their lands. In addition, SPAfs as well as PAFs were provided with employment during the construction phase. About 225 persons are currently still employed by the NEA.

16. Considerable benefits accrued to SPAfs and PAFs during the “boom” phase of construction, and their incomes rose along with their aspirations and lifestyles. Contractors provided facilities and support to the SPAfs and PAFs on a goodwill basis. Some of these include renovation of the local temple, community water supply, and a school for the Bote children. It is of concern to the IED Mission that these were not included in the list of mitigation measures to be financed formally by the project, as they were noted by communities during consultations.⁵ Skills training and microcredit was also provided. About 4,142 households have received electricity as part of NEA’s rural electrification program. Some SPAfs and PAFs are likely to have restored and improved their living standards on a sustainable basis while others are likely to experience a decline in incomes and absence of sustainable livelihoods.

17. Based on meetings the IED Mission had with the SPAfs and PAFs and discussions with NEA staff, the Mission found that their major concern was the sustainability of their livelihoods. In the absence of appropriate measures to address sustainable livelihood restoration, SPAfs, which include the Bote people, will be particularly vulnerable and if not already impoverished, are likely to face impoverishment. The opportunities for renting homes, servicing a large labor force, and finding work have now gone. The affected persons are experiencing the typical “boom–bust” impacts of large-scale development projects.

18. In essence, the Acquisition, Compensation and Resettlement Plan and the POE reports focused excessively on employment and temporary benefits, studies, and reports without adequate emphasis on the post-construction decline. The IED Mission notes that this is an important lesson learned for design of future infrastructure projects. The absence of an appropriate plan to address the requirements for sustainable livelihood restoration for SPAfs and PAFs whose primary skill and knowledge is based in agriculture and livestock raising is likely to result over time in declining incomes. For example, the Resettlement and Rehabilitation Plan for Affected Bote Families (2001) indicates a study in 1998 revealed that they experienced “over 80% drop in livestock ownership, which clearly indicated impoverishment and malnutrition.” The plan further indicates that 9 Bote persons had been retrenched and that further investigation is required to assess the present status of SPAfs and PAFs. The

⁵ ADB. 1996. *Summary Environmental Impact Assessment (SEIA) for the Kali Gandaki “A” Hydroelectric Project in Nepal*. Manila (para 70, p. 21).

domestic staff consultant for social and resettlement aspects will return to the project site once the security situation improves to conduct further investigation and consultations with SPAFs and PAFs.

19. SPAFs and PAFs also experienced acquisition of their land and assets over a period stretching from 1992 to now, even though the project was physically completed in May 2002. The IED Mission was informed that the NEA is in the process of acquiring some land in Sri Krishna Gandaki village development committee (Ward 3) for a fresh water source for the fish hatchery. For this acquisition, the three affected landowners have already been notified to collect compensation for their land. In the public consultation held on 15 September 2003 at the Birendra Secondary School, Jayapate, some PAFs said that they had experienced land acquisition three times. Three Bote families (the most vulnerable group among all affected groups) were relocated twice at the reservoir site, once from the access road and again when they relocated for the contractor workshop, and one Bote family lost land both to the access road and reservoir as well.

20. The IED Mission visited the 7 houses and a community building built by the NEA and a school for Bote children donated by the contractor and recommends the NEA make improvements that are minor tasks for the NEA but will result in exponential benefits for the Bote families. These include levelling the floors, providing electricity connections, providing a levelled access road, providing additional common toilets, and providing a water storage facility as during the dry season the families have to walk 25 minutes to obtain water.

21. The IED Mission found the school for Bote children is not running smoothly. The schoolteacher has not been paid and there appears to be difficulty with administering the school. As a matter of obligation, the IED Mission requests that the NEA look into this matter and hand over the grievance to the local education authority. The NEA/ADB could also improve the yard around the school out of goodwill, with minimal effort.

22. The IED Mission also followed up with the NEA and the contractor on the construction of the remaining houses for the 10 Bote families who were displaced by the contractor's workshop. NEA's Managing Director, J. Karmacharya, and the contractor's Project Manager, F. Calvi, agreed to expedite the construction of identical houses. The IED Mission commends the NEA's decision to hand over title for land and houses to the Bote families. The NEA confirmed they had purchased the land from the trust and that the process of ownership transfer is under way.

23. There is an urgent need for the government to reassess the social and economic status of all SPAFs and PAFs and carry out a program for sustainable livelihoods for PAFs found to be at risk of advancing income loss. Some SPAFs and PAFs are too old to be able to seek employment, having lost their lands and livestock and having no permanent alternative to agriculture, and therefore are likely to become post-construction SPAFs. The Bote people whose traditional livelihood is fishing are likely to remain as SPAFs.

24. At the time of the PCR in 2004, anticipated benefits from reservoir transport and the fish hatchery had not yet materialized. Four Bote persons were operating the boats and four were employed in the hatchery. The microcredit program was no longer operating. The Agricultural Development Bank of Nepal, which had been giving out loans for microcredit activities had moved about 30 kilometers (km) away from the project site, mainly because of insufficient transactions to sustain its operations and partly because of the uncertain security situation. The Social Synthesis Report (KGEMU, May 2002) indicated the program was not successful.

25. The NEA recognizes the potential for reservoir transportation to be an important contributor to income restoration and is currently coordinating with relevant government departments to develop appropriate mechanisms for regulating transportation and ensuring SPAFs, including Bote people, have equal access to operating the boats. The NEA will discuss with the Agricultural Development Bank of

Nepal how to restore the microcredit facility to enable SPAFs and PAFs to purchase boats rather than be employees of wealthier local residents. Appropriate regulatory measures, including safety standards, should be developed by the authorities concerned.

26. The IED Mission was informed that some local people who were arrested during earlier labor unrest and who deposited their land certificates to secure their release on bail still have not had their land certificates returned as their cases are pending in the local court. The IED Mission discussed this issue with the contractor in December 2011 and as a sign of goodwill, Mr. Calvi, the contractor's project manager,⁶ agreed to contact the chief district officer of Syangja to lift the charges filed against these people so that their land titles could be returned. The ADB Nepal Resident Mission should follow-up on this promise.

27. During the two public consultation meetings, participants demanded that the NEA reestablish a public information center and appropriate grievance redress mechanisms where PAFs and local community leaders are included in the grievance committee. Following discussions with the IED Mission, the NEA will include information on the structure of the committee in the Livelihood Restoration Action Plan.

28. Under the Loan Agreement, the NEA was required to invest 1% of net revenue generated from the Project in rural electrification in areas directly affected by the dam in Mirmi and the powerhouse in Beltari once the project was commissioned. As mentioned earlier, the NEA has to date provided electrification to about 4,142 households in Mirmi and Beltari. Many of these households were electrified even before the project was commissioned through sourcing power supply from Butwal Power Company (BPC). During the public consultations conducted by the IED Mission, affected people demanded that they get electricity directly from the project as the power supply sourced from BPC suffers from low voltage and frequent outages. NEA has agreed to initiate discussions with BPC concerning NEA's taking over from BPC of the bulk power supply to Mirmi and Beltari areas. The ADB Nepal Resident Mission should follow up on this issue.

29. The Mission met NEA's hydrologist, who confirmed that measures have been taken to protect the holy stone (Saligram). Further improvements, including a railing, raising the gabion blocks, and a walkway from the Seti Beni Bazaar to the holy stone (Saligram) will be completed within the next few months. However, a more urgent matter is related to the possible increase in sedimentation and the risk of flooding the bazaar by the coming rainy season. The Mission was informed that the supplementary study to determine the risk and mitigation plans would take approximately 45 days and cost approximately \$33,000. The NEA, in its letter of 19 September 2003, requested ADB to provide a small-scale TA grant to finance the study. The Mission responded that ADB is facing a shortfall in TA grants and suggested that the study be funded from the loan proceeds. If additional resettlement is unavoidable, NEA will inform and consult the affected residents and prepare a resettlement plan in accordance with ADB's *Handbook on Resettlement - A Guide to Good Practice* and ADB's *Policy on Indigenous People*. The IED Mission also notes that the International Sedimentation Specialist, Dr. Mahmood, warned that a risk of flooding was possible and, the POE Report (No. 8) also refers to the need to review the situation.

30. The IED Mission was informed of a proposed military installation in close proximity to the Kali Gandaki "A" HP dam site in Mirmi. While security of the area is a concern of the military in view of the uncertain security situation facing the country, the Mission's concern pertains to the acquisition of land in the area.

⁶ Impregilo's resident representative in December 2011 was Sanjeev Koirala.

31. The NEA, with Ministry of Water Resources and PAFs, should consider holding a seminar on lessons learned as this would provide excellent guidance for future projects and bring the experience into the public domain.

1. Socioeconomic Survey by the IED Mission (November 2011)

32. The assessment of the project's overall socioeconomic impact on the PAFs was revisited and compared with the preproject situation. Some of the major issues concerning the current status of the families are the focus of this survey. The Kali Gandaki "A" project has affected 12 villages of Syangja, Gulmi, Palpa and Parbat districts⁷ and expropriated the assets of 1,468 families from the affected villages. However, resettlement was mainly concentrated in Syangja District, especially in Shree Krishna Gandaki and Jagatra Devi village development committees. Of the total families, 263 were defined as SPAFs and 1,205 as PAFs.⁸ The project expropriated altogether approximately 208.68 ha of land and 90 houses.⁹ The total project-affected families includes 17 Bote and 2 Magar households in the dam site area. The project has impacted the traditional occupation of some Bote families. The project also reportedly generated risks of flood and inundation at Seti Beni Bazaar and religious-cultural site (holy stones [Saligrams]) located upstream. The downstream area is also affected due to inadequate water flow for performing "holy dips" and other rituals.

33. The survey of 119 households found the following:

- (i) reduction in total cultivated land led to lower over-all agricultural output;¹⁰
- (ii) disturbance of religious site and activities;
- (iii) fishing incomes and livelihoods are reduced;
- (iv) employment opportunities were created but sustainability of acquired skills is negligible;
- (v) social cohesion and tourism opportunities exist; and
- (vi) benefits were derived from electrification:
 - (a) travel time and the flow and volume of goods have improved,
 - (b) household incomes have increased,¹¹
 - (c) living conditions have improved, and
 - (d) the local economy is better integrated with the national economy.

34. Further information on the survey methodology and findings are in Appendix 1.

2. Environmental and Social Impacts

35. The consultation for the present design took place as documented in the report and recommendation of the President (RRP) and project files. No EIA was found for this evaluation; however, a summary EIA shows the stakeholders that were involved in the consultations. Appendix 4 provides this list. Comparing the report of consultations for the summary EIA and of the stakeholders involved during implementation shows that the consultation focused on disclosure (ADB policy) rather than thinking practically about who will be implementing the environmental and social programs. The issue of NEA's capacity to do the job was raised at Board discussion, and ADB Management assured the Board that measures had been put in place to boost capacity.

36. At present, more than 200 PAFs and SPAFs and other local people, including the poor, are engaged at Kali Gandaki "A"/NEA and the fish hatchery. They also benefit from access to electricity, roads, boats between the dam site and Seti Beni, and development of social infrastructure (such as

⁷ ADB. 1996. *Summary Environmental Impact Assessment (SEIA) for the Kali Gandaki "A" Hydroelectric Project in Nepal*. Manila.

⁸ R. P. Thanaju. 2007. Hydro Nepal. *Journal of Water Energy and Environment*. Volume 1, Issue 1, June 5.

⁹ KGEMU. Synthesis Report, 2001.

¹⁰ ADB Board noted that the major sector from which the poor derive income was agriculture.

¹¹ Increase is not attributed to the project as defined in the RRP but to the access road.

local markets). The primary school constructed under the project has been operating and has been found effective for enrolling the children of Bote and other communities at the dam site area.

37. None of these benefits, however, come from the environmental and social protection measures designed as part the application of the safeguards. The fish hatchery was intended to provide continuity of income by preserving fisheries, a main impact of the dam; however, socioeconomic surveys as part of the project performance evaluation report (PPER) reveal that PAFs and SPAFs do not derive income from fisheries. Bote families derive some 15% of their income from fishing but this maybe income from employment in the fish hatchery operation, which is now totally funded by the NEA.

38. The number of electricity connections in the project impact areas is 4,132 plus 104 connections to light industrial business. All SPAFs, PAFs, and Bote families sampled indicated spending about 2%–3% of their income on energy for their homes, implying widespread use of electricity.

39. As the mitigation measures were not designed as development projects,¹² none of these interventions resulted in long-term sustainable benefits for the local population. One clear example from the survey shows no income derived from the fisheries program by PAFs, SPAFs, or Bote families.

40. Benefits from the project have been derived from the road, the school, the markets, navigation, and electricity. Aside from the latter which is a direct outcome of the “industrial” project, none of these were included in the project’s mitigation measures. However, the government borrowed about \$6 million to implement the measures and ADB allocated many person-months to design and supervision as well as consultant time.

41. First, the socioeconomic surveys at the time show that 1% of people derived income from fisheries in the project area while 36% derived income from agriculture, yet the mitigation budget spent on fisheries was 29% of total \$5.34 million and only 0.7% was spent on agriculture. Fishery is also an environmental and biodiversity issue, but the fish hatchery has always managed to produce tonnage rather than maintain species diversity. Furthermore, the nature reserve intended to offset biodiversity losses was never implemented.¹³

42. Secondly, the summary EIA identified the major impacts on fisheries as “water development projects, pollution, improper harvest methods (dynamite and toxins), the absence of fisheries laws and poor enforcement of existing laws.” However, Kali Gandaki “A” mitigation measures did not address any of those issues but concentrated instead on mitigating direct project impacts, which were loss of downstream flow and fish passage. However in the context of the other fisheries sector problems, the mitigation measures made little difference to the downward trend in fish catch. Of a total of 57 species listed in the summary EIA in the area of the project, only 10 have been domesticated in the fish hatchery. This is an excellent result for the NARC scientists at the fish hatchery; however, the design of the mitigation measure should have included a wider perspective of the fisheries sector and included a development fund to address other problems faced and caused by the fishermen. This would have brought development value to the mitigation measures and ensured sustained benefits for local people.

¹² For example, 2 of 19 mitigation measures were designed to be implemented during the entire operation phase, 10 were during construction only, 5 were intended for prior to the project, and 2 were intended for prior to and during construction.

¹³ The measure was ill defined and the concept of offset at the time was not as sophisticated as it is now. In Nam Theun 2, for example, the watershed program offsetting the biodiversity losses was very well defined and financed and integrated into the concession agreement and therefore binding on the developer (financing, technical inputs, monitoring by POE etc.) and on the government. No such concession agreement was drafted for Kali Gandaki “A.” Monitoring of the implementation was done very carefully in Nam Theun 2 while Kali Gandaki “A” had less frequent monitoring and a lower budget.

43. The adverse social impacts were accounted for in the EIA, which advises “mitigation was incorporated in the planning and design process by evaluating various alternatives for environmental factors;” e.g., the reservoir elevation was constrained by the elevation of the Seti Beni holy stones (Saligrams).
44. Safeguards were implemented with mixed success. This is the result of the way they were designed, budgeted, and implemented, including an implementation approach relying on compliance and POE-type management (trial and error) with a budget essentially limited to the construction phase because the mitigation activities are derived from impact assessment.
45. The environmental and social impacts were summarized in the summary EIA for Kali Gandaki “A” Hydroelectric Project and in Appendix 16 of the RRP (footnote 1). The full EIA, sector development program, and environmental management plan were not reviewed as they have not been recovered in the project files.¹⁴ The environmental and social impacts can be summarized as follows:
46. Environment impacts (physical environment) include
- (i) increased erosion and landslide due to land disturbance and linked effects to the ecological and socioeconomic environments;
 - (ii) disposal of excess spoil from the tunnel, desander basin, and other project facilities;
 - (iii) inundation of lands and riverine areas;
 - (iv) significant changes in hydrology down river of the dam due to diversion and linked impacts to aquatic ecology and economics;
 - (v) changes in sedimentation patterns downstream of the dam due to flushing of desander basins;
 - (vi) hydrologic effect of peaking flows immediately downstream of the power plant;
 - (vii) alteration of drainage patterns resulting in increased erosion and potential landslides;
 - (viii) alteration of hydrology in upstream areas up to the holy stones (Saligrams); and
 - (ix) the downstream areas included 50 km downstream along the Kali Gandaki River because the EIA advised that the impact of the diminished flow regime would be down to this elevation of the river; however, it is not clear to what extent the mitigation measures were implemented in the downstream area.
47. Environmental impacts (biological environment) are
- (i) impediment to migration and loss of spawning habitat for many species of migratory fish,
 - (ii) significant hydrological effects on approximately 50 km of riverine ecosystems,
 - (iii) significant reduction to flow (by more than 10%) for 13 km of riverine ecosystems for 7 months of the year,
 - (iv) inundation of 65 ha of riverine and terrestrial ecosystem along the 5.3 km reservoir,
 - (v) permanent and temporary disturbance of approximately 200 ha of terrestrial and aquatic ecosystems,
 - (vi) impacts on and loss of habitat by species listed as “species of concern,”
 - (vii) secondary impacts due to increased harvesting and disturbance during project construction, and
 - (viii) cumulative impacts of other existing and proposed water projects on riverine ecosystems.
48. Impacts on the socioeconomic and cultural environment include
- (i) permanent taking of land and displacement of people;
 - (ii) changes in sociocultural patterns moving from a subsistence to a market driven pattern;

¹⁴ The IED Mission understands from the Board transcripts at the time of approval that the EIA was undertaken by the NEA. This document was not provided to the IED Mission.

- (iii) potential loss of livelihood among fishers of Kali Gandaki river and tributaries;
 - (iv) disturbance of religious sites;
 - (v) partial losses of 50 km of river available for rafting;
 - (vi) midterm consequences on local people and economy of a temporary work force peaking at 2,000–3,000;
 - (vii) long-term beneficial effect of an estimated 350 person permanent work force;
 - (viii) long term beneficial effect of improved road infrastructure, electrification, and water supply;
 - (ix) electromagnetism from high voltage transmission lines; and
 - (x) beneficial effect of meeting power demand (project purpose and need for economic development for the people of Nepal).
49. Cumulative impacts are
- (i) non-implementation of the recommended mitigation measures,
 - (ii) inadequacy of proposed mitigation measures as well as unforeseen impacts, and
 - (iii) watershed and cumulative impacts.
50. Review of actual impacts shows
- (i) no mention of the sedimentation effect on electricity generation and therefore financial viability; and
 - (ii) no mention of social management
 - (a) workers camps
 - (b) public health
 - (c) employment of villagers
 - (d) safety on work site.

51. The project was approved in 1996, prior to the introduction of ADB's Policy on Indigenous Peoples of 1998. Therefore, at the time of project approval, there was no provision to specifically address indigenous peoples' issues and concerns under the loan covenant. That the project did consider the Bote people and gave them plenty of special attention is a good point for the project, but did not do so under the guidance or requirement of an appropriate policy.

3. Performance of the "Mitigation" Programs: Social

52. The socioeconomic surveys undertaken as part of the PPER show that incomes of PAFs, SPAFs and Bote families have all increased since prior to the project. However, it is not certain that the mitigation measures were responsible for this or that the change may not have occurred without the mitigation measures. The mitigation measures were short-lived, narrowly defined, limited to counteracting impacts of the project, and had limited budget (about 1.5% of total project cost). However, their design and implementation were consistent with ADB policy at the time (and at present).

53. No NEA socioeconomic study of PAFs were available, but in addition to undertaking a survey, the IED Mission received reports from the KGEMU (which is now NEA-ESSD).

54. The socioeconomic survey undertaken as part of the PPER in November 2011 shows that people now living in the project area appreciated the (i) the access roads, (ii) electricity, (iii) construction and improvement of schools, and (iv) increased social awareness due to the project. Combined, these provide the local people a firm basis for improving their social and economic development.

55. According to local people, the project activities for employment generation further supported the overall socioeconomic development in the area. Local people, including the PAFs, also consider that the commencement of the project provided opportunities to be exposed with different national and

international people in diverse fields. This helped them enhance their level of confidence and broaden their knowledge and thinking. The employment opportunities in construction work and opportunities for earning from business and renting houses (especially at Mirmi bazaar, Andhimuhan bazaar, and Beltari) during the construction phase increased their household earnings and improved their living standards by constructing/renovating houses, purchasing land, sending family members for overseas employment or enrolling them in quality education, and starting businesses.

56. Following the construction of the dam, the water level of Kali Gandaki River was raised in the area of the reservoir and upstream areas, allowing enhanced navigation. This opportunity resulted in substantial reduction of the travel time between reservoir site and Seti Beni (from 3 hours to 45 minutes). This apparently benefitted the local people and businessmen of Seti Beni. The operation of boats also significantly reduced the cost of moving goods from/to Seti Beni and widened the source of earnings through starting their own boat transport business, in partnership with others or alone, or working as boat operators.

57. Collectively, local people in all project areas are happy with the project and consider that it promoted overall development. However, benefits to the people as described in the survey did not come from the mitigation measures, which included fisheries, health centre, agriculture microcredit, tree planting, foot bridge, and boat ramp. The job training was undertaken by the contractor. Respondents cited concern due to the project's inability to include drinking water supply schemes, permanent health facilities, and electrification in all project-affected areas. People in some project locations, including Seti Beni, expressed serious concern with the NEA for not coordinating with the government to ensure that 1% of the revenue from Kali Gandaki "A" goes to the project-affected village development committees. Benefits of the safeguards implementation are thus not evident.

58. Some of the mitigation measures implemented by the project, such as construction of the primary school at Andhimuhan, relocation and resettlement of Bote families of Andhimuhan village near the reservoir site, construction of the pathway at Seti Beni holy stones (Saligrams), and water supply, were not incorporated in the project design.

59. All of the PAFs and SPAFs interviewed during the socioeconomic survey have received compensation for their affected assets in accordance with government norms based on the then agreed rate. However, as reported by the NEA, a few payments remain pending to some absentees (residing abroad) and for assets without formal ownership documents.

60. Currently, some PAFs have been engaged in jobs with two project related institutions; Kali Gandaki "A"/NEA and the fish hatchery. Family members of about 100 PAFs and another 100 local people are employed at the Kali Gandaki "A"/NEA office. Similarly, about 25 persons, including the Bote SPAFs and others whose downstream fisheries income has been impacted are engaged at the fish hatchery. However, socioeconomic data show none of the impacted families seem to derive income from fisheries directly. Other, non-impacted families, may derive income from fisheries.

61. The environmental and social impact assessment was considered quite a progressive attempt to provide social and environmental safeguards for a project in the much-maligned hydropower sector. The EIA and associated full studies were not available to the IED Mission, which based its findings on the summary EIA, RRP, other project files, site visits, a survey, and interviews. The ADB Board at the time of project approval was understandably concerned about the objectivity of the EIA given that it was undertaken by the NEA. The NEA is still in charge of undertaking EIAs for hydro projects in Nepal, using the skills gained from the KGEMU formed under Kali Gandaki "A."

62. Trapping and hauling of fish was tried and abandoned as unworkable. The operation of the fish hatchery has been sustained with financing by the NEA; however, the mission was told this funding was threatened by the NEA's difficult financial condition and so funding for the fish hatchery was

guaranteed at reduced level (about one-third) up to July 2012 only. Moreover, the funding for this financial year was only received 6 months into the financial year for the following 6 months. Whether the fish hatchery will be able to continue operation beyond July 2012 is not sure.

63. Three mitigation actions were planned as part of the project: (i) a trap and transport program, (ii) riparian release, and (iii) a fish hatchery. Early attempts at trapping and transporting fish proved unsuccessful and the program was discontinued. The fish hatchery staff were able to domesticate 10 species (of 57 listed in the EIA, with 29 listed as abundant, common, or occasional in most stretches of the river). The hatchery has released up to 800,000 fingerlings into the reservoir and downstream of the powerhouse, restoring at least partly the fishing potential to before project level. The riparian release was continued in terms of volume (4 centimeter per second); however, because it was routed from the damage in the downstream flood control gate instead of the intended structure, it allowed no fish passage from upstream and downstream. Since the trap and haul program never worked, fish migration has been stopped since the closure of the dam. From the environmental mitigation perspective, this mitigation program was not successful in restoring biodiversity loss resulting from the hydropower project.

64. Other impacts to the ecology were listed as (i) erosion, (ii) loss of forest under the reservoir, and (iii) habitat loss. The mitigation measures for (i) and (iii), such as revegetation, a nursery, and nature reserve were to take place. The Mission confirmed the revegetation and establishment of a nursery however the nature reserve was not seen.

65. The PCR and the IED Mission found that three major environmental concerns were not addressed satisfactorily:

- (i) the disposal of surplus construction materials and solid wastes,
- (ii) trapping and hauling of fish across the dam, and
- (iii) sustainable operation of the fish hatchery.

The NEA has taken no further action regarding these matters.

66. The Mission reviewed the mitigation measures and concludes that the restoration of livelihood was either (i) undertaken at too small a scale (agriculture, primary health care, and nature reserve) to be of tangible sustained benefit for the local population; or (ii) was not successful (trap and haul program, microcredit, solid waste and spoil disposal, riparian release for fisheries migration, fisheries program as a form of income).

67. Other programs were either not part of the mitigation measures or not undertaken by the KGEMU (e.g., job training and the construction of primary school).

68. Similarly, although employment opportunities for about 200 persons in the Kali Gandaki "A"–NEA and fish hatchery have been provided due to Kali Gandaki "A"/NEA, at least as many PAFs and SPAFs have not benefitted from employment as have benefitted, and all the persons employed at fish hatchery are on a temporary basis with an uncertain future due to funding restrictions from the NEA.

69. Thus, the mitigation measures have not acted to bring development opportunities to the area. Some development opportunities have arisen since the project was finished, e.g., the access road to the project site is thought to have contributed huge development benefits to the region providing all-year access for trading agricultural goods in and out of the area.

70. In summary, the mitigation measures and therefore the implementation of the safeguards have not contributed significantly to development due to design, institutional arrangements, implementation, and budget aspects.