



**GLOBAL ENVIRONMENT FACILITY
OFFICE OF MONITORING AND EVALUATION**

**INDIA HILLY HYDEL
LOCAL BENEFITS
CASE STUDY REPORT**

July 2004

Dirk R Frans (SEI)
Nilufar Matin (SEI)
V. Ratna Reddy (CESS/SEI)
Juha Uitto (UNDP/GEF)

STOCKHOLM ENVIRONMENT INSTITUTE

TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	III
EXECUTIVE SUMMARY.....	V
ABBREVIATIONS AND GLOSSARY	VII
1 INTRODUCTION	1
1.1 Background to the GEF and the study	1
1.2 India Hilly Hydel Project.....	1
1.3 Terms of Reference.....	2
1.4 Methodology	2
1.4.1 Overall methodology.....	2
1.4.2 Broad study.....	2
1.4.3 In-depth study.....	3
1.5 Scope and limitations	3
1.6 Lay-out of the report	3
2 FINDINGS.....	4
2.1 Project description	4
2.1.1 Aims and objectives	4
2.1.2 Implementation modalities	4
2.1.3 Overview of schemes studied.....	5
2.2 Description and size of main local stakeholders groups	7
2.3 Overview of positive and negative local impacts.....	8
2.4 Impacts on livelihood capitals	10
2.4.1 Natural capital.....	10
2.4.2 Social capital	10
2.4.3 Physical capital	11
2.4.4 Human capital.....	12
2.4.5 Financial capital	12
2.5 Impacts on livelihood opportunities	12
2.6 Impact on gender equity	13
2.7 Impacts on stakeholder vulnerability.....	13
2.8 Impacts on sustainability of resource management	13
3 ANALYSIS	14
3.1 Local benefits	14
3.2 Negative impacts.....	14
3.3 Project concept and assumptions	14
3.4 Project design	15
3.5 Implementation.....	16
3.6 Operation and maintenance.....	16
3.7 Global Project impacts	17
3.8 Inter-linkages between global and local benefits	18
3.9 Missed opportunities	18
4 LESSONS LEARNED.....	20
APPENDIX A: TERMS OF REFERENCE.....	I
APPENDIX B: ACTIVITIES AND PEOPLE MET	VII

APPENDIX C: MAPS OF INDIA AND STATES VISITED.....	X
APPENDIX D: GLOBAL BENEFITS AND GLOBAL-LOCAL LINKAGES	XII
APPENDIX E: ENVIRONMENTAL BENEFITS: FIXING THE RESPONSIBILITY.....	XVIII
APPENDIX F: REFERENCES.....	XIX

This report has been prepared for the Office of Monitoring and Evaluation of the Global Environment Facility (GEFME). The findings, interpretations, and conclusions expressed in this paper do not necessarily reflect the views of the GEF Secretariat, UNDP or the Government of India

ACKNOWLEDGEMENTS

This case study has been made possible by the tireless input of many people. First of all Dr. Praveen Saxena of MNES deserves mentioning. We remember his enthusiastic and hard work as well as longstanding commitment to facilitate small hydro power, at times against the prevailing wind. His overview of the sector and ability to act swiftly and decisively has impressed us.

In Himachal Pradesh, where most of the Hilly Hydel schemes are found and the team spent much of its time, Mr. Ashok Rajan of HIMURJA went out of his way to facilitate the mission. He not only ensured that the team could do what it came for, meeting the local people impacted by the schemes, but also that we saw as much of the beauty of Himachal Pradesh as possible. Mr. Rajan's good humor made the days of 8-10 hours travel fly past.

Mr. Arun Kumar, Head of the Alternate Hydro Energy Centre in Roorkee, gave us a thorough introduction to his organization and the key role it played in the Project. He also facilitated the mission's visits to two schemes in Uttaranchal.

Mr. R. K. Verma of Sai Engineering Foundation also deserves a special 'thank you'. We will not easily forget his enthusiasm for small hydropower and commitment to the local people. We are inspired by his humble serving the people through an unusual combination of a commercial and NGO type approach.

In Assam Mr. Autri Bhattacharjee and his wife went out of their way to facilitate our brief but worthwhile visit. Their vision of growing and producing tea in an environmentally friendly manner was refreshing!

At the time of the case study Prof. A. C. Ittyerah and his team were completing the terminal evaluation of the Project. Prof. Ittyerah spent three sessions with the study team briefing us on his findings. He also produced an advanced version of his report which is referred to extensively in this report. Prof. Ittyerah, many thanks!

Mr. Anil Arora of UNDP Delhi deserves special mentioning. Long before the mission arrived in India he had worked out a number of tentative tour programs and laid the necessary contacts with relevant government departments, commercial forms and NGOs. Without his effort the team could never have visited as many schemes under the Project in such a short period as it did.

There are others, too many to mention by name, whom we met and who in one way or another have helped shape the content of this case study report. Most of all we would like to thank the scores of individuals in and around the schemes who took time to answer our questions concerning the impact of the scheme on their lives and livelihoods. Without their input there would not have been a report.

Finally, the study has benefited a lot from input by the participants of the local stakeholders' workshop held on 20 July 2004 in Delhi. There the draft version of this report was presented and discussed and thanks to the feedback received the data in this final report is more accurate, the analysis more comprehensive and the lessons learned more precise.

July 2004

The GEF-SEI India Hilly Hydel local benefits study team

EXECUTIVE SUMMARY

The Global Environment Facility helps developing countries fund activities that protect the global environment. In 2002 the GEF started a study to “analyze how attaining global environmental goals can contribute to the generation of local benefits and how local benefits can contribute to the attainment of global environmental goals, in accordance with the GEF mandate”. This is the report of the case study of one of 18 GEF projects selected to study local impacts, the India Hilly Hydro Project. The Project intended to: a) reduce global warming by facilitating a shift from fuel wood for cooking and heating to hydro power, b) protect biodiversity in the Himalayan regions by reducing deforestation and c) reduce urban migration by enhancing the local economy.

The case study team visited five of the 20 small hydel schemes and one improved water mill implemented under the HHP. All schemes are run-off-the-river schemes without dams or storage producing between 6 KW and 1 MW hydro power. Local stakeholders are mainly farm and other rural households. Most of the households in the area covered by the schemes visited were already grid-connected before the HHP. Many households had therefore already experienced the ‘en-lightening’ impact of having electric power, allowing the use of lights, radios and TVs. However power supply was often insufficient or absent for weeks and the HHP schemes have improved electricity supply.

Negative local impacts are mainly due to interference by the schemes developers in traditional water rights and to an almost complete absence of people’s participation. Amongst others, the shift in water usage/rights has led to angry exchanges concerning irrigation and to the closure of a number of traditional water mills. Lack of participation also led to avoidable problems during implementation.

The HHP has impacted the livelihood capitals of local stakeholders in various ways. Access and control over water has shifted from local people to scheme developers, often private commercial entities. The social/institutional capacity of National and State level organizations involved in the HHP has been increased due to the Project but the social capital of local people has not increased. The physical capital of local households had increased markedly when their homes were first electrified. The HHP has led to further marginal improvements. The same applies to the human capital of people around HHP schemes; the big leap forward had come earlier and the HHP has led to marginal additional benefits. People’s financial capital has not changed due to the HHP.

The HHP schemes visited have not had a quantifiable impact on the livelihood opportunities of local stakeholders as most opportunities had already been used when electricity was first supplied. The same applies to the impact of the Project on gender equity; electricity supply has benefited women at least as much as men, but this impact has already taken place before the HHP. Some local stakeholders have become more vulnerable due to the Project, mainly where their traditional water and grazing rights have been curtailed. Sustainable resource management has suffered as control has shifted from local stakeholders to commercial entrepreneurs from outside the area.

Analyzing the findings leads to the following conclusions. The positive impact of getting electricity, particularly in case of previously un-electrified households, cannot be overstated. Negative impacts are mainly related to shifting water rights from local people to external entities. Many of the assumptions behind the HHP appear to be as questionable now as they should have been when the Project was conceptualized. The project design was not internally consistent, leading to lower impacts than expected. During implementation positive components of the HHP were dropped and the project design did not allow other necessary midway changes. As a result of all of the above the global impacts of the HHP thus far appear insignificant. There are however numerous inter-linkages between global and local benefits and possibilities for creating a win-win situation. In the finally analysis the

HHP has missed many of those opportunities. This case study yields seven lessons that the GEF might apply to ensure that future projects better achieve, sustain and replicate global environmental impacts.

ABBREVIATIONS AND GLOSSARY

AHEC	Alternate Hydro Energy Centre
CC	Climate Change
CERC	Central Electricity Regulatory Commission
DPR	Detailed Project Reports
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GEF	Global Environment Facility
GHG	Greenhouse Gas
GoHP	Government of Himachal Pradesh
GoI	Government of India
HHP	India Optimizing Development of Small Hydel Resources in the Hilly Regions (in short: Hilly Hydel Project)
HIMURJA	Himachal Pradesh Government Energy Development Agency
IA	Implementing Agency
IREDA	Indian Renewable Energy Development Agency
LBS	Local Benefits Study
LPG	Liquid Petroleum Gas
MNES	Ministry of Non-Conventional Energy Sources
M&E	Monitoring and Evaluation
MoEF	Ministry of Environment and Forests
NGO	Non-Governmental Organization
O&M	Operation and Maintenance
PDO	Private Development Organization
PPA	Power Purchase Agreement
Rs	Indian Rupee (on 1 March 2004 exchange rate about Rs 44 per US \$)
SEB	State Electricity Board
SEI	Stockholm Environment Institute
SERC	State Electricity Regulatory Commission
SHP	Small Hydro Power
TER	Terminal Evaluation Report
UNDP	United National Development Program
UNEP	United Nations Environment Program
UREDA	Uttaranchal Rural Electrification Development Authority

1 INTRODUCTION

1.1 Background to the GEF and the study

The Global Environment Facility (GEF), established in 1991, helps developing countries fund projects and programs that protect the global environment. GEF grants support projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants. Since 1991, the GEF has provided \$4.5 billion in grants and generated \$14.5 billion in co-financing from other partners for projects in developing countries and countries with economies in transition.

GEF funds are contributed by donor countries. In 2002, 32 donor countries pledged \$3 billion to fund operations between 2002 and 2006. Since 1991, GEF has provided grants for more than 1,300 projects in 140 countries. GEF's implementing agencies, the United Nations Development Program (UNDP), the United Nations Environment Program (UNEP) and the World Bank play key roles in managing GEF projects on the ground (see www.thegef.org).

In 2002 the GEF decided to conduct a study that will “analyze how attaining global environmental goals can contribute to the generation of local benefits and how local benefits can contribute to the attainment of global environmental goals, in accordance with the GEF mandate” (Todd et al, 2003, 5). The multi-phased methodology of what has become known as the “Local Benefits Study” (LBS) includes a desk review of more than 125 GEF projects, a detailed review of secondary data of 35 projects and detailed field-based case studies of 18 GEF projects (Todd, 2003b, 2).

The “*India: Optimizing Development of Small Hydel Resources in Hilly Areas*” project, known as the Hilly Hydro Project (HHP), is one of the 18 GEF projects selected for a field-based case study. This is the case study report of the HHP study.

1.2 India Hilly Hydel Project

The HHP, with a total budget of US \$ 14.64 million, of which US \$ 7.5 million was provided by GEF/UNDP, was conceived in 1991-92, formally approved in March 1994 and started in 1995. The Project was initially intended to last until July 1998 but was later extended three times until its official completion on 31 December 2003.

The Project was designed to assist the Government of India (GoI) in the optimum utilization of small hydel resources in the Himalayan and sub-Himalayan regions of India. This was to be done through setting up 20 commercially viable small hydel demonstration projects, by upgrading the institutional and human resource capabilities from the local to national levels and finally by formulating a national strategy and a master plan in this sector. By developing a package of appropriate technologies and management and ownership models which would be people-centered and environmentally sound, the Project would demonstrate the potential to reduce deforestation and protect bio-diversity in the eco-fragile Himalayan and sub-Himalayan regions, besides reducing emission of Greenhouse Gases (GHGs).

The project document envisaged that through the HHP rural people would shift from using fuel wood for domestic purposes to electricity and from shifting cultivation to irrigation-based agriculture (GEF, 1994, 6). In total 18,000 “tribal, poor, and illiterate villagers in the remote hilly regions” were expected to benefit from the HHP (GEF, 1994, 11).

1.3 Terms of Reference

The Terms of Reference (ToR) for the case study can be found in Appendix A. The ToR states the following objective “...to understand the relationship/linkage between local benefits (and/or negative impacts) and the attainment of global environmental benefits of the GEF supported project: *Optimizing Small Hydel Resources in Hilly Regions*” (p 2)

The ToR defines local benefits for this study as: “*Project outcomes, which directly or indirectly have positive impacts upon people and ecosystems within or adjacent to Project areas, and which provide tangible gains in the livelihoods of communities and the integrity of ecosystems.*” (p 2)

1.4 Methodology

1.4.1 Overall methodology

The methodology followed in this case study is derived from the methodology of the overall LBS (Todd et al, 2003b) and the ToR and has four components:

- Conduct national and state level stakeholder interviews:
 - The Ministry of Environment & Forests (MoEF), the GEF focal point in India
 - UNDP as the HHP implementing agency
 - Government Ministries and Departments, particularly the Ministry of Non-conventional Energy Sources (MNES)
 - Autonomous bodies such as the Indian Renewable Energy Development Agency Ltd. (IREDA) which provides soft loans to commercial Small Hydro Power (SHP) developers
 - State-level nodal organizations for SHP developments such as HIMURJA, the nodal agency in Himachal Pradesh etc.
- Survey project documentation, correspondence and SHP scheme logbooks etc.
- Conduct open interviews and/or focus groups discussions with key local stakeholders such as local government representatives, local beneficiaries and project affected people, SHP scheme developers, NGOs etc.
- Direct observation of SHP schemes and their local impact.

1.4.2 Broad study

The HHP in principle covers the 13 Himalayan States, an area of over 400,000 km² and a population of over 200 million. The 20 schemes implemented are spread over six of those states, namely Himachal Pradesh, Uttaranchal, Assam, West Bengal, Sikkim and Bihar. To get a comprehensive view of the schemes the team visited five of the 20 in three states, i.e., in Uttaranchal, Assam (over 1500 km from Delhi) and in difficult to access areas in Himachal Pradesh. Due to time constraints and field conditions (winter/spring) the team could not visit the most remote and truly stand-alone schemes.

To get as much information from the local people as possible, an extensive field visit program was made covering 9 of the 18 in-country days. At scheme level the four member team subdivided into two teams and at village level the two members often held separate interviews. When necessary project staff assisted the team by translating between English and Hindi or the local language/dialect. A total of about 30 households were visited, their senior male and/or female members interviewed and their livelihoods, lifestyles and electric gadgets observed. Besides, two group discussions with men and women were held at village level and the Panchayat Pradhan (Village Council Head) of two villages were interviewed to get a broader view of the situation. Furthermore the team met a wide variety of government officials (see Appendix B) as well as private developers and entrepreneurs.

The nature of the HHP and the time available meant that only qualitative research methods could be used during the broad study. The case study team was fortunate that the draft of the HHP Terminal Evaluation Report (TER) became available during the fieldwork. The case study has benefited much from this draft report and a verbal update at the stakeholder workshop. Findings are referred to where relevant.

1.4.3 In-depth study

In line with the overall methodology the broad study would lead to an in-depth study by local consultants. This in-depth study would look into specific issues at greater length, making use of qualitative as well as quantitative research methods. However, the SHP schemes have been operational between one and two-and-a-half years and none of those is stand-alone. The team therefore concluded that it would not be possible to do a meaningful, quantifiable impact assessment of any of the HHP schemes.

“The Terminal Evaluation Report can best be seen as a baseline. In due course, when the schemes have operated for a number of years and people adjusted their lives to stable power, UNDP might want to do an impact study.”
(Team leader Terminal Evaluation Study)

UNDP-India intended to conduct an impact study of a non-GEF SHP scheme to quantify the local benefits of the Putsil (Orissa) stand-alone scheme that has been operational since 1999. There local people have had time to adjust their lives and livelihoods to electricity supply. However, in spite of much efforts by the UNDP staff this did not work out as the NGO turned out to be not interested.

1.5 Scope and limitations

The scope of this case study is limited in two ways. Firstly it focuses on only one element of the HHP, namely the link between local and global benefits. As such it is different from and complementary to the TER. Secondly while by definition the TER looks back at what has been achieved, this study looks forward to how future GEF projects can ensure more mutually beneficial links between achieving global and local benefits. It is therefore more qualitative in nature, seeking to understand and explore.

There are two fundamental limitations of the HHP case study. Firstly, at the time of the study, the oldest SHP schemes visited have only been operational for about two and a half years. One scheme was still undergoing testing. This, together with the fact that local benefits from electricity take time to materialize, means that relatively fewer benefits have been found in the field than will be seen in due course. The second limitation is that all schemes visited had electricity before, in some cases for decades. Furthermore only two of the SHP schemes visited can operate independently from the grid, in stand-alone mode. In grid connected schemes there is a problem of attribution, that is, it is methodologically difficult if not impossible to separate the benefits from the SHP scheme from those of being connected to the State grid.

1.6 Lay-out of the report

This report has three more chapters. Chapter two starts with a brief description of the HHP and then presents the main findings. It describes the main local stakeholder groups, gives an overview of the positive and negative project impacts, describes in detail the impact on the livelihood capitals of local people, their livelihood opportunities, their vulnerabilities and on resource management.

Chapter three analyses the findings, looking particularly at the local impacts of the HHP, the project concept, design, implementation and operation and maintenance, the global project impacts, the inter-linkages between local and global impacts, the sustainability of resources management and finally missed opportunities. In the last chapter the lessons learned are presented thematically. The appendices contain supporting documents such as the ToR, the study team activities, people met and references.

2 FINDINGS

2.1 Project description

The SHP schemes developed under the HHP exploit part of the huge and largely unused small¹ hydel power potential in India. The purpose of the HHP was to demonstrate that SHP schemes are economically viable. Apart from identifying the potential sites, the demonstration projects were expected to develop capability to develop, manufacture, install and operate SHP schemes. Alongside the local beneficiaries of the Project, the Ministry of Non-conventional Energy Sources (MNES), State Electricity Boards (SEBs), technical institutions, Non-Government Organizations (NGOs), etc would benefit in terms of capacity building.

The Ministry of Non-conventional Energy Sources executed the HHP. As of 2004 MNES has identified sites that can yield over 10,000 MW through SHP schemes and assumes that an additional 5,000 MW of potential may be as yet unidentified. Currently there is less than 1,600 MW of installed capacity in India's SHP schemes, that is, schemes up to 25 MW (MNES).

2.1.1 Aims and objectives

According to the project document (Gef, 1994, 2, 49), the HHP intended to achieve the following:

- a) reduce global warming by facilitating a shift from fuel wood for cooking and heating to renewable, perennial, non-fossil fuel small hydro power, resulting in yearly savings of 7,100 tons of fuel wood and a reduction in carbon emissions of 3,200 ton per year
- b) protect biodiversity in the Himalayan and sub-Himalayan regions by reducing deforestation
- c) reduce rural to urban migration by 9,000 persons due to enhanced local economic opportunities.

2.1.2 Implementation modalities

As the executing agency, the MNES implemented the HHP through a Project Management Cell, headed by a National Project Director and a National Project Coordinator. UNDP/GEF kept an eye on implementation through its National Coordinator.

The GoI provided the MNES with substantial resources to implement the HHP (Ittyerah, 2004, 25). At the State level commitment and support varied. Himachal Pradesh and Uttaranchal (both close to Delhi and the Alternate Hydro Energy Centre (AHEC) in Rorkee) showed a high degree of commitment. However the Eastern and North-Eastern States, with the possible exception of West Bengal and Assam, showed very little interest. As a result some of the highest potential States benefited the least from the HHP (Ittyerah, 2004, 26).

The Terminal Evaluation Report notes that the States neglected to dovetail and coordinate the HHP activities with those of related agencies and departments. If dovetailing could have been achieved, *"the impact on the ground or on the beneficiaries in the targeted areas would have been substantial in terms of achieving the employment, livelihood and regional development objectives of the Project."* (Ittyerah, 2004, 26). Ittyerah points out that the main reason for the lack of integration of HHP activities with other developmental work is that State nodal agencies often were understaffed, under financed and lacked the authority to related to others and solve administrative problems (p. 26).

¹ MNES uses these definitions: Pico = < 5 KW; Micro = < 100 KW; Mini = < 2 MW; Small = < 25 MW.

The TER notes that among the stakeholders the various government and private participated actively, but that the local population, particularly women were hardly involved. As a result, *“this non-involvement of the local population has been a major set back for the timely and effective implementation of the Project and has diluted the actual and effective impact of the Project.”* (p. 27)

2.1.3 Overview of schemes studied

For the purpose of the study, five SHP schemes from the 20 demonstration projects were selected located in three states in the sub-Himalayan States. All of the 20 schemes are run off the river system, i.e. they do not store water behind a dam and therefore do not involve inundation of land and settlements. However most schemes appear to interfere with existing water usage and water rights.

The details of the SHP schemes visited are presented in the table below, one of which is a watermill modernized under the HHP was visited. Of the six sample schemes studied the Kalmoni and Titang schemes have the facility of the stand alone as well as being grid connectivity. The remaining schemes are all permanently grid connected and cannot work independently from the grid.

Name	Location	Installed Capacity	Cost (Rs. in mill)	Developer	Date of Completion
1. Neergad (Watermill)	Dist: Tehri Garhwal State: Uttaranchal	6.0 KW	NA	Individual Owner	1998
2. Kanva Ashram	Dist: Pauri Garhwal State: Uttaranchal	2 x 50 = 100 KW	8.84	State Agency (Uttaranchal Non-conventional Energy Development Agency)	February 2004
3. Titang	Dist: Kinnaur State: H P	800 KW	44.4 (45.9)	NGO (Sai Engineering)	December 2001
4. Solang	Dist: Kullu State: H P	2 x 500 = 1000 KW	69.06 (68.72)	Private (A Power Himalayas)	June 2002
5. Kothi	Dist: Kullu State: H P	2 x 100 = 200 KW	27.2 (19.0)	State Govt. (HIMURJA)	June 2001
6. Kalmoni	Dist: Gauhati State: Assam	100 KW	10.7 (9.97)	Private tea estate (Rani tea estate pvt. Ltd.)	October 2003

Note: Figures in brackets are estimated costs taken from the Detailed Project Reports (DPRs).

Source: MNES, New Delhi; HIMURJA, Shimla; AHEC, Roorkee and Ittyerah (2004).

At **Neergad**, a 60-year-old traditional water mill running off the local stream, was modernized during 1998 by installing a metal turbine and a generator. Simultaneous grinding and electricity generation is only possible when there is enough water, i.e. during rainy season. Only one of them functions during the lean season. Grinding is given priority during the day. According to the owner, grinding is not efficient, especially during lean season, due to low speed. At present the mill has sufficient or excess grinding capacity, as there is not much demand for coarse grinding. The capacity of the mill is about 200 Kg per day when water flow is good. The mill is not fully operational even in the lean season,

despite the fact that charges are less than at flour mills available in nearby villages (Rs. 0.50 as against Rs. 1.00). Since 2002 the site is grid connected and the owner seems to be losing interest.

There is a niche market for the rather coarse kind of flour that this modernized traditional mill produces. Buddhists in particular are reportedly interested in using this kind of milling as it suits their food habits. Apparently the market share of coarse wheat is small, less than 10%. While his capital costs are marginal the running costs include: Rs. 260 per year to the forest department for the use of water and Rs. 1000 per year towards maintenance. Under the HHP a total of 143 watermills have been modernized, but only three have the dual milling and electricity production capacity of Neergad.

Kanva Ashram SHP scheme is based on perennial water flow used for irrigation for decades. At the time of the visit it was undergoing final testing. The power generated here is supplied to the local grid with the help of a new line laid at a cost of Rs. 1.6 million (20% of total cost). On the basis of a Power Purchasing Agreement (PPA) with the State Electricity Board (SEB) the power is sold at Rs. 1.70 per Kwh to the grid while the SEB charges about Rs. 2.80 per unit to the end domestic users. Of the Rs. 1.70 collected by the developer, Rs. 0.67 is allocated for the O & M of the system, which might be done on contract basis (including the salary for the operator - a local person - @ Rs. 1500/month). The remaining Rs. 1.03 is kept with the developer to cover the capital cost and perhaps major maintenance. Some officials interviewed said that the day-to-day maintenance would be handed over to a local community but others say O&M will be handed over to a commercial firm.

The estimated cost of generation ranges from Rs. 2.33/Kwh (without subsidy on capital costs) to Rs. 2.08/Kwh (with subsidy on capital costs). In fact, the developer agreed to close down the unit due to the pressure from the local farmers who threatened to shut it down forcefully as it interfered with irrigation. Generation costs would escalate if production stopped during lean season.

Titang is the only private project in the tribal areas and the only HHP scheme implemented by an NGO. The developer, Sai Engineering Foundation, is unique as it blends commercial profit making with NGO development activities. This project is located on a local stream, has a capacity of 800 KW and has the facility of stand alone as well as grid connectivity. It serves six villages under two *Panchayats* when the local grid is down, while it normally supplies to the grid. The villages are: Titang, Dobbiling, Pooh, Namgia, Maling and Nako. Though the project depends on a perennial stream, the water flow is not stable as it depends on water from a glacier which are low during winter and high during summers. During winter the plant load factor drops to 25% of capacity.

SAI, as an NGO, faced some disadvantages in terms of gaining access to credit from financial institutions. The effective interest subsidy was only 5%, as they could not provide any collateral. Besides, there is no deemed electricity provision for the developer in case the grid is down as it was dropped in lieu of non-payment of royalties to the state electricity board.

Grid failure is a regular phenomenon in this region. According to the developer this is not a profit-making venture despite the fact that low cost indigenous equipment was used. The revenue generated is enough to pay the loan installments to the co-operative bank (financer) and partial payment to IREDA. The remaining payments to IREDA and the O&M are currently met from the Sai Engineering Foundation account. In order to increase the load the developer distributed 1000 cooking stoves and 200 water-heating rods free of cost in the beneficiary villages, but these are hardly used at all.

Solang is a second private-sector developed project outside the tourist town of Manali. The project has an installed capacity of 1 MW. The developer, the Power Group of Companies, is a subsidiary of Regency Carbide Pvt Ltd who consume roughly 20 MW of power in their industrial plants in the plains. The developer has made a 'wheeling' arrangement with the SEB so that for every kWh produced by the SHP plant, one kWh is subtracted from the consumption of their industrial plant (minus 2% for losses). This means that the effective rate that the state electricity board is paying for electricity from the project is Rs 3.1 per kWh, even though the costs of generation are roughly Rs 2.3 /

kWh. This margin makes the Solang scheme commercially very attractive. If the grid is not working and electricity is supplied to the surrounding vicinity, the SEB pays Rs 2.5 per kWh. The developer is developing another five sites.

The SHP in **Kothi**, like Solang located near Manali town, is developed by HIMURJA, the HP Renewable Energy Authority and has an installed capacity of 200 KW. Kothi was the first of the projects commissioned under the HHP and it was completed in June 2001. The investment costs were met on a 50-50 basis by a grant from the state government and a grant from the UNDP-GEF funds. There is no Power Purchase Agreement (PPA) and the electricity generated is supplied to the grid. Sai Engineering Foundation carried out the work on the project.

The **Kalmoni** Scheme is a stand-alone project in a tea estate to provide electricity to the tea estate factory and houses. In the past the electricity was produced on-site by diesel generators. While the scheme was implemented the owner also acquired a grid connection but this has not been used since the SHP became operational in October 2003. Availability of water is good and the machine will run at full capacity round the year except for two months (January-February) when electricity demand is low. In fact, the owner is planning to establish another 100 KW capacity unit. The economic viability of this SHP, without 50% subsidy from the State, is doubtful. However, the crucial benefit seems to be that the SHP supports the eco-friendly status of the tea estate.

2.2 Description and size of main local stakeholders groups

The **Neergad** watermill benefits the owner, his brother (whose tea stall across the road is sometimes provided with electricity) and the owner's family (wife and five children). Those who grind their wheat at the mill benefit from it, but demand is low in spite of the fact that grinding cost only half of what it does at nearly electrified modern mills.

At **Kanva Ashram** the intended beneficiaries are local villagers, most of whom are farmers. For generations the villagers have made a living from irrigated agriculture, growing three crops a year. Although nearby villages became grid connected through the scheme, there is at least one village nearby that is not electrified yet. It is as yet unclear to what extent local households will benefit from this electricity produced by this scheme as it has only just completed testing and it is uncertain how many months per year it will be able to operate.

Titang covers six villages and about 700 households. Though the villages are 'remote', most inhabitants are relatively well off as they are involved in growing high value crops like apples and vegetables. This region produces the famous and expensive Kinnaur apples. Most of the villages get irrigation from the local streams ('*khuls*') and due to heavy snowfall many activities come to a standstill during the winter season. In fact, some of the areas are inaccessible for about six months in a year. The agriculture season starts from March-April and lasts till October. This region has been grid connected for about 30 years, but the grid is very weak and people were cut off for 45 months at a time. The SHP scheme strengthens the grid and stabilizes the power supply to these villages and also support supply to villages on the way to an even more remote area covered by the Lingty SHP scheme.

The schemes in **Kothi** and **Solang** each serve about five villages around Manali with about 200 households each, most of which have had electricity from the grid for 20 years. These villages were at the tail end of the grid and voltage was often low and power supply interrupted. Economic activities in these villages include agriculture and tourism.

Kalmoni provides electricity to the tea estate. The main use is in the tea factory while employees' quarters and the estate guesthouse are connected. Presently eight households are provided with free electricity and the number may go up to 30 in the coming years.

Although there are a number of issues related to definition and methodological, it seems from the schemes visited that fewer people benefited than the 18,000 anticipated in the HHP document. In some schemes, the number of beneficiaries was limited to a handful of people.

2.3 Overview of positive and negative local impacts

Assessing the local impacts and attributing the benefits to the SHPs is a difficult task, as many of the villages that benefit from the visited schemes have been grid connected for over 20 years. Hence, the only clear impact is in stabilization of supply and an improvement in the voltage rather than the provision of power per se.

Neergad: While the traditional mill was used only for grinding, the modern one produces electricity as well. Electricity is used mainly for lighting, TV, tape recorder and two refrigerators in the owner's food stall. The owner's benefits include savings in his electricity bills to the tune of Rs. 1200 per year and the income from the mill, which on an annual basis could be in the range of Rs. 1000 to Rs. 2000.

Though there is a clear improvement in the owner's income during the last 5-6 years, it can't be attributed to the modernization of his mill. According to him, his livelihoods situation is more stable now. Due to the increased business activity he has started two new shops, one his own and one for his brothers. Thus the mill is benefiting his close relatives though the benefits are not much.

In terms of social capital, the gains are difficult to gauge. However, he is now better connected to the officials who visit or bring visitors regularly. This, perhaps, may add value to his personnel standing. On the other hand, the mill is too small to have any significant impact. Its impact on local benefits and environment is marginal as it benefits one household only. The recent connection to the grid has reduced the relevance to the owner.

It seems that a lot of effort has gone into upgrading the water powered milling equipment, with only marginal impact on increased efficiency and income generating capacity. Discussions with a private producer of improved watermills suggest that there is only a market for these mills if they are heavily subsidized or supplied free of cost. The Neergad mill is well placed to serve as a demonstration site.

Kanva Ashram: While it is too early to assess the long term local benefits, one positive short term benefit is the employment of local people during construction and the business activity this created for local shops. However, during the visit feedback from the local community focused on negative local impacts. These are mainly caused by the SHP scheme upsetting the sensitive irrigation system that works on a rotation basis. The design that allows automatic and manual switching of flows between right and left streams upsets the existing '*warabandi*' (rotation) system. Given the low water flows, the SHP scheme may only operate when there is enough water, i.e. from July to February.

Furthermore the people pointed out that the project was started with a promise of providing electricity and drinking water to all nearby villages. This has not happened as the power generated is fed to the grid while at least one nearby village remains unconnected. During the visit local people said they feel that they have been cheated as the power is supplied to villages already grid connected earlier on. MNES staff were unaware of this and have pledged to ensure that the village concerned will be connected as soon as possible. Finally, it seems to the study team that the institutional and participation dimensions have been totally neglected in this scheme. MNES denies this and points at the two year delay in implementation caused by a landslide as the reason for people's frustrations.

Titang: The benefits of a SHP scheme in this region are expected to be higher due to its extremely cold climate. The benefits vary across the nearby villages depending on their location which ranges from 1 Km to 30 Km from the site. Pooh village is the most benefited of all the villages due to its administrative importance (including an army base). As a result, the villages between the power house

and Pooh also derive benefits. Prior to the SHP the power supply position in this village was irregular and voltage was often low. People say supply is more stable and regular thanks to the Titang scheme.

Electricity is mainly used for lighting purposes and TV. LPG is used for cooking mainly during summer months while smokeless 'chulas' are used during the winter months. The 'chula' helps in cooking as well as warming the house during the winters. Local people do not use the electric stoves and heaters that they got free of charge because they say their electricity bill would be too high. However, some government officials living in Pooh are reported to use the electric cooking stoves.

According to the people the main benefit from the SHP is that they are getting the assured lighting during the evenings. This also helps the children to study for longer hours and facilitates TV viewing during leisure hours. The use of kerosene for lamps has come down. Now kerosene is used mainly for lighting the 'chula'. Indoor air pollution and, consequently, lung disease has been reduced by the more regular electric lighting.

The limited local benefits are less evident in the far off villages. In Nako, one of the villages located away from the SHP, about 70% of the households own electrical wool spinners, but all of them were acquired long before the commissioning of the SHP. Some of the people interviewed in Nako were unaware of the local SHP scheme in Titang. None of them use the electric stoves and many did not get the stove or heater. Most of the households use gas and they feel that availability of LPG has changed their lives rather than electricity. The village does not even have streetlights. They feel that the situation has not changed much after SHP. Some households still use solar lights provided by HIMURJA at a subsidized rate. They feel that there is potential for three grinding and two oil-extraction mills in the village. However, unreliable power supply does not encourage such activities. Prof. Ittyerah stated that there were 813 grid breakdowns during one month (at 20 July '04 workshop).

The improved power situation has not made much impact on the local economic activities. Households use appliances such as wool spinning machines and a few butter churners. A number of people said that if stable supply continues they may invest in a small oil and flour mill.

Construction of the powerhouse got delayed because a private landowner wanted an extremely high price for his land. When he heard about the plans to build the powerhouse he planted apple trees on the site to increase the price. Finally Sai Engineering threatened to drop the scheme unless the land would be sold at the going rate. The Panchayat intervened and finally the owner was compensated slightly above the market rate.

Kothi and Solang: Electricity first came to the villages now served by Kothi and Solang SHP schemes 20 years ago and everyone was very happy and used the electricity mainly for lighting. At the time an immediate impact was to allow women to weave the necessary shawls and cloth for home consumption in the evenings. This allowed them to spend more time on farming the land which became more productive. Also diesel generator sets that were earlier used to generate power at weddings, etc. were no longer needed as there was electricity. Most of the households own a TV. Over the years electricity has also stimulated expansion of tourist related facilities in the area.

In the past, there often used to be no electricity for 10-20 days when the grid wires were broken. People say there's been a slight improvement in voltage since the powerhouse came. Power still does go off in the winter when it snows, but not for more than 7-8 days. For cooking the people either use LPG (in the summer when it's not windy) or firewood. Firewood usage has decreased in the past years because of increased use of LPG.

Also, some people have made their rooms lower so that they have less space to heat and instead of bringing 3 tractor-loads of firewood per year they now need only 1 tractor-load. The Pradhan estimates

"How can a foreign delegation to the HHP come all the way to our area and not visit the power house?" (A Site Engineer's question after the study team decided not to visit the power house so as to spend more time talking to local people).

that there's been a decrease of 15-20% in fuel wood collection over the past 8 years. This is partly because of the government regulations, partly because of move to LPG.

A potentially important benefit is the provision of 17 streetlights in Solang Village by the project. However there are some reports that they are not often operational. During construction local labor was hired, 7-8 people from Kothi and 5-6 from Solang. There were also Nepali workers because of labor shortage locally.

When the Kothi project was planned there were consultations with the landowners (two brothers) and the land was purchased from the brothers at government rates while one was also given a job at the powerhouse. In Solang the land was already purchased in 1980. According to the Panchayat '*Pradhan*' (head) the council was consulted in both cases when it came to land acquisition. This consultation is compulsory under the law irrespective of whether it's private or government land. The Panchayat didn't have objections.

In these villages very few people use solar panels as the sky is often clouded so the panels don't get charged. There have been benefits from the projects by way of voltage improvement and less disruptions during last winter.

The major benefit from the **Kalmoni** is environmental in nature. The estate saves up to 70, 000 liters of diesel per year after the commissioning of the project. Electricity is used mainly for the factory and to a very minor extent in staff housing for lighting, TV and music systems. Currently six tea garden staff households are provided with electricity and each household saves about 60 liters of kerosene per year, which they were using for lamps. Higher income households use LPG for cooking while lower income households use fuel wood.

2.4 Impacts on livelihood capitals

2.4.1 *Natural capital*

The field visits show that entitlement and access to local natural resource by various stakeholders groups has changed due to the HHP in several ways. The main gainers are the state and commercial developers who have gained access to water for producing electricity. In the process some local people have lost their traditional access to natural resources.

In the rural areas concerned, water was traditionally mainly used for irrigation and milling. In one project the traditional irrigation system has been upset to the point where local farmers have demanded the SHP scheme be closed during the lean season. On the day of our field visit, of which they were not aware, the village leaders had in fact come to stop power generation by padlocking the powerhouse. In another instance six traditional watermills have gone out of business because the SHP scheme diverts all the water from the intake to the power house. Finally in another scheme the commercial developer has restricted the communal cattle grazing on the land surrounding the power project.

In other words the HHP has increased the access to natural resources by outside private and state entities while the traditional rights of the local communities have decreased. Given the fact that there has been hardly any public participation from the very beginning and the stress on commercial sustainability in project design and implementation, it is not surprising that commercial interest has impinge upon the traditional rights of the community over water and land.

2.4.2 *Social capital*

One of the objectives of the Project was to development the institutional and human resource from the national to the grassroots level. There is not doubt that the HHP has contributed much to the capacity

development of the MNES and to a lesser extent to that of the State nodal agencies. The increased capacity of the MNES is amongst others visible in the steep increase in increased power generated by SHP schemes. Until 1998 the yearly increased for the whole of India was between 3 and 16 MW. In 1998-99 the figure jumped to 28 MW and has been around 80 MW per year since then.

At national level originally three institutions were to be developed, in Itanagar, Guwahati and Roorkee. However, only of those, the Alternative Hydro Energy Centre (AHEC) in Roorkee has been improved under the HHP. It now functions as the lead apex institution at least for the north-central states. At the same time in the North-Eastern States the lack of state level institutions that could provide the necessary institutional support, conduct feasibility studies and training sessions, etc. is also clearly visible. As the TER noticed the North-Eastern States have the highest potential for SHP. Nevertheless the HHP could only develop two sites in Assam and one in Sikkim.

People's participation was one of the key activities in the HHP. However, both the TER and the case study findings are that next to nothing has been done in this area. As mentioned above, at one of the sites visited, Kanva Ashram, the local leaders had gathered on the day of our visit (not knowing the team was coming) to padlock the SHP powerhouse until the monsoons started. They say it had created havoc for their irrigation system. As reported in the TER at Raskat SHP scheme (not visited by the team) the private owner has closed off the area around the powerhouse up to the water source to prevent grazing of cattle by the local people. This has created much animosity. At Solang SHP, visited by the team, the private developer has run into trouble with the local community because of tourist related activities. While not directly related to SHP, this did lead to one of the powerhouse staff being beaten up by local villagers. When the team wanted to visit that village the staff were very reluctant to let us go and refused to accompany the team.

All in all, the HHP has considerably expanded institutional capital at national and state level, though not as widespread as planned. The team has not seen any evidence of a planned positive impact of the HHP on grassroots institutional capital. However, the negative impact of the HHP in some schemes has resulted in local people getting together to voice their concerns and opposition to some of the SHP schemes. As such the HHP has unwittingly contributed to an increase in their institutional capacity.

2.4.3 Physical capital

Electricity supply has a lot of potential to increase the physical capital of households as people become interested in various electrical appliances. In all the schemes visited households already had access to electricity so the HHP as such has not made a big difference to the appliances that people own. All houses have electric wiring and at least one and often more bulbs and outlets. Many of the better off households own a TV, a radio and/or cassette player.

The SHP schemes have supplemented and marginally stabilized the availability of power in the surrounding villages. As a consequence, consumption of electricity by the households has increased. However, the HHP has only lead to a very marginal increase in the number or type of electrical appliances. Amongst them are few electric threshers, some (free) electric stoves and heaters.

In Titang site, Sai Engineering Foundation has distributed electric cookers, immersion rods for heating water and room heaters (for institutions only). It was assumed that access to these appliances and their use would reduce use of fuel wood and thereby lessen carbon emission. However, as the cost of electricity was much higher than of fuel wood and LPG, very few of these appliances (though distributed free of cost) were in use. According to the people the conditions that would make conversion of fuel wood and LPG run cookers and heaters to electricity, i.e., a competitive tariff structure and stable supply of electricity, are not in place and may never come.

2.4.4 Human capital

Electricity supply, through increased access to radio, cassette recorders and television, is known to have a positive influence in the development of human capital. In areas that have stable lighting, students benefited as they can study longer hours at night. These developments were seen in all the villages visited. However, as all villages visited already had electricity supply before the HHP, these benefits cannot be directly attributed to the project. Furthermore due to irregular electricity supply solar and gas lamps were found replacing and supplementing the traditional kerosene lamps and electric bulbs.

Although development of human capabilities at the local level was a stated objective of the Project, no direct provision of skills, knowledge or training to local stakeholders or institutions like the Panchayats was attempted. The Sai Engineering Foundation attempted to train and involve a few individuals in operating the SHPs but no replication was noted in other project sites.

Human capital development in terms of training programs was geared to capacity development of the national and state level officials. A total of 59 Central and State Government officials received training abroad, 160 technical officials were trained at national level and further 200 on water mills (Ittyerah, 2004, 45). However, in the absence of an appropriate personnel policy, the sector could not retain the officials trained. Many were transferred to other departments thus affecting the consolidation of expertise at the national and state levels.

2.4.5 Financial capital

The HHP intended to stimulate economic activities by supplying soft loans to local people. However such loans have not materialized. The increased in economic activities due to the HHP has been very minor, so that too has not lead to an increase in the financial capital of local stakeholders.

2.5 Impacts on livelihood opportunities

Given the marginal improvement of power supply as a result of the HHP in the schemes visited, impacts on livelihood opportunities are minimal. When electricity was first supplied to villages there was often a positive change on livelihood opportunities. For instance, tourism related activities in Kothi and Solang, like tea-stalls, restaurants and hotel facilities received a boost when electricity became available in the 80's. Where the electricity supply improved (less power cuts and better voltage) following the implementation of HHP, experienced further improvement in these activities.

The Project had positive impacts on home based income generating activities like electricity operated wool spinning and milk-churning machines. Though these were there before, the HHP seems to have increased their use, particularly in areas where it could provide more stable power supply like in Pooh. Both these activities expanded since women could work longer at night. Earlier the introduction of lighting had already allowed women to weave the necessary shawls and other cloth after sunset, freeing them up to do more work on the land during the day. Similarly, use of electric iron has helped the tailoring business. A few employment opportunities were created in the operation of electric thresher, cable operation for TV and operation and maintenance of the SHP schemes. However, mainstream livelihood activities, such as agriculture and apple cultivation remain largely untouched by the Project.

2.6 Impact on gender equity

The main objective of the Project has been to provide renewable, perennial and non-fossil fuel-based energy thereby reducing carbon emission and helping to prevent deforestation. To the extent that this objective was achieved, it is foreseeable that supply of hydel electricity would have direct impact on gender equity. After all women are the ones who collect fuel wood for household consumption.

Though it is perhaps too early to draw any definite conclusions in this respect, there is evidence that economic considerations, i.e., higher cost of electricity compared to LPG and fuel wood, combined with irregular supply and low voltage of available electricity, are not conducive to changes in cooking and heating fuel usage. Thus women's burden of collecting and carrying fuel wood remains intact.

On the other hand, supply of electricity has made considerable contribution to other roles of women as producers apart from providing the comfort of having light. At least two frequent uses of electricity were noticeable: most of the traditional wool-spinning and milk churning devices were now being run by electricity. This has the effect of reducing drudgery and improving productivity. Availability of electricity in the evenings has also allowed more flexible allocation of time between various economic activities, for instance more time can now be spent during the day for field agriculture while wool spin could be done in the evening. All in all women's time at work has increased.

Access to TV provides entertainment, but more importantly exposure to outside world and could bring home images of varied gender relations. Women also feel that provision of light in the evenings has improved their security and mobility.

2.7 Impacts on stakeholder vulnerability

The Project has only had a marginal impact on reducing stakeholder vulnerabilities in terms of access to power supply as that supply, though improved, remains unstable. At the same time the HHP has increased people's vulnerability vis-à-vis the promoters of hydel power schemes. The later have increased their access to and control over local water and land resources, while local people have lost out on their traditional rights (see above).

Local people complained about their loss of access to local resources, now usurped by outsiders who do not necessarily share the output/profit with them. People reported a similar trend in forestry. In the past only local people used the forest for their livelihood activities. The Forest Department now prohibits people from felling trees, allowing them only to pick up branches that have fallen off naturally. At the same time the exploitation of the forest is auctioned off to the highest bidder. Most often these are outside businessmen who truck the produce out to lucrative markets. The local people however get no benefit from this and have to spend more time and effort to get their subsistence supply of firewood. People see a similar trend in tourism where outsiders reap the main benefit.

2.8 Impacts on sustainability of resource management

The HHP has resulted in a shift from community managed natural resource management to those resources being controlled by the State or by commercial parties. Where the private party has the interests of the local community at heart, such as in the case of Sai Engineering Foundation in the Titang SHP scheme and to a lesser degree in the Kalmoni, resource management is as sustainable, or more so than before the HHP. However, in most other SHP sites the indications are that private commercial interests prevail and the sustainability of resource management suffers as profit making is their main goal.

3 ANALYSIS

3.1 Local benefits

There is no doubt that local people appreciate electricity supply very much. People who are connected for the first time are literally “de-lighted” when they experience how one bulb can convert their night into day. Later on, when people have saved enough cash to buy and operate a TV, they experience another leap forward. This is the case particularly in remote and isolated areas, such as those visited in Himachal Pradesh, where the evenings and winters are long. Notwithstanding all else that is written in this report about the impact of the HHP, these clear and valued local benefits must not be forgotten.

Once a household has been connected to the grid, the introduction of a SHP scheme adds only marginal additional local benefits. In fact it is often next to impossible to distinguish the local SHP benefits, particularly when the unit cannot operate in stand alone mode, from those of being connected to the grid in the first place. This is not to say that there are no benefits, but only that the benefits are so diffused that it is empirically difficult to identify them and trace them back to the Project.

3.2 Negative impacts

As detailed before, implementing the 20 SHPs under the HHP has had some negative impacts on the local people. Fundamentally this has to do with implicitly turning the rights to manage local water resources over from the local population to commercial and State SHP developers. They are motivated by private profit and/or maximum electricity production and all else has to move for that.

At a practical level it seems that most of the negative impacts could have been avoided if local people had been pro-actively involved in all stages of scheme development. The Titang SHP is an example of how an enlightened commercial approach can be a win-win situation for all concerned.

3.3 Project concept and assumptions

From a global environmental perspective the basic concept behind the HHP, producing electricity by small scale hydro power, is sound. However, there is worldwide debate among key stakeholders whether, given the option, hydro power can best be produced on a large, medium or small scale. When commercial viability is the main consideration, as in the HHP, the larger units get top priority. This is even the case when only small scale production (< 25 MW) is considered. The main argument in favor of the largest possible scale is economics, while management by local communities (not done in the HHP) favors smaller schemes.

In line with the GEF mandate the HHP was expected to reduce Climate Change (CC) through a reduction of GHGs through the substitution of firewood used for cooking and heating with hydro power. The case study has found very little evidence that this is happening. Discussions with local people suggest that such substitution is driven by the relative price of firewood, electricity and other (clean) alternatives such as LPG. Even the current substantially subsidized kWh price of less than US \$ 0.02 does not favor electricity. It must therefore be concluded that the assumption of firewood substitution was flawed mainly because economics were overlooked (Chakravorty, 2003). This finding is not surprising, as electricity is not

“Who will foot the bill of LPG or electricity? Wood is free!” (Poor woman near Kothi)

widely used for cooking and heating in India even where supplies are reliable and households are able to afford the costs. The provision of electricity is important in adding new energy use opportunities but the basic assumption behind the Project, that the hydro power would reduce GHG emissions from fuel wood use, was not investigated in terms of whether such a switch was likely and this assumption was fundamentally flawed.

Although not envisaged in the project design, SHP schemes have replaced fossil fuel (diesel) in three stand alone schemes implemented in tea gardens. However calculations show that even with a 50% subsidy on the investment, such substitution is not economically sustainable. Replication will therefore only take place under specific circumstances such as in eco-friendly tea-estates where the environmentally clean 'image' of SHP is worth more than the loss on the investment in SHP infrastructure.

The HHP furthermore assumed that electricity would be provided to remote and as yet un-electrified villages and households. Of the 20 HHP schemes, seven (35%) fall in this category. The main reason why so few HHP schemes serve un-electrified villages and are truly stand alone is that the Project focused on commercial developers. By definition they are interested in economically viable schemes and such viability requires larger schemes and a high plant load factor. These two conditions can only be met if the SHP scheme can supply electricity to the grid. The second reason why remote areas have been avoided is that the implementation and management of schemes in remote areas is very costly. Finally those who conceptualized the HHP were apparently unaware of the high level of electrification as well as the GoI's existing plans to expand the grid. The assumption that the HHP would provide electricity to remote villages has proven to be substantially wrong.

Finally, at the national level it is doubtful whether investing in SHP has been the most strategic use of GEF funding. For instance in the mid 1990s the GoI investigated how best to reduce firewood consumption in the Himalayan region, concluding that LPG was the best option. The case study confirms that choice and given its global know-how, GEF should have anticipated this. Furthermore it appears that in the teagardens factories major improvements can be made to the heating/drying process. Doing so would require a fraction of the investment now spent on SHP and would yield substantial savings on the firewood, coal and/or furnace oil now used. A similar, though more capital-intensive option in the construction sector would be to help brick factories convert from using firewood and coal to gas. In summary, it seems that one of the ideas underlying the HHP has been that it is mainly households in remote areas that cause substantial damage to the environment and GHG emission, through the use of firewood. The probably much larger negative impact of commercial activities seems to have been 'out of the picture'.

3.4 Project design

As pointed out in the TER (Ittyerah, 2004) the project design was overoptimistic about what could be achieved on the ground within the original project period of 3½ years. The case study confirms the recommendation of the TER that a two phased design, with a 3 year preparation and a 3 year implementation phase would have been appropriate with the second phase conditional on the first.

The project design implicitly assumes that providing electricity on its own would result in major changes in people's livelihoods and that electricity would transform the local economy. The case study does not support that assumption. As the fieldwork makes abundantly clear, people's livelihoods are very complex, have developed over decades and are based on local realities as well as the (slowly) changing socio-economic and political reality in which they find themselves. For major improvements in people's livelihoods and for changes towards a more environmentally sound economy, a synergy is needed between the interventions of the various government departments at village level. Such cooperation and coordination is conspicuous by its absent from the HHP design and implementation.

The project design combines a community based approach to an approach that is commercially viable and replicable. The work of Sai Engineering Foundation in Titang and three other SHP schemes shows that a people-oriented approach can be combined with commercial viability. However, there are only a few organizations and individuals willing and able to follow this route. In fact less than 2% of the SHP schemes taken up until now, fall in this category. In all other cases a purely commercial approach, sometimes blatantly so, prevails. If commercial replication of SHP schemes is to be sustainable it must have a positive local impact. This will only happen if such commercialization is governed by laws that protect the rights of local communities, better still that ensures local people a stake in such activities.

3.5 Implementation

The field work shows that on all accounts the HPP appears to be a traditional, top-down, technology-driven project. The project documents do mention community and people's participation a lot, but apparently only as lip-service. While the lack of experience of government departments in people's participation was well documented, it is surprising that the project authorities have not made provisions in the composition of the cooperating agencies or involved local and international experts on people's participation to translate the buzz-words used into practice during implementation. Furthermore, the HPP stress on commercial viability of schemes, complicating things even more.

“From a people’s participation perspective this is a pathetic Project!” (An MNES official’s first comment when we mentioned we had visited Kanva Ashram SHP scheme)

“Local community should have been involved from day one in planning, so that there’s local ownership. Now they think it’s a government Project.” (A UREDA Official reflecting on the same Kanva Ashram SHP scheme)

While all the formalities of the GoI and UNDP on EIAs and EMPs have been followed there is little evidence on the ground that investments have been made to protect or enhance the environment. The most that has been done is that the Forest Department has been given funds to plant replacement trees for those (limited in number) that had to be cut for the SHP infrastructure to be built.

Stricter adherence to the project design during implementation could have increased global environmental impacts and their sustainability. If the people's participation aspect of the HHP had been followed, local opposition could have been avoided and local benefits and the sustainability of the schemes increased.

3.6 Operation and maintenance

Although the project document called for involving the communities in operation and maintenance, this seems to be a non-viable proposition in all but three truly stand alone HHP schemes. After all, grid connected schemes and the tea garden units are most run at maximum load to ensure profitability. These schemes will be operated and maintained on a commercial basis by the private developers or the state agency responsible for the scheme. Involving communities in their O&M seems unrealistic.

The three schemes that are not at all connected to the grid are not yet operational and have not been visited by the study team. It seems possible to involve the local community in at least setting the parameters for operating these SHP schemes. With appropriate training and support local people can also take responsibility for actual operation as well as routine and preventative maintenance.

3.7 Global Project impacts

The project document is explicit about the justification for assistance from UNDP/GEF based on the Project's intended global environmental benefits (for an expanded version of this section see Appendix D). It is stated that the Project intends to achieve:

- Reduction in global warming through use of hydro energy;
- Protection of biodiversity by reducing deforestation; and,
- Reducing migration of population from remote areas to urban centers, thus affecting pollution reduction in urban areas.

As pointed out above **reduction in global warming** was based on the assumption that fuel wood would be substituted with electricity produced through the development of small hydel. The mission findings confirm that this energy transition is taking place only on a very limited scale. People have not shifted to electricity for cooking for two reasons. Most importantly, the price of electricity remains prohibitive and the people interviewed invariably stated economic reasons for not using stoves, heaters and other electric appliances. Wood can be collected free of charge. Secondly, while there has been a major shift to using LPG for cooking purposes, especially in the summer months, wood fuel still has the advantage of room heating during the winter months. Consequently, firewood remains the preferred fuel for cooking and heating in villages.

In theory there is scope for reducing the use of fuel wood in the villages through increased use of electricity for heating and cooking purposes. There are several preconditions to this transition, which would take time to materialize. First, people must become confident that the electric power supply is now adequate and stable. Secondly, increasing the energy efficiency of the traditional housing could provide an important means to reducing heating needs. Thirdly and most importantly, transition to electric heating and cooking must be affordable to the population. This means a considerably lower price per KWh, i.e. an even higher subsidy than is the case right now.

The field work did find a reduction in fuel wood use, mainly due to a shift towards LPG. It is however very difficult to estimate the amount of fuel wood that has been saved in the past years and impossible to attribute these savings to the impacts of the Project. Similarly, it is difficult to estimate the impacts of these savings on **deforestation rates and biodiversity conservation**. The mission did not find evidence for transition from '*jhoom*' cultivation to irrigation-based agriculture and the resulting positive impact on biodiversity conservation. The Project has a component that promotes improved designs for water mills, including the replacement of wooden blades and runners with iron ones. Taking into account the environmental impact of producing metal parts it is unlikely that this component has a positive environmental impact.

In sum, it appears safe to assume that the Project has had little impact on fuel wood usage and, consequently, deforestation and biodiversity in the HHP area.

The field survey carried out under the TER team revealed that there has not been any significant in- or **out-migration** in the project areas. This finding was supported by the qualitative interviews carried out by the team amongst the villagers.

The HHP has made an impact on global warming through the SHP schemes in the **tea-gardens** in Assam and West Bengal. There the Project has played a direct role in replacing diesel with hydro power. The four tea garden SHP schemes could result in annual savings of 200,000 liters of diesel. It is however unclear whether there is scope to increase the number of schemes on a purely commercial basis, that is, without the current 50% subsidy.

In conclusion the global environmental benefits of the Project appear thus far insignificant. Furthermore, it appears that little emphasis is given in project implementation to the global

environmental dimensions of carbon emission reduction, deforestation control and biodiversity conservation. The focus has been on energy provision and use.

3.8 Inter-linkages between global and local benefits

Energy production through small hydro is by and large clean and does not result in GHG emissions, which produces apparent global environmental benefits that are at the centre of the GEF mandate. At the landscape level, the environmental disruption of SHP schemes is minimal due to their limited scope. The HHP schemes do not require damming of major rivers or the creation of large reservoirs. Consequently, their direct impacts on habitat destruction, population displacement and land use are largely negligent, pertaining only to the immediate location of the power plant. During construction employment was generation and, to a lesser degree, in operation and maintenance of the power plants. The employment impact has, however, been limited to a few local people. At the household level, a reduction in the use of fuel wood for lighting and cooking leads to reduced levels of indoor air pollution and associated health risks.

However, as argued in the previous chapter, increased electricity usage and economic development per se can lead to less than sustainable lifestyles. Consideration should also be given to the overall preferability of SHPs viz. large-scale hydropower, especially in remote and sparsely populated areas. There is evidence that unit costs of power produced drop with larger schemes. In areas that are not served by the national grid the local benefits of SHP schemes would be most evident.

The benefits of **reduction of deforestation and conserving biodiversity** to the local communities are obvious. For example, in the hilly regions of Himachal Pradesh where the Titang, Kothi and Solang projects visited by the mission operate, the risk of landslides and rock falls is considerably increased by deforestation. These pose major risks to the infrastructure and transportation, as well as life in the villages. Maintaining the forest cover in the hills also improves the hydrological balance and consequently the water supply. Vegetation cover is also important for the sustenance of productive topsoil that can be used for farming. As long as the population is dependent on firewood as fuel for cooking and heating, deforestation would lead to scarcity of wood and consequently long trips for fuel wood collection. This would pose an additional burden to the villagers, especially women.

The issues pertaining to '*jhoom*' cultivation, which the project is aimed at transitioning to irrigation-based agriculture through the use of hydel, are more complex. Shifting cultivation has been practiced in the hills for centuries with little environmental damage. However, the increasing population has led to the intensification of land use and shorter fallow periods. This in turn threatens the sustainability of the production and poses stress on the environment. Theoretically, utilizing emission-free small hydel to irrigate sedentary agriculture would bring about both global and local benefits. In practice for more simultaneous change in a number of areas would be needed to reduce '*jhoom*' cultivation

In conclusion, there are numerous inter-linkages between global and local benefits and there are good possibilities for creating win-win situations in which both the local populations and the global environment benefit.

3.9 Missed opportunities

The case study team identified the following areas, in relation to the India HHP, where GEF could have had a larger impact both concerning the global environment and local benefits.

First of all, by focusing on additional electricity production through SHP schemes and improved water mills, the GEF missed an opportunity to make a major difference in India in reducing greenhouse gas emissions. If one looks at the whole of the Indian economy and tries to identify where the biggest

gains can be made from a global environmental perspective this does not seem to be in reducing firewood consumption by rural households or improving the efficiency of water mills. A more thorough review of the Indian economy and the sectors contributing to GHG emission would have identified commercial sectors where more results could have been achieved with less input (see Appendix E). In a case of preserving biodiversity a rural focus does of course make sense.

Secondly, if for whatever reason, reducing firewood consumption by rural households had been identified as strategic to the GEF mandate, then a proper analysis of the available options and people's preferences would not have led to a project to increase electricity supply but to providing cheap LPG.

Thirdly, if for whatever reasons enhancing electricity supply to remote rural households had been identified as of strategic importance, then an analysis of the bottlenecks in getting power to the people would have probably identified the need to strengthen the grid, rather than producing more energy. Even if the analysis had also identified the need for more power at the tail end of the grid, then strengthening the grid to those remote areas would have been seen to be part of the solution.

Fourthly, if generating more electricity through SHP had been identified as of strategic importance to GEF, then an analysis of the existing level of electrification would have led to a focus on those areas that would not be grid connected for the foreseeable future, if ever. As a result the focus would have been on stand-alone units, not grid connected commercially viable schemes. In the mean time the GoI has started a program to electrify all villages that cannot be supplied from the grid through non-conventional energy sources including SHP by 2007 (GoI, 2003).

Fifthly, if the potential for stand-alone SHP schemes had been properly understood then the focus of the activities would not have been the States close to Delhi and AHEC (Roorkee), but in the North-Eastern States and to a more concerted effort to build up the capacity of the two Institutes in that area.

Sixthly, when it came to the strengthening of the three regional institutions the Project fell short of the expectations. In the original design, three technical institutions were selected each with a regional focus: AHEC in Roorkee for the northern region; Institute of Science and Technology, Itanagar, for the NE region; and College of Engineering, Jammu, for the NW. However, for various reasons, some of them unavoidable such as lack of security and lack of state level counter funding, only AHEC was strengthened under the Project. This has slowed down the development of small hydro in the north-east and north-west, which is unfortunate, as these regions have considerable potential in the sector.

Seventhly, if the importance of stand alone unites had been understood and be seen to be important to global and local benefits and sustainability of SHP schemes, then community participation would have been given due importance. In the implementation of the HHP such participation is almost completely absent and this is one of the major shortcomings of the Project as it is.

Finally a major missed opportunity is not seeing rural electricity supply as part and parcel of the livelihood and development of local people. The assumption seems to have been that supplying (better) electricity would automatically lead to a wide range of improvements. This assumption is unrealistic. Because of the narrow focus on electricity supply many opportunities for synergy between the HHP and other local government, non-government and commercial sector activities have been lost.

All of the above-mentioned missed opportunities have one thing in common; they have reduced the possible impact of the GEF funding to India on enhancing the global environment considerably. Those missed opportunities mean local people have benefited much less than they could have otherwise.

4 LESSONS LEARNED

This chapter summarizes the lessons learned from the case study of the local benefits of the India HHP. Following a summary of the findings, the lessons learned are printed in bold and in italics. **These lessons learned focus on how in future projects and programs the GEF might better achieve, sustain and replicate global environmental impacts.**²

1 Conceptual issues and assumptions

The HHP was one of the GEF's first projects, conceived during the pilot phase and possibly designed in a hurry. Nevertheless, from a global, strategic perspective it is unclear why in India the GEF decided to focus on increasing electricity production through SHP. Looking at the Indian economy it seems that much more global environmental benefit can be achieved in the commercial sector than in rural households, the focus of the HHP. Furthermore if firewood consumption by households was the most crucial issue, then stimulating the use of LPG, rather than electricity, would have made sense. The assumption that people would substitute firewood used for cooking and heating by electricity seems to be as untenable now as they would have been when the HHP was designed. Furthermore the project design does not seem to have taken into account the high and growing percentage of rural electrification in the early 90s. Finally some of the HHP objectives (such as stand alone schemes that had to be commercially viable) were mutually inconsistent.

The GEF must carefully scrutinize project concepts and objectives to ensure that they are internally consistent, that underlying assumptions (including financial viability) are spelled out, that sectors and activities are selected that ensure maximum global environmental impacts. (+4/-4)

2 Institutional

Strengthening of key national institutions like MNES and state level organizations like HIMURJA, UREDA and AHEC has been done and this has contributed much to the HHP achieving one of its main objectives: replication of SHP schemes through the private commercial sector. AHEC is in fact providing technical and consultancy services to government and commercial sector projects throughout India. However, for various reasons two institutions in the NW and NE of the country have not been strengthened partly. The lack of institutional capacity has limited the impact of the HHP in the NW and NE regions that have much potential for SHP. Furthermore, although the project envisaged community involvement and people's participation, no capacity building of community institutions was included in the project design nor any budgetary provisions.

During the design phase the GEF must conduct a capacity mapping of all organizations that are crucial in achieving project objectives and then ensure appropriate capacity building and necessary budget provisions. (+12/-0)

² At the local stakeholders' workshop held on 20 July 2004, the 13 participants were asked to 'vote' for or against these seven lessons learned. They were each given 7 green and 7 red dots and could use as few or as many as they wanted. Behind each recommendation the number of 'for' (+) and 'against' (-) votes are noted. The only recommendation not accepted is the first, which would have resulted in the HHP not being done. Given the audience this outcome was predictable. The other recommendations were broadly supported.

3 People's participation

In the HHP very little has been done in the area of people's participation. The master plan and the zonal plan are purely technical, IREDA is purely financial and MNES appears to have a limited mandate, focused only on increasing electricity production. Lack of people's participation has led to questionable activities (handing over free appliances), otherwise unnecessary delays (land acquisition) and even temporary closure of a SHP (due to interference with irrigation) and to the livelihoods of local people being threatened (when traditional water mills became obsolete because of water diversion and grazing was restricted). All of this has antagonized the very people whom the Project wanted to engage in more environmentally friendly energy use. This has undermined the very changes in people's livelihood activities that were supposed to yield global environmental benefits. Much of this can be traced back to a lack of attention for people's participation in the project design stage.

The GEF must ensure that in all projects in which local people are impacted or involved one way or another, people's participation is an integral part from conceptualization all the way to implementation and O&M and that this integration is reflected in the choice of cooperating organizations, the budget, the technical assistance and the project timeframe. (+14/-0)

4 Integration with other development initiatives

Although there have been national level linkages with other government, non-government, state and commercial sector programs, the design of the project did not foresee the need to dovetailing scheme-level HHP activities with local developmental activities by other key developmental actors. While such dovetailing of activities between government departments is notoriously difficult in many countries, two other main reasons are the narrow, technology and supply driven approach of the HHP and its short-term, project mode of implementation. Much potential synergy has been lost due to the lack of integration of SHP development with other local and longer term developmental activities. As a result both global and local benefits of SHP schemes have been less than expected.

The GEF must optimize global and local benefits by ensuring that GEF supported activities are an integral part of national long term development processes and integrated with relevant local development initiatives. (+10/-1)

5 Ensuring backward and forward linkages

In the case of electricity, distribution is an integral part of the supply chain. In the design of the Project only stand-alone schemes were envisaged and therefore only local grids. When the Project shifted to mainly grid connected schemes the Electricity Act did not allow MNES to get involved in developing the grid, which, until 2003, was solely under the mandate of the State Electricity Boards. The HHP therefore focused on electricity production and not on strengthening these grids. However, on the ground, problems of the tail-end and the connection to the wider grid have resulted in poor supply and wastage due to underutilization of installed plant capacity. Although improving the grid requires high investments, combining increased production and an improved grid would have yielded a higher rate of return and more global and local benefits than by focusing on production only. However, the project design did not allow this.

The GEF must ensure that backward and forward linkages are integrated in the project design and then monitor these linkages during implementation. (+13/-0)

6 Improved monitoring and flexibility

The HHP has deviated from the project objectives of doing stand-alone SHP schemes and ensuring extensive people's participation. The lack of focus on truly stand alone schemes can to a large extent be explained by the other HHP objective of stimulating commercially viable schemes. The idea was that these schemes would work as demonstration projects for the commercial sector, ultimately leading to replication, a key GEF goal. While replication has certainly been achieved, the objective of stand-alone units has been sacrificed in the HHP. In the case of people's participation UNDP and the MTR have stressed all along the need for more to be done in this area. However, the project design had no financial provisions for this nor apparently could the design be changed midway to accommodate growing understanding and/or changed circumstances.

The GEF and the implementing agency must carefully monitor implementation as well as the project assumptions and external environment in relation to their influence on the project strategy and achievement of objectives and when necessary, during implementation, adjust the project design and budget accordingly. (+9/-1)

7 Inter-linkages between global environmental and local benefits

While the institutional and replication objectives of the HHP have been met, most of the global environmental and local benefits are yet to be achieved. The case study suggests that in a local community-based project global environmental benefits can only be achieved locally. Therefore, local interventions and benefits must be promoted and proper design and implementation should then ensure global benefits, thus creating a win-win situation.

Since global environmental benefits can only be achieved and sustained locally in projects whose strategy relies on making local development sustainable, interventions supported by the GEF should start with locally beneficial interventions that are (re-)designed and implemented in such a way as to maximize global environmental benefits. (+11/-0)

APPENDIX A: TERMS OF REFERENCE

January 22nd 2004

Global Environment Facility

THE NATURE AND ROLE OF LOCAL BENEFITS IN GEF PROGRAM AREAS

CASE STUDY

India: Optimizing Small Hydel Resources in Hilly Regions

TERMS OF REFERENCE

For

Study Team

Duration:

TERMS of REFERENCE

20 days

Start date:

22 February 2004

GEF Team Leader

Dirk R Frans (SEI)

Team Members

Nilufar Matin (SEI)

V. Ratna Reddy (CESS/SEI)

Juha Uitto (UNDP/GEF)

A. Objective of the Portfolio Wide Study

The GEF mandate incorporates the role of local benefits through its emphasis on a sustainable development approach and by requiring that the programs and projects it funds be country-driven and based on national priorities designed to support sustainable development. In this study, local benefits are defined as:

“Project outcomes, which directly or indirectly have positive impacts upon people and ecosystems within or adjacent to project areas, and which provide tangible gains in the livelihoods of communities and the integrity of ecosystems.”

The GEF is conducting a portfolio wide study to better understand the relationship between local benefits and the attainment of global environmental benefits. The objective of this study is to assist in maximizing the level of local benefits included in future GEF policy, strategies, programs, project design and implementation within the context of GEF’s mandated focus on global environmental benefits. The study includes in-depth desk reviews, internal and external expert interviews as well as primary and secondary fieldwork case studies.

The India: Optimizing Small Hydel Resources in Hilly Regions Project (Hilly Hydel Project) has been selected as a case study because of the explicit linkages the project design make between improvements in local benefits (particularly health, income and employment benefits) and the attainment and sustainability of global environmental benefits. The project has a strong potential to yield critical findings, lessons and recommendations, which will inform the future development of GEF interventions in the Climate Change focal area.

B. Objectives of the Case Study

The objective of the case studies is to understand the relationship / linkage between local benefits (and/or negative impacts) and the attainment of global environmental benefits of the GEF supported project: Optimizing Small Hydel Resources in Hilly Regions .

C. Scope of Fieldwork Investigation for the project

The Study Team will report on progress in achieving results relating to project objectives, outputs and outcomes, within the specific context of (depending on availability and quality of data):

- Assessment and description of the types and scale of local benefits and negative impacts, intended or unintended, which have resulted from the GEF Project, including local perceptions of the benefits and impacts.
- Examination and description of the nature of the links between local benefits and the attainment of global environmental benefits (according to project environmental indicators)³. This will be based on an analysis of linkages in terms of how global environmental benefits can affect local benefit / negative impacts and how the generation of local benefits / negative impacts can affect global environmental benefits.

³ See Todd, 2003, p 10.

- Evaluation and description of the extent to which the strategy and environmental management options in the project design and implementation properly incorporated the opportunities to generate greater levels of local benefits: essentially looking at what the projects did not do, as well as what they did do.

D. Analysis Framework and Expected Outcome

The case study will address the following questions:

1. **What are the overall objectives and outcomes of the project?**
 - a. **Overview of the investment:** a brief profile of the project being evaluated, which describes the project policy and institutional context, structure, objectives and anticipated results (outputs, outcomes, impacts) and relates this to the host country's development context. Specifies intended local benefits and target groups. Based on existing documents and on interviews with stakeholders.
 - b. **Overview of Global Environmental objectives and achievements of the project:** This overview will be done based on existing documents and interviews with expert stakeholders. It will include an assessment of the accomplishments of GEF funded activities in supporting institutions, policies and activities that contribute to the improvement in biodiversity conservation. It will include a review of the environmental resource characteristics of the area.
2. **What have been the local impacts (human and environmental) of the project?**
 - a. What are the types and scale of local benefits and negative impacts?

The study will assess the project's positive and negative impacts using a livelihoods approach focusing on livelihood capitals, including natural, financial, social and institutional, physical and human capitals. (See Annex A: Model of Livelihood).

- This analysis will be differentiated by gender within each stakeholder group. Attention will be paid to indigenous / ethnically distinct people and other disadvantaged stakeholders where they constitute a distinct group.

- b. What are the impacts of the GEF project in the relationship of local level processes to wider social (including gender), economic and environmental processes?

The study will examine how impacts on the various capitals have affected resilience and vulnerability of local communities to shocks from external factors that are normally beyond their control. Stronger or weaker livelihood capitals are assumed to lead to higher or lower resiliency respectively. The study should try to assess the extent to which this assumed relationship is actually taking place or at least should provide evidence that the impact on capitals is resulting in higher or lower resiliency. This assessment can be done by looking at processes that occur at different levels but have a direct impact on local populations, two examples are:

- Processes at the local level such as better-organized communities (social capital) that are more capable to respond to food insecurity and natural resource variations (e.g., drought).
- Changes in external institutions such as laws and regulations that might result in benefits or costs at the local level.

3. What are the contributions or detriments of the project's local impacts (positive or negative) to the attainment of global environmental benefits?

The study will identify the links (positive and/or negative) between local benefits and the global environment. The following are four examples of possible patterns that the study might consider to assess these links:

- Changes in production and consumption patterns that reduce or exacerbate global environmental stresses (e.g., substitution of poultry for game meat).
- Cumulative local environmental changes that over large areas can have positive or negative global environmental consequences (e.g. deforestation or reforestation).
- Reduction of vulnerabilities that can contribute to changes to the balance in policy priorities (e.g. moving from the urgency of poverty reduction to improved environmental management).
- Changes in the external institutional environment, (e.g. the development of better governance as a consequence of local level empowerment and greater public awareness and political support for environmental issues)

4. Considering the projects objectives, did the overall strategies and environmental management options selected in the projects effectively incorporate the opportunities to generate local benefits?

Specific attention will be paid to opportunities for women, the poor and minority groups, as these are more likely to be overlooked in project design and implementation.

5. What are the key findings and lessons to be learned from the project⁴?

E. Stakeholder Involvement

The Study Team will use appropriate participatory methods, to ensure active and meaningful involvement by investment partners, beneficiaries and other interested parties. Stakeholder participation will be integrated in fieldwork design and planning; information collection; development of findings; evaluation and verifying findings.

⁴ Including any relevant accountability issues, such as elements of approved Project plan, which were not implemented?

F. Methodologies

The Study Team will develop methodological tools for data collection based on the project contexts. The methods may include quantitative and qualitative approaches⁵, such as survey questionnaires, focus groups and formal and informal semi-structured interviews. Identification of the suite of methods will be context dependent but be agreed by the Team Leader and other Study Team members.

The Study Team will:

- Conduct national-level stakeholder interviews:
 - GEF focal point.
 - Government Ministries and Departments.
 - Environmental NGO and Community CBO representatives
- Survey project documentation and correspondence
- Interview / conduct focus groups etc with key local stakeholders (e.g. project managers, local government officers, local beneficiaries (including gender groups, local NGOs / CBOs, and the private sector).

These activities will further establish the data inputs into the case study report.

G. Accountabilities and Responsibilities

The GEF M&E Team Leader of the project study is responsible for:

- Overall responsibility and accountability for the case study
- Coordination within the Study Team
- Guidance throughout all phases of execution
- Approval of all deliverables
- Co-ordination with other case studies

The Team Members are responsible for, where necessary:

- Cooperating with the Team Leader to develop and implement a fieldwork program
- Assisting with day-to-day management of operations in the field
- Progress reporting to GEF M&E Team Leader
- Co-compiling a report based on initial field study visit under the direction of the Team Leader
- In the event of any differences of opinion concerning findings, lessons and recommendations contained within the report, Team Members will submit these in writing to the Team Leader for inclusion in an annex to the final report

H. Deliverables

The Study Team will prepare:

- Case Study Report

⁵ Given the time and resource constraint they are may be limited to qualitative approaches.

The report will be submitted to the GEF Overall Study Team Leader (Dr. David Todd)

Draft Case Study Report

The first draft of the report will be produced by the Study Team by 21st May 2004 and circulated to project stakeholders for comments. project stakeholders will be given 7 days to comment on the draft case study report.

Final Case Study Report

The final case study report will incorporate key stakeholder comments, as appropriate and be produced by the 1st June 2004.

APPENDIX B: ACTIVITIES AND PEOPLE MET

ACTIVITIES AND PEOPLE MET

Date	Place	Activities
22 Feb	To Delhi, India	<ul style="list-style-type: none"> International travel by Dr. Juha Uitto, Mrs. Nilifur Matin and Mr. Dirk R Frans National travel by Dr. V. Ratna Reddy
23 Feb	Delhi, UNDP	<ul style="list-style-type: none"> Meeting with Mr. Maurice Dewulf (Senior Deputy Resident Representative), Dr. Neera Burra (Assistant Resident Representative Environment & Energy Division and Project staff) and Mr. Anil Arora (Assistant Program Officer) on the mission's objectives and approach Meeting with Dr. Praveen Saxena (Director & National Project Director Ministry of Non-conventional Energy Sources (MNES)) and Prof. Anil Chandy Ittyerah (Impact Assessment-cum-Terminal Evaluation of Hilly Hydel Project) to brief the mission members on the Project, including viewing of the Project video "Power to the People" produced by MNES Meeting with Mr. Sunil Khatri (Joint Secretary & National Project Director, MNES)
24 Feb	Neergad	<ul style="list-style-type: none"> Travel by road to the Alternate Hydro Energy Centre (AHEC), Roorkee, (Uttaranchal State) Visit water mill demonstration site at Neergad
25 Feb	Kanvashram	<ul style="list-style-type: none"> Briefing by Mr. Arun Kumar (Director AHEC, Roorkee) on AHEC activities and tour of AHEC facilities Visit Kanvashram SHP including briefing on the technical aspects of the Project and interviews with local men, women and Panchayat Ray representatives
26 Feb	Delhi	<ul style="list-style-type: none"> Travel back to Delhi by road Meeting with Mr. D. Majumdar (Director-Technical, Indian Renewable Energy Development Agency Ltd.) for a briefing of the role of IREDA in facilitating SHP as a financing institute Meeting with Mr. S.K. Joshi (Director, Ministry of Environment & Forests and GEF Focal Point in India)
27 Feb	Delhi	<ul style="list-style-type: none"> Meeting with Dr. Praveen Saxena (Director & National Project Director MNES) to be briefed on the Project and discuss the field visits in detail Meeting with Prof. Anil Chandy Ittyerah (Impact Assessment-cum-Terminal Evaluation of Hilly Hydel Project) on the tentative findings of his evaluation
28 Feb		<ul style="list-style-type: none"> From Delhi to Shimla by air Meeting with Mr. Sushil Srivastava, IFS, (Chief Executive HIMURJA, Mr. Subhash Tejpal (Director), Mr. Ashok Rajan (Joint Director), Mr. B.K. Kaushal (Executive Engineer (Civil)) and Mr. Mahesh Sirkek (Executive Engineer (E)) Meeting with Mr. R.K. Varma (Chief Executive Officer Sai Engineering Foundation) and Mr. Munish Sharma (Assistant General Manager)
29 Feb	Shimla to Kappa	<ul style="list-style-type: none"> All day travel by road from Shimla to Kappa

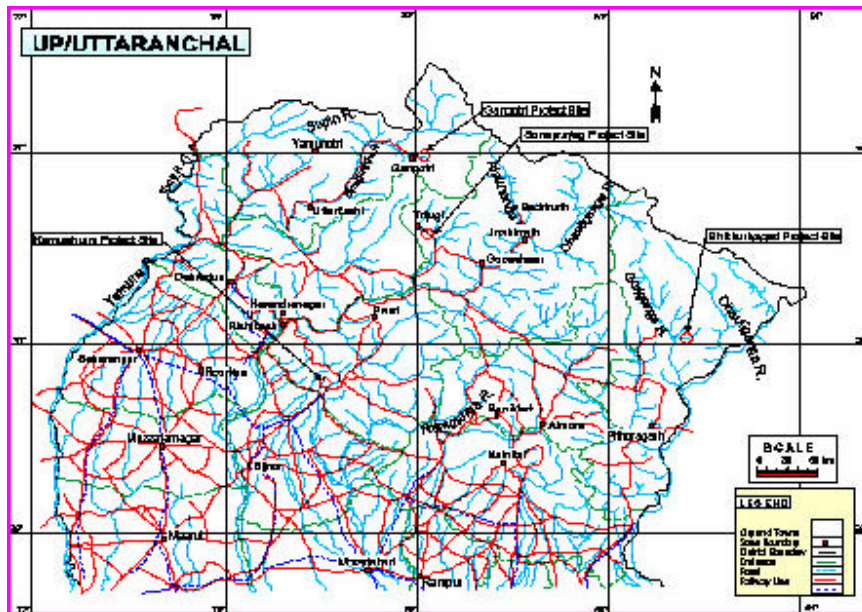
Date	Place	Activities
1 Mar	Dabbling, Boubling, Namgia	<ul style="list-style-type: none"> Travel from Kappa to Titang SHP site Brief introduction to the Titang SHP by Mr. Prakash Thakur (Project Engineer, Sai Engineering Foundation), Mr. Pradip Bhanot (Project Officer, Kinnaur), Mr. Sunil Gupta (Executive, Sai Engineering Foundation) and Mr. Rajendra Negi, (Mechanical Engineer) Mrs. Nilufar Matin and Mr. Dirk R Frans visit Namgia village and interview local people Dr. Juha Uitto and Dr. V. Ratna Reddy visit Dobbling village and interview a number of people After lunch the team splits up, and Dr. V. Ratna Reddy and Mrs Nilufar Matin travel to Nako and interview local people Dr. Juha Uitto and Mr. Dirk R Frans go to Pooh Mr. Sushil Sana (Panchayat Pradhan) Dr. Juha Uitto and Mr. Dirk R Frans travel to Rampur
2 Mar	Pooh	<ul style="list-style-type: none"> Dr. Juha Uitto and Mr. Dirk R Frans travel from Rampur to Manali Dr. V. Ratna Reddy and Mrs. Nilufar Matin interview people in Pooh village and then return to Rampur
3 Mar	Manali, Kothi, New Kothi, Palchan, Bharua, Shonag, Kullu	<ul style="list-style-type: none"> Dr. V. Ratna Reddy and Mrs. Nilufar Matin travel by road from Rampur to Kullu Dr. Juha Uitto and Mr. Dirk R Frans visit five villages impacted by Kothi and Solang SHP Farewell dinner at the Able Garden Valley for Mr. Ashok Rajan (Deputy Director HIMURJA) and Mr. R. K. Varma (CEO, Sai Engineering Foundation)
4 Mar	Kullu to Delhi and Delhi, UNDP	<ul style="list-style-type: none"> Study team returns from Kullu to Delhi by air Debriefing meeting at UNDP with Dr. Neera Burra (Assistant Resident Representative Environment & Energy Division and Project staff) E-mails to Dr. Dave Todd (LBS Team leader) on proposed in-depth study
5 Mar	Delhi, UNDP	<ul style="list-style-type: none"> Typing out the field notes Discussions and e-mails about
6 Mar	Delhi, UNDP	<ul style="list-style-type: none"> Searching the internet for case studies on the local impacts of mature SHP schemes Typing out field notes
7 Mar	Delhi, hotel	<ul style="list-style-type: none"> Team member Dr. Juha Uitto returns to New York Typing out field notes and starting drafting the case study report
8 Mar	Delhi to Guwahati	<ul style="list-style-type: none"> Dr. V. Ratna Reddy, Mrs. Nilufar Matin and Mr. Dirk R Frans fly from Delhi to Guwahati for the Assam State part of the field work Visit to Kalmoni SHP in Rani Tea estate and meeting with Mr. Autri Bhattacharjee (Director MKB (ASIA Pvt. Ltd.)) and Mr. D.J. O'Connor (Teagarden Consultant) Interviews with a number of teagarden employees living on newly built and electrified houses on the tea estate
9 Mar	Guwahati and back to Delhi	<ul style="list-style-type: none"> Meeting with Mr. Dharma Ranjan Das (Principal Scientific Officer & Head of the Assam Renewable Regional Office) Meeting with Dr. Baruwa (Director of the Assam Energy Development Agency) and Mr. Mrinal Krishna Chaudhury

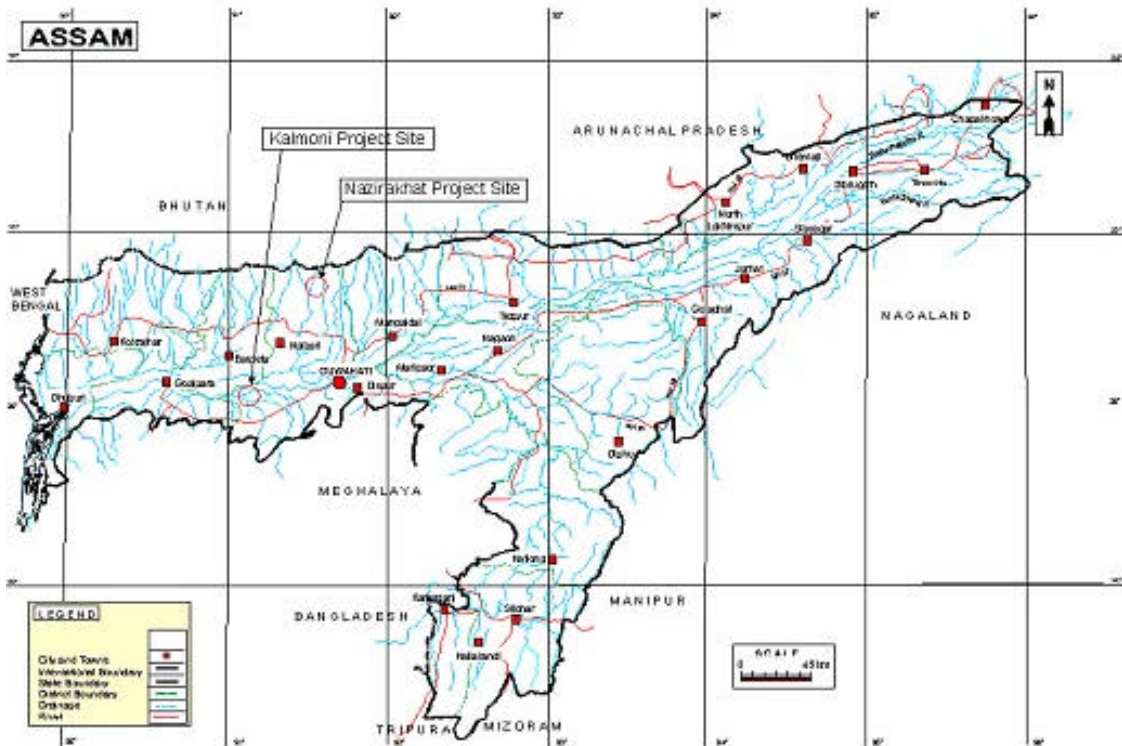
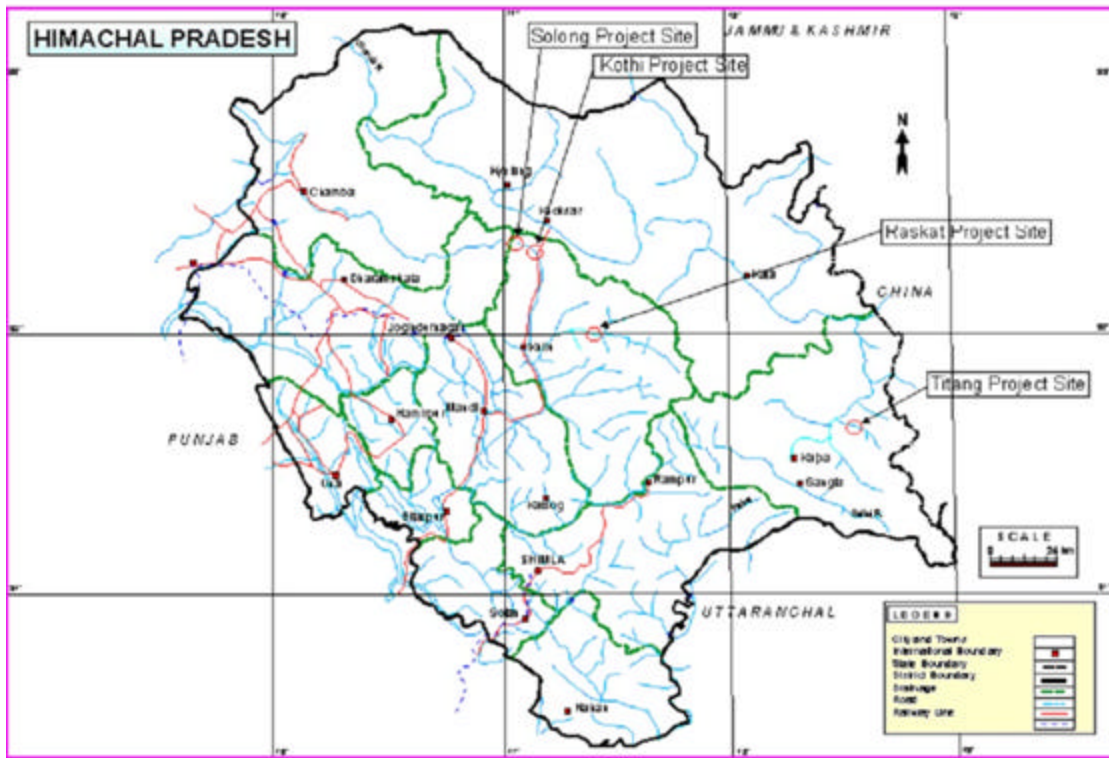
Date	Place	Activities
		<p>(Senior Scientific Officer of the Assam Energy Development Agency)</p> <ul style="list-style-type: none"> • Meeting with Mr. D. Kedia (Owner of Hydel Equipments and Industrial Consultants) a private commercial firm producing modernized water mills • Team members fly back to Delhi • Finalize the initial draft case study report and e-mail it to Dr. Juha Uitto for input
10 Mar	Delhi, UNDP	<ul style="list-style-type: none"> • Include Dr. Juha Uitto's feedback in the report • E-mail the initial draft case study report to
11 Mar	Delhi, UNDP	<ul style="list-style-type: none"> • Meeting to discuss the initial draft case study report with Dr. Praveen Saxena (Director & National Project Director MNES), Prof. Anil Chandy Ittyerah (Impact Assessment-cum-Terminal Evaluation of Hilly Hydel Project) and Mr. Anil Arora (Assistant Program Officer) • Completing draft HHP case study report • Dr. V. Ratna Reddy returns to Hyderabad.
12 Mar	Departure	<ul style="list-style-type: none"> • Team members Mrs. Nilufar Matin and Dirk R Frans return to The Netherlands
20 July	Delhi	<ul style="list-style-type: none"> • Local stakeholder workshop where the draft report was discussed and feedback given by 13 key stakeholders

APPENDIX C: MAPS OF INDIA AND STATES VISITED



Source: The following three state maps produced by AHEC, Roorkee





APPENDIX D: GLOBAL BENEFITS AND GLOBAL-LOCAL LINKAGES

Global environmental benefits

The Project document is explicit about the justification for assistance from UNDP/GEF based on the Project's intended **global environmental benefits**. It is stated that the Project intends to achieve:

- Reduction in global warming through use of hydro energy;
- Protection of biodiversity by reducing deforestation; and,
- Reducing migration of population from remote areas to urban centers, thus affecting pollution reduction in urban areas.

The Project was expected to lead directly to the reduction in the deforestation trends in the hilly regions of India. The Project document explains that energy produced by the demonstration Projects and the upgraded water mills would be used for cooking, heating, etc., and that this will save fuel wood with a consequent reduction in deforestation. Further, it was asserted that availability of electricity for pumping of water for irrigation purposes would change the agricultural practices from the traditional shifting cultivation (*'jhoom'*) to irrigation-based cultivation. Afforestation of catchment areas would be carried out by the forest departments of the State governments involved.

According to the estimates contained in the Project document, there would be a saving of 7,000 tons of fuel wood per year and a reduction in carbon emissions by about 3,200 tons per year on completion of the 20 demonstration Projects. These savings would result from a shift to using electricity for cooking and heating instead of fuel wood. It was foreseen also that the small hydels would replace carbon emitting diesel generators.

As far as **village hydel** schemes are concerned, the expected scenario for emissions reduction is based on a series of assumptions pertaining to fuel substitution with electricity produced through the development of small hydel. It was assumed that with the availability of electricity at affordable price households would automatically switch to using electric appliances replacing the burning of fuel wood. No explicit activities to enhance this transition have been included in the Project.

The mission findings confirm that this energy transition is taking place only on a limited scale in the rural households in the target areas served by the SHPs. While highly appreciated and useful, electricity is used primarily for lighting and entertainment (especially TV) purposes. It plays only a minor role in cooking and heating. Even in the Titang scheme where the NGO distributed 1,000 electric heaters and 200 electric cookers to the intended beneficiaries free of charge, very few households have actually taken to using them. In the Pooh, 370 households (out of the total of 409) received free electric stoves. According to the Panchayat Pradan, only government employees are actually using them (this is probably explained by their better than average income levels and familiarity with an urban lifestyle), while other inhabitants continue cooking with fuel wood and LPG. In villages, such as Dubling, none of the households uses the stoves, which have been stored away. The explanations to this reluctance are two-fold. Most importantly, the price of electricity remains prohibitive and the people interviewed invariably stated economic reasons for not using stoves, heaters and other electric appliances. Wood can be collected free of charge.

Secondly, while there has been a major shift to using LPG for cooking purposes, especially in the summer months, wood fuel still provides notable advantages. First and foremost, cooking with wood provides the additional benefit of room heating, especially during the long and cold winter months in the mountains. LPG is also harder to use when it is very windy. Furthermore, storing of adequate numbers of LPG containers for the winter months when their transportation is difficult is problematic to households. Several households also cited economic reasons for not using more of LPG. Consequently, firewood remains the preferred fuel for cooking and heating in villages.

Nevertheless, there has been an overall reduction in fuel wood usage. This can primarily be attributed to two factors. First, the above-mentioned shift to cooking with LPG. Secondly, in the past, rural households used to use firewood and kerosene for lighting purposes. This practice has been replaced by electric lights. Only the latter cause of reduction in wood usage can be attributed to electricity. However, even in this case it would be impossible to credit this change to the Project. All of the Project sites visited have been connected to the grid for some two decades. The Project's main contribution has been providing better quality and stability of electricity in the grid's tail-end. The substitution of wood lighting by electricity has taken place much before the commissioning of the Projects.

It is very difficult to estimate the amount of fuel wood that has been saved in the past years. It is even more difficult to attribute these savings to the impacts of the Project. Interviews with people reveal a wide range of estimated reductions, from 65% reduction in fuel wood usage by a relatively well-off family who can afford the use of LPG to no change at all reported by poorer respondents from two households, all in Kothi. The Pradhan of Kulang village that is being served by both the Kothi and Solang schemes estimated that there would have been a 15-25% reduction in fuel wood usage in the five villages of the Panchayat over the past 8 years. Of course, this period predates the SHPs when electricity and LPG already were available in all of the villages.

Similarly, it is difficult to estimate the impacts of these savings on deforestation rates and biodiversity conservation. Apart from fuel substitution, there are government policies that ban the cutting of trees in the forests. Villagers thus mostly collect branches and brushes that have fallen – or left by commercial tree cutting operations that continue unabated – which makes fuel wood less available (it would seem obvious, though, that the government regulations are frequently flaunted). Interviews with Himachal Pradesh Forestry Department officials by the TER team indicated that the officials have not detected any change in deforestation rates in the Project areas (Ittyerah, 2004).

In sum, it appears safe to assume that the Project has had little impact on fuel wood usage and, consequently, deforestation and biodiversity in the area.

There is nevertheless further scope for reducing the use of fuel wood in the villages through increased use of electricity for heating and cooking purposes. There are several preconditions to this transition, which will take time to materialize. First, people must become confident that the electric power supply is now adequate and stable. Over the years of erratic and weak power supply, people have developed a certain level of cynicism regarding the reliability of electricity. While the voltage has been strengthened and the stability increased in areas where the SHPs are connected to the grid, there are still frequent and sometimes lengthy power disruptions. Reducing these requires not only supplying additional power from the SHP stations but, notably, improvement of the existing grid for better distribution and evacuation. This should be a high priority for any future Project.

Secondly, increasing the energy efficiency of the traditional housing could provide an important means to reducing heating needs. This could be achieved by improved insulation and ventilation of the houses, better building materials, and reduction of the size of the spaces that need to be heated. Some of this is already taking place. New houses are being built with bricks, which have better heat retention qualities. The mission also observed a household in Kothi who had lowered the ceilings of their house with the objective of reducing the space.

Thirdly and most importantly, transition to electric heating and cooking must be affordable to the population, which it currently is not. In Kulang, which is served by both the Kothi and Solang schemes, the Pradhan predicted that 50% of the households would make the transition if they were given the equipment and if the electricity tariffs were subsidized by the government (she also felt that it was the right of the villages to get subsidized electricity; after all, it was locally produced). All in all, electricity usage and economic development must proceed in tandem in a process that will take years

to materialize. The demand for electricity will increase when the economic situation of the communities improves, which is partly spurred by the availability of energy.

The mission could not verify any transition from '*jhoom*' cultivation to irrigation-based agriculture, although it appears that commercialization of agriculture is taking place. In particular, apple orchards and other horticultural gardens are maintained for the market.

The field survey carried out under the TER team revealed that there has not been any significant in- or out-migration in the Project areas. This finding was supported by the qualitative interviews carried out by the team amongst the villagers.

The situation is different regarding the **tea-gardens** in Assam and West Bengal where the Project appears to have played a much more direct role in fuel substitution. The tea estates operated as commercial operations by entrepreneurs have established SHPs as stand-alone units servicing local grids within their domains. There is evidence of large-scale substitution of diesel with electricity. This substitution not only provides the owner-operators with savings in fuel costs (although the SHP investments need first to be recovered), but also have the additional benefit of a cleaner environment for growing tea. There is a growing niche market in the West for high-quality tea produced organically without chemicals. Clean energy that does not leave residues to the crop is an additional advantage to the growers to fetch a higher price on the export market.

It is estimated by the TER team that during the first growing season after the commissioning of the SHP at Chamong, the use of electricity saved 50,000 liters of diesel. Evidence points to similar trends in the other tea estates, such as Kalmoni, Pussimbing and Daragaon, covered under the Project. Assuming the same rate in all of them would result in annual savings of 200,000 liters of diesel. If the demonstration effect of the Project in these estates were to lead to large-scale replication by other tea estates in Assam and West Bengal, there could be major savings in diesel oil usage in northern India. It is however too early to draw further evidence on this matter.

The Project has a component that promotes improved designs for **water mills**, including the replacement of wooden runners and blades with iron ones. This component has potential benefits through reduced deforestation and biodiversity conservation. Traditionally, the water mills' runners are made from trunks of very large trees, which thus need to be felled for this purpose. Furthermore, the life cycle of these runners is only about 3 years on the average, requiring frequent replacement. As there are 40,000 water mills in the state of Uttaranchal alone, utilization of iron runners would provide obvious benefits. Furthermore, these lifespan of iron runners' and blades is significantly longer requiring replacement at the most once a decade.

It is, however, important to consider the environmental cost of producing the iron runners and blades. The iron needs to be smelted and manufactured in a process that inevitably consumes wood fuel and produces carbon emissions. While it is difficult to quantify the environmental costs of this process, it is obvious that it partly offsets the environmental benefits from stopping the use of wooden runners and blades.

In conclusion the global environmental benefits of the Project appear thus far insignificant. Furthermore, it appears that little emphasis is given in Project implementation to the global environmental dimensions of carbon emission reduction, deforestation control and biodiversity conservation. The focus is on energy provision and use.

There is evidence of reduced fuel wood usage in the villages for lighting and cooking purposes. This reduction is, however, mostly due to the increased use of LPG for cooking and the availability of electric lighting. Wood remains the preferred fuel for all households during the winter and for poor households throughout the year.

Both of these substitution processes started well before the SHPs under the Project were commissioned. The incremental savings induced by the Project are impossible to determine in the absence of baseline data.

The decrease in fuel wood usage has not translated into detectable reductions in deforestation rates or biodiversity conservation.

The substitution of diesel fuel with electricity in the tea estate Projects has potentially significant global environmental benefits in the form of cleaner energy and less greenhouse gas emissions. Assuming that all demonstration schemes under the Project were to substitute 50,000 liters of diesel oil per annum, this would result in measurable reductions in emissions.

Having stated this, it is important to bear in mind that the SHPs have only been commissioned quite recently. Their impacts on the global environment are therefore still in the future and will be multiplied once the successful demonstrations result in replication of the models by others. It would appear that there is considerable replication potential both for the commercial SHPs that serve villages and the grid, especially in the more easily accessible areas, as well as those providing power to the tea estates. The ultimate success of the Project in promoting sustainable energy transitions depends, however, on a variety of factors.

Finally, consideration must be given to the fact that promotion of enhanced electricity use and economic growth will inevitably lead to changed lifestyles and increased consumption of goods and services. While this is necessary in areas where poverty is still highly prevalent, experience from more industrialized countries unequivocally suggests that this leads to increased per capita GHG emissions and use of natural resources. Efforts should thus be made to render the development process as environmentally sound as possible.

Inter-linkages between global and local benefits

Energy production through small hydro is by and large clean. It does not result in GHG emissions, which produces apparent global environmental benefits that are at the centre of the GEF mandate. The Project was originally designed to induce reduction in carbon emissions by the generation of electricity through SHPs that would replace the use of fossil fuels, such as wood and diesel.

At the landscape level, the environmental disruption of SHPs is minimal due to their limited scope. SHPs do not require damming of major rivers or the creation of large reservoirs. Consequently, their direct impacts on habitat destruction, population displacement and land use are largely negligent, pertaining only to the immediate location of the power plant. In the case of Kothi in Himachal Pradesh, for example, the power plant was constructed on the land purchased at government rates from two brothers. The Panchayat was involved in approving the purchase. Furthermore, the landowners stipulated in the purchase agreement that one of the sons be trained and employed in operation and maintenance of the power plant. In Uttaranchal, the Neergad scheme was built on the land of the shopkeeper who would then become the owner and operator – indeed the main beneficiary – of the SHP and associated water mill.

It can be added that local benefits have accrued by way of employment generation, especially during construction and, to a lesser degree, in operation and maintenance of the power plants. The employment impact has, however, been limited to a few local people. There is evidence that significant numbers of laborers were brought in from outside of the Project areas for construction of all of the schemes. Largely, at least in Himachal Pradesh, this was due to a local labor shortage caused by the fact that the construction season coincided with an agricultural peak season. Partly, it is suggested that foreign labor, especially from Nepal, was brought in for cost savings purposes.

In the Neergad scheme, the benefits accruing solely to the owner-operator of the SHP and water mill and his family may actually have contributed to widening income differentiation in the village.

The Kanvashram scheme, also in Uttaranchal, was built in connection with an existing village irrigation scheme. Again, no major issues arose regarding resettlement. However, a conflict arose between the local government agency, UREDA, constructing the power plant and the local community. This conflict pertains to the prioritization of water use for irrigation vs. power generation. It stems directly from a total lack of public consultation and participation in the Project planning, design and operation.

All in all, hydel provides considerably clean power with limited environmental disruption that can enhance local economic and social development through better lighting, entertainment and information dissemination, heating, cooking, and productive uses, as discussed elsewhere in this report. At the household level, lesser use of fuel wood will also lead to reduced levels of indoor air pollution and associated health risks.

However, as argued in the previous chapter, increased electricity usage and economic development per se can lead to less than sustainable lifestyles.

Consideration should also be given to the overall preferability of SHPs viz. large-scale hydropower, especially in remote and sparsely populated areas. There is evidence that unit costs of power produced drop with larger schemes. While large hydropower plants inevitably lead to submersion of large areas with concomitant ecosystem damage and population dislocation, the disruptions can be minimized by building the Projects in areas where no resettlement will be needed and where no significant natural areas will be destroyed. Remote areas of Himachal Pradesh would provide such places that are uninhabited and where there is no vegetation due to high mountain desert conditions. In some cases, the environmental impacts of SHPs may in fact be higher, as by definition they need to be built close to where the power will be consumed – i.e. settlements – and require the building of roads and other infrastructure.

In areas that are not served by the national grid the local benefits of SHPs are most evident. Providing power through SHPs where electricity is previously not available brings all the social, economic and health benefits to the area.

In the tea estates that maintain their own local grids, replacement of diesel fuels with clean hydel energy allows the plantations to produce environmentally sound tea that fetches a higher price on the international markets.

The benefits of **reduction of deforestation and conserving biodiversity** to the local communities are obvious. For example, in the hilly regions of Himachal Pradesh where the Titang, Kothi and Solang Projects visited by the mission operate, the risk of landslides and rock falls is considerably increased by deforestation. These pose major risks to the infrastructure and transportation, as well as life in the villages.

Maintaining the forest cover in the hills also improves the hydrological balance and consequently the water supply. Vegetation cover is also important for the sustenance of productive topsoil that can be used for farming. As long as the population is dependent on firewood as fuel for cooking and heating, deforestation would lead to scarcity of wood and consequently long trips for fuel wood collection. This would pose an additional burden to the villagers, especially women.

The issues pertaining to '*jhoom*' cultivation, which the Project is aimed at transitioning to irrigation-based agriculture through the use of hydel, are more complex. Shifting cultivation has been practiced in the hills for centuries with little environmental damage. In fact, the locally evolved agricultural systems using shifting cultivation techniques have proven to be well adapted to the local conditions and less vulnerable to climatic fluctuations than modern agriculture. However, the increasing

population has led to the intensification of land use and shorter fallow periods. This in turn threatens the sustainability of the production and poses stress on the environment. Theoretically, thus, utilizing emission-free small hydel to irrigate sedentary agriculture would bring about both global and local benefits.

In conclusion, the inter-linkages between global and local benefits are manifold and contain good possibilities for creating win-win situations in which both the local populations and the global environment benefit.

These benefits from the Project are, however, yet to materialize. The energy transition from fuel wood, kerosene and diesel to electricity is still far from complete. It will require action on multiple fronts and electricity must become affordable before it provides a viable option to satisfy most of the communities' energy needs.

APPENDIX E: ENVIRONMENTAL BENEFITS: FIXING THE RESPONSIBILITY

It is often argued that environmental degradation is a result of excess dependence of poor on the natural resources, be it fuel wood or fodder. This argument is applied not only at the local level but also extended to global level i.e., developing countries housing majority of the global poor are responsible for greenhouse gases and global warming. As a result, developing countries have become hunting grounds for aid agencies to identify the issues and factors that cause global environmental problems. While it is true that poor depend more on commons for their livelihoods, they are not the degraders. On the other hand, they tend to protect the commons and use them in a sustainable fashion, as they need them most.

A number of micro studies have revealed that poor are the victims rather than causes of degradation (Leach, Melissa and Robin Mearns (1991)). This is mainly due to the reason that the needs of the poor are limited when compared to that of rich. Irrespective of the nature of dependence, i.e., for own use or for earning, the magnitude of their use is marginal. Not only are their needs limited but also they deploy simple techniques of exploitation. Furthermore the poor are often held responsible by looking at their dependence on commons instead of their actual use. The difference is poor may be depending on commons for all their needs while the quantum of the resource they use is much less. On the other hand, the dependence of rich on commons is less as they have alternative avenues but their share in the total consumption is much higher (Reddy, 1999).

In the context of the present study, it is perceived that global environmental benefits can be achieved through the reduction in fuel wood consumption among poor households. It was assumed that clean hydelenergy would substitute the fuel wood and other less clean fuels like diesel and kerosene. At the same time the Projects are expected to be economically viable through market mechanisms like user charges. Our quick appraisal of the local communities in the Project sites revealed that the objectives contradict each other. For, most of the households do not want to shift to electricity beyond lighting, as they can't afford it in the given price structure, which is heavily subsidized already. Any further subsidies would hinder the viability of the Projects. Besides, the climatic conditions in some of the regions do not favor a shift away from fuel wood.

Another important observation is that in majority of the cases households collect dry and waste twigs from the nearby forests, as cutting trees is no longer allowed. Even the thoroughly degraded forests seem to suffice their needs. While afforestation efforts are on to improve the forest cover in the reasons for forest degradation are commercial than livelihood purposes. For instance, forests were exploited for making apple crates till the early 1990s. By the time the impact was realized exploitation crossed the reversible limits in some areas. On the other hand, forests are not that degraded in the absence of such intensive commercial exploitation in regions like Uttaranchal. Therefore, the local and global environmental benefits from investments in SHPs appear to have been over emphasized. However, we hasten to add that this in no way belittles the importance of these investments. While investments in SHPs enhance the share of clean fuels in the energy portfolio, there is need for identifying ways and means to reduce unmindful degradation of commons for commercial purposes. For, the poor and their livelihood strategies have a miniscule role in the process. Involving the local communities would help breaking the process to a large extent, as in the case of Joint Forest Management. Unfortunately, involvement of local people is the most important missing dimension in this Project.

APPENDIX F: REFERENCES

- Chakravorty, Ujjayant, (2003), *Endogenous Substitution of Energy Resources: Theory and Application to the Energy Sector*, in India and Global Climate Change, Perspectives on Economics and Policy from a Developing Country by Michael A. Toman et al, Oxford University Press, New Delhi
- GEF (1994), *India Optimizing Development of Small Hydel Resources in the Hilly Regions (Project Document)*, Washington, Global Environment Facility, January 1994
- GoI (2003), *Programme for Electrification of Remote Census Villages and Unelectrified Remote Hamlets of Electrified Census Villages through Non-conventional Energy Sources*, GoI, Delhi, 16 December 2003
- Ittyerah, R.K. (2004), *Terminal Evaluation Report of the Hilly Hydel Project (informal draft)*, UNDP, March 2004
- Jodha N. S (1986), *Common Property Resources and Rural Poor in Dry Regions of India*, Economic and Political Weekly, Vol. 21, No. 27
- Leach, Melissa and Robin Mearns (1991), *Poverty and Environment in developing Countries: An Overview Study Report*, IDS, Sussex, UK.
- Parikh, Jyoti (2003), *India's Efforts in Minimizing Greenhouse Gas Emissions: Policies, Measures, and Institutions*, in India and Global Climate Change, Perspectives on Economics and Policy from a Developing Country by Michael A. Toman et al, Oxford University Press, New Delhi
- Pachauri, R.K. (2003), *Global Climate Change: Indian Perspective Revisited and Restated*, in India and Global Climate Change, Perspectives on Economics and Policy from a Developing Country by Michael A. Toman et al, Oxford University Press, New Delhi
- Puri, Shubhra (2003), *Blueprint for Growth; Impact and scope of the New Electricity Act*, in Powerline, Volume 7, no 8, May 2003, Delhi
- Reddy V. Ratna (1999), *User Valuation of Renewable Natural Resources: User Perspective*, Economic and Political Weekly, Vol. XXXIV, No. 23
- Todd, David; John Soussan and Lee Risby (2003), *The Nature and Role of Local Benefits in GEF Program Areas: Inception Report (Study Document number fourteen)*, Washington, Global Environment Facility, August 12-th 2003
- Todd, David (2003b), *Short Summary of Local Benefits Study*, Washington, Global Environment Facility, 2003
- Vysa V. S. (1991), *Agrarian Structure: Environmental Concerns and Rural Poverty*, Elmirst Memorial Lecture, XXI International Conference of agriculture Economists, Tokyo, Japan, August 22