Community Involvement in the Development of Small Hydro in Uttaranchal, India

by

Matthew McCandless

A Thesis submitted to the Faculty of Graduate Studies
of The University of Manitoba in partial fulfilment of
the requirements of the degree of

Master of Natural Resources Management

Natural Resources Institute
University of Manitoba
Winnipeg, Manitoba
Canada

UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES
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ABSTRACT

India is a developing country experiencing a rapid pace of growth. This growth is focused primarily in the larger cities where standards of living are approaching those of more developed countries. However, this prosperity remains largely a trait of cities in the plains region of India. The benefits of a surging economy are slow to trickle down to the rural poor. In fact, these people are often adversely affected when large developments come into their area to capitalise on the resources that they have been using sustainably for hundreds of years. Hydroelectricity is one such area. There are many large projects being developed in the state of Uttaranchal for the benefit of southern urban dwellers, and often the people living nearest to these developments have no access to electricity.

An alternative to these large projects that can bring more direct benefits for small isolated villages are small hydroelectric generating stations. These facilities can bring about much improvement for people in remote developing regions who may otherwise have little or no access to electricity. The purpose of this research was to determine the potential capacity for improved participation through community-based approaches to small hydroelectric development in the Indian Himalayas. The objectives of the research were: (1) to establish the current roles of the civic, public and private sectors in small hydro development; (2) to examine the potential for learning through participation during the development of small hydro projects; (3) to determine the potential for using community-based environmental assessment in future projects; (4) to investigate the benefits of community-driven small hydro development, and (5) to determine the

implications of the findings for environmental policy and decision-making. Data were gathered using Participatory Rural Appraisal methods including semi-structured interviews, transect walks, and landscape analysis.

There were five case study projects (Niti, Bampa, Jumma, Malari and Bamini/Badrinath), each in the Indo-Tibetan border region of the Indian Himalayas. The plants are all run of river, and range in capacity from 25 kW to 1.2 MW. Four of the villages had no electricity prior to the development of the small-hydro plants, while one had a prior connection to the state electrical grid (Bamini/Badrinath). The Bamini facility is the only plant that was not developed primarily for rural electrification. The villages are inhabited by Bhotia tribespeople, and are occupied only during the summer growing season. The residents travel to lower altitude villages for the winter months.

The most successful project examined, in the village of Malari, was one where community development and energy needs were considered simultaneously, and where the local community was highly involved in planning, construction and operation. The less successful projects were those where community involvement and development, sound planning, and detailed geographic information about the site were lacking in their development and operation. This was observed in the village of Jumma, where the plant never began operations because it was damaged by an avalanche prior to its inauguration. At the time of the research the plant at Bamini/Badrinath was being inaugurated, the Niti

plant was in the early stages of construction, and the Bampa plant was in the preliminary planning stages.

PLEASE NOTE: As of January 2007 the State of Uttaranchal was renamed Uttarakhand. The change is not reflected in this thesis.

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GLOSSARY OF TERMS

AHEC	- Alternative Hydro Energy Centre
CBEA	- Community-Based Environmental Assessment
CEAA	- Canadian Environmental Assessment Act
DPR	- Detailed Project Report
EA	- Environmental Assessment
IIT	- Indian Institute of Technology
NGO	- Non-governmental Organisation
NTPC	- National Thermal Power Corporation
PAR	- Participatory Action Research
PRA	- Participatory Rural Appraisal
RRA	- Rapid Rural Appraisal
SPWD	- Society for the Promotion of Wastelands Development
SSI	- Semi-structured Interview
UJVNL	- Uttaranchal Jal Vidut Nagam Limited
UREDA	- Uttaranchal Renewable Development Agency
UPJVNL	- Uttar Pradesh Jal Vidut Nagam Limited

1.0 INTRODUCTION*

Hydroelectric power can bring about much improvement for people in remote areas who may have little or no access to electricity (Naidu 1996, Rovero and Collins 1998, Khennas and Barnett 2000). The construction of new projects can impart skills and training to people who may never otherwise acquire such expertise. Having a reliable source of electricity can also lead to improvements in public health (Naidu 1996).

Large scale hydro projects are still being carried out in many parts of the world, often in ecologically and culturally sensitive areas such as the Bala Dam in Peru, the Mphanda Nkuwa in Mozambique, the Three Gorges in China, and Tehri in India, often with the backing of foreign governments and international non-governmental organisations (NGOs) (Khagram 2004 de Villiers 1999). These projects are touted as being keys to prosperity, but rather than opening the door to a better standard of living, they often shackle those most directly affected to a world of ecological devastation and social problems (Khagram 2004 de Villiers 1999). Indigenous peoples tend to oppose large projects that may adversely affect their livelihoods. Some have even mounted armed resistance in the face of forced relocation, as was the case with the Narmada Dam in India in 1993 (Bhatia 1997). Despite the fact that massive hydroelectric projects are

* *At the time this thesis was defended in late 2006 the official name of the state in which this research was conducted was Uttaranchal. The name of the state was officially changed in January 2007 to* Uttarakhand. *As this document was nearing publication at the time, it is referred to as Uttaranchal throughout this thesis.*

being undertaken in the Indian state of Uttaranchal (now known as Uttarakhand), over 1000 villages in the state remain unelectrified because the power is being transmitted out of the region to fast-growing cities in the plains.

One way of avoiding potential conflict such as in the Narmada Valley, as well as preventing the ecological and cultural degradation associated with large hydro projects, is to build smaller projects that do not alter the landscape to the same extent. Compared to large hydro, small-scale hydro also has many advantages, such as affordability, shorter design and construction phases, much smaller heads (as little as 2 m) and the advantage of being more suited to isolated communities that cannot easily be connected to regional or national power grids (Naidu 1996, Khennas and Barnett 2000, Rovero and Collins 1998).

India, like many other rapidly growing and developing nations is aggressively pursuing its energy potential. Northern India in particular has vast water resources and as a result has been the focus of considerable hydro development including such large projects as the Parbati and Larji Dams in Himachal Pradesh, and the Tehri and Vishnuprayag projects in Uttaranchal; with many more proposed (Independent Review Team 1997; Bhatia 1997). There is also considerable small-scale hydro development in India. In the state of Uttaranchal there are currently 32 such projects in operation producing 145 MW (Ministry of Information and Broadcasting 2004). Over 200 potential sites for small-scale hydro have been identified (Naidu 1996).

Small hydro projects are beneficial for small isolated villages, such as those in the Indian Himalayas that are not connected to the regional power grid. Small hydro can provide energy that can simplify the daily chores of villagers, and lead to economic and industrial development. If a small hydro plant is community operated and managed, then there is the opportunity for villagers to increase their skills as a result of working on, or helping to manage the facility.

While small-scale hydro projects have the potential to greatly benefit people in remote areas, if improperly implemented the benefits may never be realised (Shevchenko 2001; Sinclair 2003). In India, there are examples of small-scale hydro projects being implemented without the knowledge of, and input from, the affected community. In Uttaranchal, the majority of small projects failed in their first years of operation. Often these failures can largely be attributed to a flawed environmental assessment (EA) particularly the inclusion of locals in project decisions. Had a more participatory approach been used, it is possible that the developers would have had a better understanding of the needs of the local inhabitants and a better understanding of the local environment (Sinclair and Diduck 2000, Sinclair 2003). Such instances are unfortunate because the point of the developments in the first place is to improve the livelihoods of local inhabitants; and because most, if not all, development aid agencies that support these projects promote the involvement of local people in project design, construction

and operation to ensure maximum benefits and acceptability. Public participation in an EA is essential for ensuring public acceptance of a proposed undertaking.

One way of ensuring more meaningful public participation in assessment is through community-based environmental assessment (CBEA). CBEA is the practice of assessing a development or undertaking using techniques of Participatory Rural Appraisal (PRA) (Spaling 2003). By making use of participatory PRA techniques, CBEA is inherently participatory in that the community is directly involved in the assessment through mapping projects, interviews, workshops, and other participatory tools. As such, a potential further benefit of CBEA may be enhanced public education through participation, potentially improving the capacity of people to better respond to future undertakings in their region and enabling them to participate more meaningfully in future community development.

1.1 Purpose

Given these issues, the purpose of this research was to determine the potential capacity for improved participation in small hydroelectric development in the Indian Himalayas.

1.2 Objectives

The objectives of the research were as follows:

1. To establish the current roles of the private, public and civic sectors in small hydro development;

2. To examine the potential for learning through participation during the development of small hydro projects;

3. To determine the potential for using CBEA in future projects;

4. To investigate the benefits of community-driven micro-hydro development; and

5. To determine the implications of the findings for environmental policy and decision-making.

1.3 Methods

The research was based on five case studies in the state of Uttaranchal using Participatory Rural Appraisal (PRA) methods including semi-structured interviews, transect walks, participatory mapping, and activity charts. Further detail on the methods employed in this research is included in Section 3.4.

This project is part of a larger project, *The Roles of the Public, Private and Civic sectors in Sustainable Management: A Search for Balance* a project of the Natural Resources Institute, University of Manitoba, and the University of Delhi. The principal

investigators are Dr. A. J. Sinclair and Dr. R. B. Singh of the Universities of Manitoba and Delhi respectively.

1.4 Organisation

The thesis is organised into six chapters. This first chapter outlines the work carried out, and provides basic rationale for the research. The second chapter features a review of relevant literature on participation, learning through participation, CBEA, and small hydro. Some historical insight into the study area is also provided. The research methods employed and a brief discussion of the fieldwork carried out are presented in the third chapter. In the fifth chapter the results presented in Chapter 4 are analysed and discussed in terms of Objectives 2, 3, and 4. In the final chapter, conclusions are presented.

2.0 PUBLIC PARTICIPATION AND ENVIRONMENTAL ASSESSMENT

The focus of this research was public participation and environmental assessment regarding small hydro projects in rural India. This chapter is a review of literature on effective public participation and how it is attained in environmental assessment, as well as the results and outcomes of effective public participation. The provisions for public participation through environmental assessment are reviewed, as is relevant legislation in India. Some background and historical context is also provided. The chapter also includes a section on hydro development.

2.1 Public Participation Rights

Many countries throughout the world have legislation requiring that the public be consulted during the development of projects or undertakings that will have an effect on their lives and their livelihoods. For example, the Canadian Environmental Assessment Act (CEAA) and the Indian Environmental Impact Assessment Notification Regulation require that the public be consulted prior to issuing approvals or permits to developments (Canadian Environmental Assessment Act, CEAA 2001, Fitzpatrick and Sinclair 2003, Government of India 1994, Vyas and Reddy 1998, Sinclair and Diduck 2000, Pandya et al 2005). Most nations require some form of public consultation in this regard, as do many NGOs and development banks such as the World Bank, Asian Development Bank, and Inter-American Development Bank. When performing work in other countries, environmental legislation of the home country requiring public consultation often applies

to firms operating in other countries, as is the case with Canadian companies and the CEAA.

The concept of public participation as a right has long been recognised and has been formally and informally adopted by government systems for thousands of years.

Public participation has evolved to the point where it is now seen as a human right. The roots of this movement started with the United Nations Universal Declaration of Human Rights (UDHR 1948), which states in Article 3 that *"Everyone has the right to life, liberty and security of the person."* The International Covenant on Civil and Political Rights and the International Covenant on Economic Social and Cultural Rights were ratified in 1976. Along with the Universal Declaration of Human Rights, these three documents are collectively known as the International Bill of Rights (UN-CCPR 1976, UN-ICESCR 1976). *"The States Parties to the present Covenant recognize the right of everyone to an adequate standard of living for himself and his family, including adequate food, clothing and housing, and to the continuous improvement of living conditions"* (UN-ICESCR 1976).

The International Bill of Rights establishes that all human beings have the right to a livelihood. These rights are further affirmed with the United Nations Declaration of the Right to Development (UN-DRD 1986), and the Rio Declaration on Environment and Development (UN-CED 1992). These rights to pursue a livelihood lead to difficulties

when one party wants to make decisions regarding a common resource that is instrumental to some people's livelihoods. Conflicts regarding common resources such as water or land can ensue when there is not adequate consultation and compensation. Such conflicts include the Narmada Dam conflict in India, and the Oka Crisis in Quebec.

The inclusion of input from the public in decision-making on shared resources has evolved out of the recognition of this right. The right to participate in decisions on resources that are fundamental to peoples' livelihoods has been enshrined by many countries in EA legislation such as the Canadian Environmental Assessment Act, and The Indian Environmental Assessment Notification Regulation.

It has been shown that dialogue between project proponents and communities can prevent conflicts from occurring (Sinclair and Diduck 2000, Sinclair 2003, Shortt et al 2006, Rist 1997). Failure to adequately consult the public during a development can lead to the failure of projects (Spaling 2003, Sinclair 2003). In some cases, failure to adequately consult the public can lead to resistance and protest, as was seen with the Tehri and Narmada dams in India (Khagaram 2004). The World Bank, thorough an internal review of 121 rural water supply projects revealed that 68% of projects that featured public participation were highly successful, whereas of projects that did not feature any public involvement, 12% were considered effective (World Bank 1998 Zazueta 1995). A separate study of 25 World Bank sponsored projects found that 13 of them had been abandoned once financial assistance had ended, their demise being attributed to a lack of

participation and attention to local organisation building during project formulation (Zazueta 1995).

The high failure rate of international development projects that do not feature public participation is commonly viewed as a failure and rejection of the more traditional 'growth' model of development, which assumes that a phenomenon similar to Europe's 18th century industrial revolution will take place in third world countries given the proper economic conditions and infrastructure (Chambers 1983, ICAE 1987, Rist 1997). The 'grass-roots' model favours local thought and knowledge which will lead to development from the ground up, as opposed to the growth model's 'trickle down' effect (ICAE 1987, Rist 1997, WB 1998).

While it can be demonstrated statistically that the inclusion of public participation in projects is a factor in greater project success, solid definitions of the concept remain elusive. There are also separate definitions for public involvement, public participation, and public consultation. The many NGOs, government agencies, private consultants, and corporations who are in the business of providing public participation services, or who incorporate public involvement into operations, define public participation in their own way (Roberts 1995, Connor 2001, WB 1999, WCD undated, WCDb undated, IDB 2000, CAPP 2003). These definitions may be genuine attempts to gather public input into projects based on established principles (IDB 2000, WB 1999), or they may be attempts

to put a friendlier face on operations that have come under intense public scrutiny (WCD undated, WCDb undated, CAPP 2003).

Generally, definitions of public involvement revolve around the need for mutual understanding between project proponents and affected communities, the actions required to come to such an understanding, and how to proceed once this understanding has been reached (Connor 2001, Roberts 1995). While the terms public involvement, public participation, and public consultation are frequently interchanged, Roberts (1995) argues that they are in fact three separate ideas. Public involvement is a process by which the public are involved in the decision-making process. Public consultation and public participation are means of achieving public involvement (Roberts 1995). According to Roberts (1995) participation brings the public into the decision-making process, whereas consultation involves a gathering or sharing of information, and possibly negotiation with the public while keeping them separate from the decision-making process.

Since there are no agreed upon definitions of public participation, it follows that there are no standard procedures for carrying out public participation. Many consultants in the business of public participation publish their own manuals detailing their own methods (Connor 2001, Roberts 1995). Government agencies that require public involvement as part of a legislative requirement often publish guidelines on how this should be carried out (CEAA 2006). Many NGOs that incorporate public involvement into their activities publish manuals on how it is to be done (IDB 2000, WB 1999, IUCN 2005). Private

corporations and industry groups often publish participation manuals to highlight procedures that are, or should be followed, when involving the public (WCD undated, WCDb undated, CAPP 2003). There have also been attempts to standardise public involvement methods by agencies such as the Canadian Standards Association and the International Association for Public Participation, however none of them have come to be recognised as being the accepted testaments of public involvement protocol.

While there are no universally accepted processes for carrying out public participation, there are several common elements that are noted in participation manuals for making public participation effective (WB 1999, Shortt et al 2006, Chambers 1983 1993 1994, IDB 2000, Roberts 1995, Stewart 2005, Sinclair and Diduck 2000, 2005, Zazueta 1995):

1. Notice: Early and adequate notice of all major steps in project planning and decision-making should be provided.
2. Access: Fair and reasonable access to registry and project information should be granted.
3. Assistance: Financial assistance should be made available to groups in the civic sector so that they can adequately represent their interests in project planning and decision-making.
4. Meaningfulness: Meaningful opportunities to comment on and influence decisions regarding the project, alternatives to the project, and key project features and impacts should be allowed.
5. Openness: Open and fair public hearings should be held when the project proposal generates significant conflict and controversy.

6. Inclusiveness: Inclusive and adequate representation should be provided to engage interested and affected parties.
7. Transparency: Integrity and accountability, including transparency of process and follow-up on input given by the public should be inherent.

These seven principles are the keys to effective EA public involvement, and should be present in all participatory processes. Another way of evaluating public participation is with Arnstein's ladder. Sherry Arnstein in 1969 published a seminal paper on the evaluation of public involvement. Arnstein's (1969) ladder defines eight rungs of citizen participation in three broad categories. The categories are non-participation, tokenism, and citizen power. Falling in the non-participation category are the rungs of manipulation and therapy; in the tokenism category are informing, consultation and placation; in the citizen power category are partnership, delegated power, and citizen control (Arnstein 1969). Figure 2-1 is shows the arrangement of Arnstein's ladder.

The bottom two rungs of Arnstein's ladder are in the 'non-participation' category. The two classifications within this group are Manipulation and Therapy. Manipulation is described as being a situation where the public are manipulated into conforming to the will of those with power. These rungs are considered non-participation because the public really do not have a voice. The rungs of Informing, Consultation, and Placation are viewed as tokenism. Arnstein viewed these rungs as not constituting public participation because the public are not assigned significant roles in the process. They may participate, but there is no assurance that their participation is taken into account.

The upper rungs of partnership, delegated power and citizen control are classified as 'citizen power'. It is within these rungs that the public do have the opportunity to provide meaningful input that can affect the outcome of a process. With partnership, the public become active participants within the process. With delegated power, the public are assigned certain roles within the process over which they will have autonomy. With citizen control, the public have full managerial control over the process.

	Rung	Category
8.	Citizen Control	- Citizen Power
7.	Delegated Power	- Citizen Power
6.	Partnership	- Citizen Power
5.	Placation	- Tokenism
4.	Consultation	- Tokenism
3.	Informing	- Non-participation
2.	Therapy	- Non-participation
1.	Manipulation	- Non-participation

Figure 2-1:Arrangement of Arnstein's ladder of Citizen Participation (Arnstein 1969).

While Arnstein takes a somewhat cynical stance regarding the middle rungs of the ladder, these are the rungs that are most commonly associated with public participation.

2.1.1 Participation in Cross-Cultural Settings

The principles of effective public participation apply not just to EA cases, where a decision is being taken on an undertaking that may have negative impacts on peoples' livelihoods. Public participation can also be instrumental to the success of projects that aim to improve peoples' livelihoods, such as international development projects. This dynamic applies equally in academic research where the experiences, interests, and aspirations of people are being studied. In developing societies, the barriers to public participation are more pronounced when dealing in cross-cultural settings where there may be communication barriers, differences in levels of education, political considerations, and different cultural protocols (Vasseur and Hart 2002, Chambers 1983, 1994, 2006, Neefjes 2000, Zazueta 1995).

In order to more adequately interact with people in indigenous and developing societies, the approach to public participation commonly used in the developed world does not always apply. In an attempt to shift away from the paradigms of the 1960s and 1970s, Robert Chambers pioneered a technique of participatory research with specific applications to international development. It is known as Participatory Rural Appraisal (PRA) (Chambers 1983, 1993, 1994, 1997, 2003). He defines PRA as:

> *"A growing family of approaches, methods, attitudes and behaviours to enable and empower people to share, analyse and enhance their knowledge of life and conditions, and to plan, act, monitor, evaluate and reflect"* (Chambers 2003:2).

Four elements are listed in Chambers's definition: approaches, methods, attitudes and behaviours. PRA is frequently seen simply as a method; however the methods cannot function effectively without the other elements. While the methods are the exercises used to gather information, the other elements have to do with the mindset and preconceptions of the of the PRA practitioner. The essence of PRA has been captured by Chambers (1997) and Mascarenhas (1991) as follows:

1. The behaviour and attitudes of outsiders who facilitate, not dominate;
2. The methods, which shift the normal balance from closed to open, from individual to group, from verbal to visual, and from measuring to comparing; and
3. Partnership and sharing of information, experience, food, and training; between insiders and outsiders; between organisations.

These are collectively known as the 'three pillars' of PRA (Chambers 1997).

Pillar No. 1: Behaviours and Attitudes

This cornerstone of PRA focuses on the approach and mindset to which the PRA practitioner must adhere. The overlying approach of PRA is that the appraisal should be conducted by local people, and that outsiders are facilitators, learners and consultants (Chambers 1994). Outsiders are there to *"...establish rapport, to convene and catalyze, to enquire, to help in the use of methods, and to encourage local people to choose and improvise methods for themselves. Outsiders watch, listen, and learn"* (Chambers 1994:1255).

Chambers (2003) summarises some of the attitudes and behaviours required of PRA practitioners: PRA is about listening, not lecturing. PRA practitioners must watch and learn and not attempt to control the situation. This includes not imposing ideas, categories and values on participants, and using the practitioners own better judgement at all times

PRA is about letting THEM do it, embracing error, unlearning (the preconceptions of the PRA practitioner), facilitating, not rushing, asking them, being nice to people, relaxing, having fun and sitting down to listen learn and respect (Chambers 1997).

Pillar No. 2: PRA Methods

The second pillar of PRA is the methods of interaction between the PRA practitioner and the community. Traditionally in development oriented fields, research is inherently biased (Chambers 1983). Biases include spatial biases (bias based on accessibility), project bias (biases based on a known activity taking place), person biases (bias based on researchers not meeting the most disadvantaged members of a society), dry-season bias, and profession bias (where researchers concentrate on those who work in known professions) (Chambers 1983, 1993). One of the goals of PRA is to reduce and eliminate bias. This is to be achieved by ensuring that all sectors of a society are consulted and given equal consideration during the process. Identification of the various sectors of a society can be done by having villagers draw an institutional diagram of relative wealth within the community. Bias can also be treated by attempting to recognise when biases

occur, and offsetting those biases (Chambers 1997). A list of some PRA methods is included in Section 3.2.

Pillar No. 3: A Culture of Sharing

The third pillar of PRA is the dynamics of the relationship between the practitioner and the community of interest. The relationship is to be one of sharing. Primarily what is being shared in PRA is knowledge; community members are sharing their knowledge, food, training, experiences, work, etc with the practitioner (Chambers 1997).

Other participatory research techniques closely related to PRA are participant observation, Participatory Action Research (PAR), and Rapid Rural Appraisal (RRA). Participant observation is a research technique commonly used in anthropology where the researcher immerses his/herself in the culture, and may assume certain roles in order to make inferences about a community's responses (Yin 2003). PAR is similar to PRA, except that the goals of PAR are more oriented to helping communities achieve social and political empowerment (Lofman et al 2004, Gardner 2004). RRA is similar to PRA, except that there is less emphasis on a two way flow of information. RRA is meant to be more extractive, and is a means to gather information quickly (Chambers 1983, Zanetell and Knuth 2002). While the methods to carry out the various forms of participatory research are similar, the differences primarily lie with the objectives of each form.

2.1.2 Learning

Participation in public process has been linked to learning among participants (Diduck and Mitchell 2003, Fitzpatrick 2001, Fitzpatrick and Sinclair 2003, Sinclair and Diduck 2001, Webler et al 1995). Such learning is important because it can impact not just final project approval and design, but can also help to foster new thinking about sustainability.

There are two main theories on non-formal adult education that have been applied to the study of learning through public participation in EA: transformative learning and critical education. Transformative learning is a highly individualistic learning theory that focuses on the dynamics of the learning process that an individual undergoes. The concept was first described by Jack Mezirow after studying the experiences of adult women who returned to college in the 1970s. The transformative learning process is outlined as follows (Mezirow 1991, 1997, 1997a, 2000, Cranton 1994).

1. A disorienting dilemma;
2. Self-examination with feelings of fear, anger, guilt, or shame;
3. A critical reflection of assumptions;
4. Recognition that one's discontent and the process of transformation are shared;
5. Exploration of options for new roles, relationships, and actions;
6. Planning a course of action;
7. Acquiring knowledge and skills for implementing one's plans;
8. Provisional trying of new roles;
9. Building competence and self-confidence in new roles and relationships;
10. A reintegration into one's life on the basis of conditions dictated by one's new perspective;

Mezirow also defines six conditions necessary for learning to occur. The conditions are:

1. Provision of accurate and complete information;
2. Freedom from coercion;
3. Openness to alternative perspectives;
4. Ability to reflect critically upon presuppositions;
5. Equal opportunity to participate; and
6. Ability to assess arguments in a systematic manner and accept a rational consensus as valid.

Work on transformative learning through adult environmental education published by Hall (2004), which included an examination of the Chipko environmental movement in Uttaranchal, concluded that transformative learning in the environmental sector can be manifested in the following nine ways:

1. The development of new practices;
2. Increased participation or mobilization;
3. Changes in gendered roles or behaviours;
4. Linking between local and global contexts;
5. Production or recovery of knowledge;
6. New legislation or policies;
7. Increases in self-sufficiency and bio-regionalism;
8. Increases in co-operation; and
9. Existence of new alliances and networks.

Critical reflection and transformative learning are keys to autonomous thinking (Mezirow 1997). This thinking can lead to greater awareness of where one is situated relative to one's economic and social surroundings (Lange 2004). This awareness parallels the conscientisation process first described by Freire (1972). Conscientisation is the realisation that an individual can influence and change conditions that are oppressive (Freire 1972). Conscientisation leads to the state of critical consciousness. In an EA context this conscientisation would cause participants to question development in a sustainability context. Critical consciousness is described by Shor as having four qualities (Shor 1993, p32):

1. Power Awareness
   - Knowing that history and society can be made and remade by human action and organised groups;
   - Knowing who exercised power in society for what ends and how power is currently organised and used in society.

2. Critical Literacy
   - Analytic habits of thinking, reading, writing, speaking, or discussing which go beneath surface impressions, traditional myths, mere opinions, and clichés;
   - Understanding the social contexts and consequences of any subject matter;
   - Discovering the deep meaning of any event, text, technique, process, object, statement, image, or situation; and applying that meaning to your own context.

3. De-Socialisation
   - Recognising and challenging the myths, values, behaviours, and language learned in mass-culture;

- Critically examining the regressive values operating in society which are internalized into consciousness – such as racism, sexism, class bias, homophobia, a fascination with the rich and powerful, hero-worship, excess consumerism, runaway individualism, militarism and national chauvinism.

4. Self-Organisation/Self-Education
   - Taking the initiative to transform school and society away from authoritarian relations and the undemocratic, unequal distribution of power;
   - Taking part in and initiating social change projects;
   - Overcoming the induced anti-intellectualism of mass education.

Shor then describes ten values, commonly referred to as Shor's descriptors, for a pedagogy that is aimed at developing critical consciousness in students. The learning process must be (Shor 1993):

1. Participatory: The learning process should be interactive and co-operative;
2. Situated: Subject matter is based in student thought and language;
3. Critical: The students reflect on their own language and knowledge on the subject matter, and the relation of their knowledge to society;
4. Democratic: Discourse is constructed equally between the instructor and the students, and among the students;
5. Dialogic: The students are doing education rather than having it done to them;
6. De-socialisation: Previously learned social dynamics of learning and instruction are challenged; the teacher is no longer domineering, the students are no longer passive;
7. Multicultural: All racial, ethnic, regional, age-based, and sexual cultures are recognised and there is a critical attitude towards discrimination;

8. Research-oriented: Students are encouraged to examine their own speech, behaviours and conditions;
9. Activist: The learning dynamic is active through problem posing and solving, co-operative learning and participatory formats; and
10. Affective: The problem-posing, dialogic method includes a range of emotions from humour to compassion to indignation.

Shor's descriptors capture the essence of the elements that a critical pedagogy must have in order to be effective. These descriptors are often used as criteria against which to test for critical learning. The ten values which Shor describes are the values that allow Friere's critical pedagogy to work; therefore critical education could occur in any process, such as a public participation process in an EA, which embodies the same ten values.

Freire's critical pedagogy has been the focus of much study and debate over the years. There has been less criticism of his theory than of Jack Mezirow's, possibly because Freire's is a new method, rather than an attempt to explain an existing phenomenon. There is criticism of Freire's notion of powerless societies: his pedagogy is designed for societies that wield no power, and this is seen to be an idealistic notion because even the most oppressed are rarely politically or economically insignificant (Blackburn 2000).

The themes common to both transformative and critical learning are that the processes feature high degrees of engagement by the 'pupils' where they are active in solving problems. In a process such as the development of a small hydro project, this is

equivalent to public involvement. The development processes must be inclusive, must not be coercive, must treat all participants equally, and must be situated in the 'pupils' thought and language.

There are conceptual links between Mezirow's transformative learning theory, and the elements of effective public participation that were outlined in Section 2.1.1 (Sinclair and Didcuk 2001).

1. Provision of accurate and complete information

   This condition of Mezirow's corresponds closely with the effective public participation requirements that early and adequate notice of all major steps in project planning and decision-making be given, and that fair and reasonable access to information be provided.

2. Freedom from coercion

   This corresponds to a process being open and fair, as well as transparent.

3. Openness to alternative perspectives

   This condition also corresponds to the principle that a process must be open and fair, and also that opportunities to comment on and influence decisions be meaningful.

4. Ability to reflect critically upon presuppositions

   This condition relates more to the reasoning ability of the individual, rather than the process; however, the provision of assistance to affected groups to represent their interests does equip participants to better understand the implications of a project in order to make critical reflections.

5. Equal opportunity to participate

This corresponds with the principle of inclusiveness. A process should allow adequate representation and engage all interested and affected parties.

6. Ability to assess arguments in a systematic manner and accept a rational consensus as valid.

This corresponds with the principles of meaningfulness and transparency of process.

In order to apply Shor's descriptors to these cases it is necessary to recognise that the ultimate aim of a community run micro-hydro plant is to provide electricity to a community, and in the process impart skills to the community that will increase their capacity to meet similar challenges in the future. The process should be participatory and it should be situated in the local thought and language. The process should be critical in that the villagers have the capacity to reflect on the ideas, and how they relate; not necessarily to society; but to the project as a whole. The process should be democratic in that it is exclusionary and all participants are given equal standing. The process should be dialogic in that there is discussion between members of the village about the challenge at hand and how to address it. It should be de-socialised as required in order to effectively carry out the project. The process should recognise and attempt to eliminate gender and caste based distinctions. The process should be research oriented in that there is a focus on using the local knowledge of the area to determine the best solutions to problems. The learning should be activist in that there is a focus on active problem solving by participants. Participation should be encouraged. The process should be affective in that it triggers intense self-reflection into the needs of the participants and

how to best meet these needs. The self-reflection should include a look at all of the activities and important activities and aspirations of the participants, which may trigger emotional responses.

These adapted ideal-conditions would not necessarily lead to critical consciousness, but they would allow for learning in the sense that villagers would increase their capacity to work together and realise goals for the betterment of the community.

The emancipatory theories of Freire and Mezirow have many similarities, but they have different origins. Freire's theory developed from observing adult education in 1960s Brazil, while Mezirow's theory was spawned from an analysis of the mechanics of an individual's learning from observing adult women's experiences after returning to college in the 1970s (Cranton 1994). Whatever the commonalities and differences between the theories, the fact remains that both theories assert that education is a means to increased awareness of one's surroundings, and ultimately, empowerment.

2.2 Public Participation in Environmental Assessment

EA is the process of assessing a project or undertaking with the goal of preventing or mitigating environmental impacts (CEAA 2001). The EA process typically involves several steps, including screening, scoping, baseline data collection, identification of impacts, evaluation of alternatives, public input, and report writing (CEAA 2001; Sinha 1998; Valappil et al 1994; Vyas and Reddy 1998).

EA is recognised as:

> *"a formalised, systematic and comprehensive process for identifying, analysing, and evaluating environmental consequences of a proposed action, consulting the views of affected parties, and taking the findings of this evaluation and consultation into account in planning, authorising and implementing this action"* (Cherp 2001 p. 360)

The legislation of public participation in environmental assessment has become a key legislative tool that guarantees peoples' rights to provide input into decisions affecting their livelihoods. In India, EA requirements were first enacted with the Environmental Protection Act in 1986 (Sinha 1998; Valappil et al 1994; Vyas and Reddy 1998). The EA process for India is diagrammed in Figure 2-2. At first the Environmental Protection act applied primarily to larger projects (Kohlt 2004; Sinha 1998).

In 1994, the Environmental Impact Assessment Notification was enacted as a sub-regulation of the Environmental Protection Act. The important features of the EIA Notification regulation is that it set out a list of 30 development types to which EAs are required. The regulation also enshrined the public participation requirement in EAs.

> ***(2)*** *Notice of Public Hearing: -*
> *(i) The State Pollution Control Board shall cause a notice for environmental public hearing which shall be published in at least two newspapers widely circulated in the region around the project, one of which shall be in the vernacular language of the*

locality concerned. State Pollution Control Board shall mention the date, time and place of public hearing. Suggestions, views, comments and objections of the public shall be invited within thirty days from the date of publication of the notification.

(ii)All persons including bona fide residents, environmental groups and others located at the project site/sites of displacement/sites likely to be affected can participate in the public hearing. They can also make oral/written suggestions to the State Pollution Control Board.

(Ministry of Environment and Forests 1994 Schedule II)

The EIA Notification regulation has been amended in 1997, 2000 (twice) and 2001 (twice). Among the features of the amendments was the expansion of the list of developments to which the regulation applies. A draft revision of the EIA Notification regulation was presented by the Ministry of Environment and Forests in November of 2005. One exception to the EIA notification regulation relevant to this study is that hydroelectric projects with an initial outlay of under Rs 1B ($14M CDN) are exempt (Naidu 1996, Paliwal 2006). The process by which projects follow through the EA process is charted in Figure 2-2.

The Environmental Protection Act is just one of many that may require a project be assessed. Other federal legislation such as the Forest Act, and the Air Amendment Acts may apply, as well as environmental legislation at the state level (Valappil et al 1994; Vyas and Reddy 1998; Sinha 1998). As previously mentioned, hydro projects are but one of the many projects that are not featured on the EA notification list. These projects are not exempt from environmental approvals, they are simply not required to follow the EA

process as stipulated in the Environmental Protection Act. Clearances may still be required by other agencies such as the Ministry of Environments and Forests, or the Federal or State Pollution Control Boards. Often these clearances amount to having the project 'rubberstamped' through having a Detailed Project Report (DPR) cleared by applicable government agencies. The process by which projects typically follow is charted in Figure 2-3.

The public participation component of environmental clearance in India has often been shown to have flaws and can often be exploited by proponents in order to gain necessary approvals. Shortcomings have included poor access to relevant information by participants, public hearings being conducted too late in the process, and information presented in the hearings in inaccessible (Paliwal 2006, Rajaram and Das 2006, Sinclair 2003). The content of environmental assessments is typically prepared by consultants hired by project proponents, and frequently the information contained in the EA submissions is incorrect or flawed (Rajaram and Das 2006). One example of this is with the proposed Sethusamudram Ship Channel project which would allow ship traffic to pass between Tamil Nadu and Sri Lanka (presently ships must travel around Sri Lanka because the waters of the Gulf of Mannar are too shallow to allow vessels to pass). It was determined that the concerns of the public were not considered, and significant objections were raised which could have been prevented had the public been involved in the process at the scoping stage (Rajaram and Das 2006). Paliwal (2006), through study

of EIA practice in India assessed the strengths, weaknesses, opportunities of the process and threats it faces:

Strengths

- Well-defined legal structure
- Presence of a well-knitted regulatory structure

Weaknesses

- Screening and scoping process not well-defined
- Insufficient baseline data
- Inconsistent application of evaluation and predictive tools
- Improper monitoring and implementation
- Inadequate public participation
- Poor quality EA reports and non-accountability of EA professionals
- Lack of co-ordination and poorly defined decision-making process

Opportunities

- Increasing public awareness
- Growing consciousness through NGOs
- Self-regulation in industrial sector
- Integration of EA with plans policies and programs

Threats

- Poor governance and corruption
- Effect of economic reforms
- Lax regulations for small-scale industries

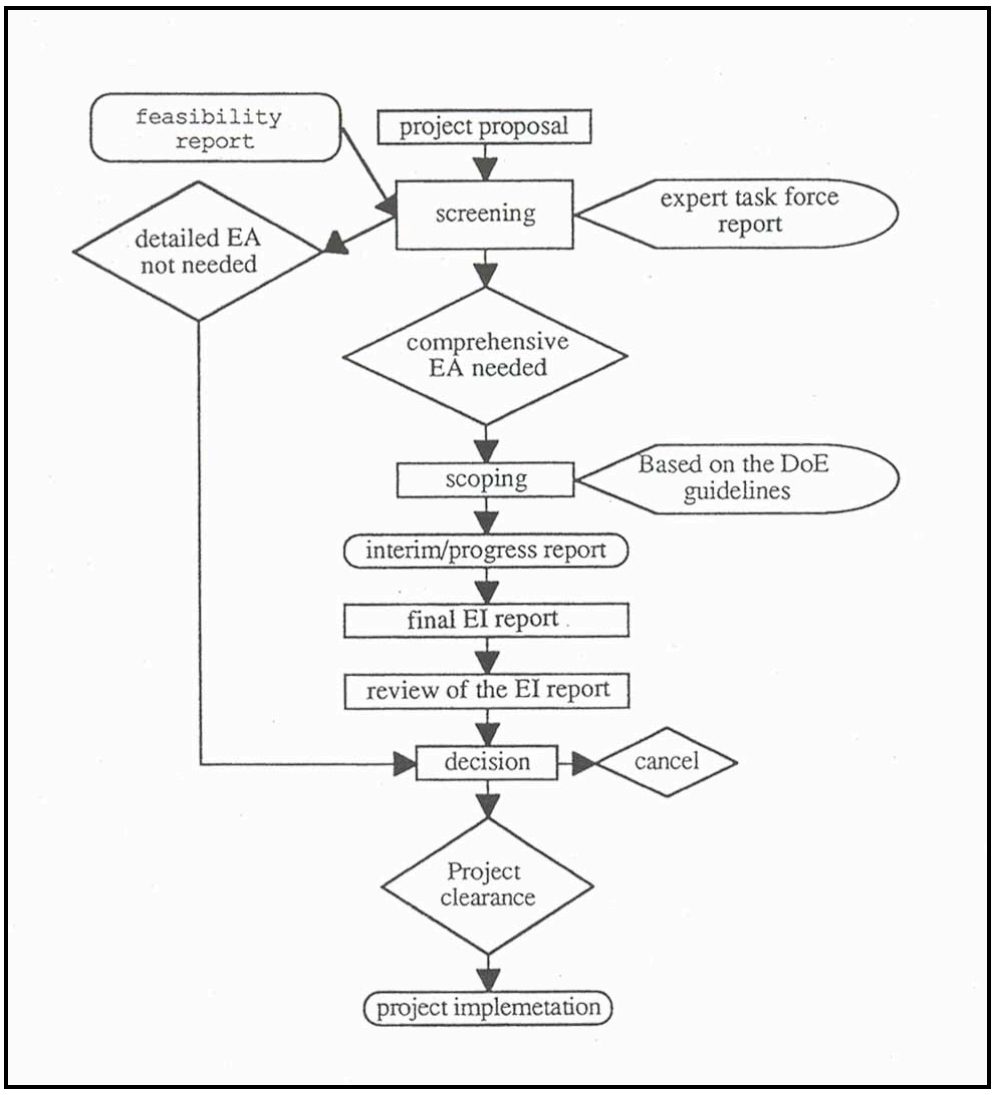

Figure 2-2: Environmental Assessment Process in India (Valappil et al 1994).

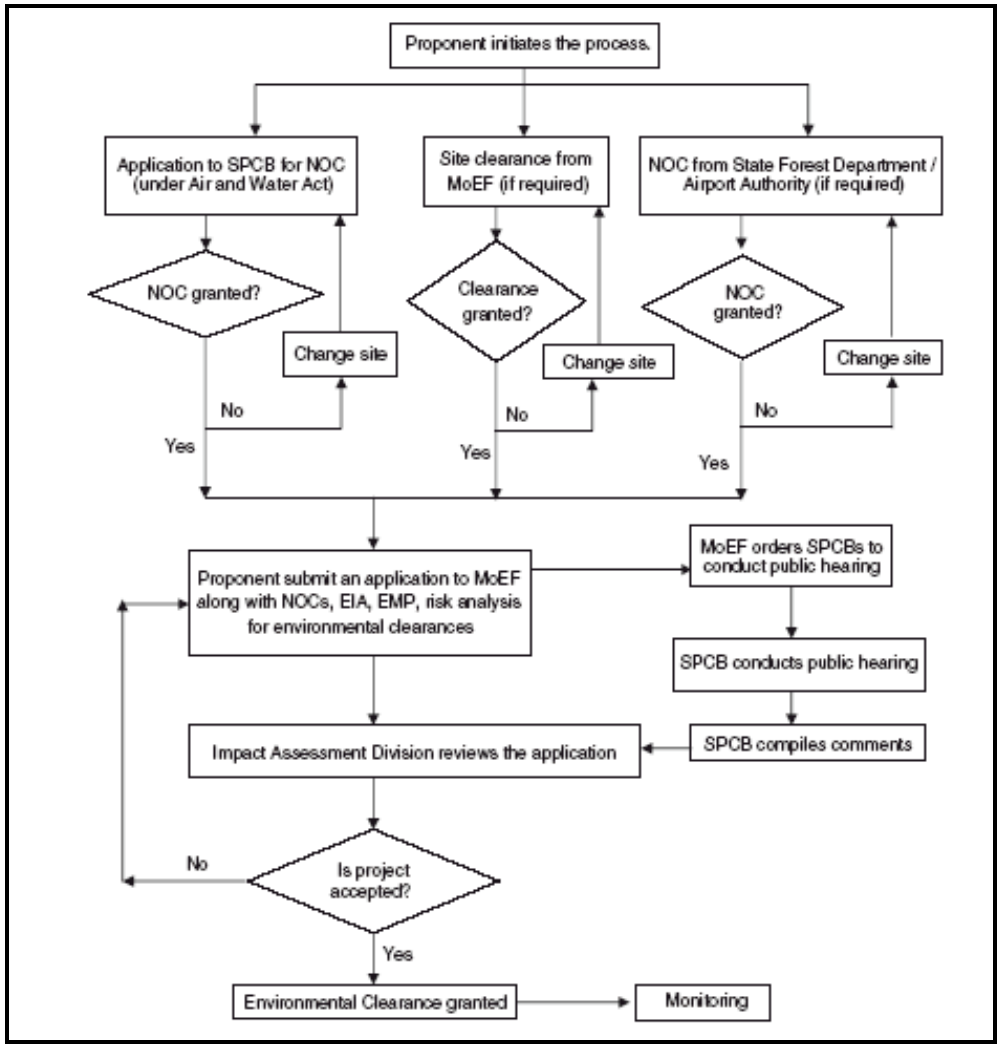

Figure 2-3: Environmental Clearance Process in India (Paliwal 2006).

There is also criticism of the process relating to the new draft EA Notification Regulation. It has been argued that the revised regulation makes the process favour proponents and leaves it open to corporate influence (Kalpavrikish Environmental Action Group 2005).

Due to shortcomings in public participation, the applicability of EA for community development projects has frequently come into question (Neefjes 2000; Shepherd 1998; Meredith 1992). Criticism includes the inability of EA practitioners to adequately consult with local people and failure to identify socially differentiated impacts (Neefjes 2000). In community development projects barriers can also come up because of low literacy levels, and because EA results are often not expressed in the local vernacular, rendering interpretation of results difficult (Sinclair and Diduck 2000). Insensitivity of gender-related matters during consultation; and cultural and communication problems between indigenous populations and outsiders are other considerations (Neefjes 2000). Another criticism within the community development context is that EA tends to be focused on minimising negative impacts rather than enhancing positive impacts (Neefjes 2000).

2.2.1 Community Based Environmental Assessment

To ensure that small-scale projects such as hydro provide maximum benefits at minimum costs, involvement of local people at every stage of the process is essential (Vasseur and Hart 2002). As Meredith (1992) observed, increased participation from affected people

needs to be achieved within the EA context. CBEA, or Community EA as it is also referred to, is the concept of bringing community development tools into EA, making it more applicable for community development projects by approaching EA from a public participation perspective (Spaling 2003). Essentially CBEA is carrying out an EA through engaging local people with PRA tools. Spaling (2003) cites four reasons for the evolution of CBEA:

1. Funding agencies and governments (such as the Canadian government) require EAs for all projects for which they contribute funding. This includes international community-development projects.
2. NGOs recognise that sustainable project outcomes depend on sound management of local resources.
3. Environmental sustainability has become a core value for many NGOs.
4. Two other related evolving concepts provided impetus for the evolution of CBEA. Community conservation entails getting the community involved in conservation activities. Environmental programming entails involving the community in activities intended to address specific resource problems, such as soil conservation. The advancement of these concepts relates to CBEA through their community-centred environmental foci.

In keeping with Chambers's (1983) approach, in CBEA the household is the social unit in which poverty is expressed, and development means 'putting the last first' (as opposed to the popular economic concept of the 'trickle-down' or 'growth' effect); and expanding it to include sustainable social systems (Spaling 2003). These concepts combine to provide community development with the ideals of self-determination, self-reliance, inclusive

democracy, social equity, decentralised decision-making, and environmental sustainability (Spaling 2003).

PRA dominates community development practice, and PRA is an effective means of gathering input. Since an integral part of EA is public participation, incorporating PRA into EA is the natural outcome of combining EA with community development principles.

2.3 Hydroelectricity

The power of running water has long been recognised. For millennia people have been harnessing running water to power machines. These machines have been used for everything from milling grain and minerals, to smelting iron, to pumping water out of mines. These machines operated by having the flowing water in a river or stream turn a wheel connected to a shaft (Sims 1991).

Having these wheels generate electricity is an idea that was realised in the 1880s when the first hydroelectric generating stations were constructed (Oud 2002). Storing water behind dams gave engineers the ability to control the amount of water that passes through the generators, allowing energy to be stored for times of need. Hydroelectric dam building continued from its beginnings, with dam construction peaking between World War II and the 1980s; most hydro projects worldwide were commissioned in the thirty years from 1955 to 1985 (Oud 2002). Currently there is over 700 gigawatts (GW) of

hydroelectricity being generated throughout the world (see Figure 2-4 for a breakdown of hydroelectric generation by region). The current slowdown in dam construction is largely attributable to the fact that the best dam sites have now been exploited, fossil fuel prices in the 1980s and 1990s were relatively low, thermal plant efficiency improved, and reliance on private sector capital cost outlays increased (Oud 2002, Khagaram 2004). However, increased attention may turn to hydro power again in the future as fossil fuel prices continue to rise and because of global commitments to reduce greenhouse gas emissions (Frey and Linke 2002).

One other reason for the possible decline in large-dam construction is public opposition (de Villiers 1999, Khagaram 2004). Large dams require large forebays in order to store energy potential for times of need. These forebays flood vast amounts of land and cause environmental degradation of the affected area through loss of habitat, altered water regimes, and siltation (de Villiers 1999). These forebays also bring about relocation of local inhabitants of the area, often bringing about considerable social and economic hardships for these people despite the fact that the dams themselves are hugely profitable (de Villiers 1999, Inter Church Task Force 1976, Bartle 2002; Zutshi and Bhandari 1994, Frey and Linke 2002, Sims 1991, Khagaram 2004). Opposition to impending forced relocation can become violent, as was seen in India's Narmada Valley (Independent Review Team 1997; Bhatia 1997, Khagaram 2004).

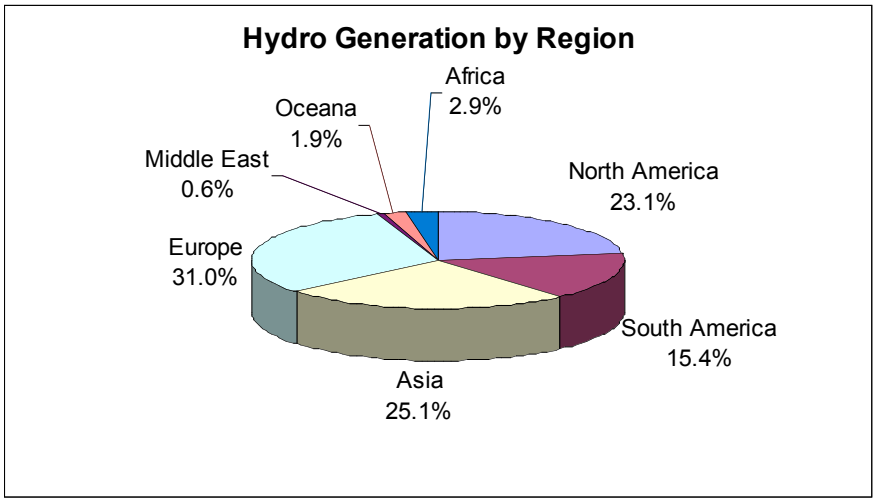

Figure 2-4: Breakdown of worldwide hydroelectric generation by region
(Source data: WEC 2003)

While the pace of dam building may have slowed, it has not stopped and is continuing into the 21st century. Most of the potential dam sites that have been realised are in developed countries (Figure 2-5), so those countries are now exporting their expertise and capital to developing countries in order to profit from the hydroelectric potential of the developing world, where most of the undeveloped potential sites remain (de Villiers 1999; Sims 1991; Oud 2002). International NGOs and foreign companies are active in the development of hydro resources in Asia, Africa, and South America. Canadian companies are among those active in hydroelectric development in India, contributing funding for, among others, the Chilla Dam (See Plate 2-1, Appendix B) and Bhairon Ghatti projects in Uttaranchal (The Statesman, July 27, 2003).

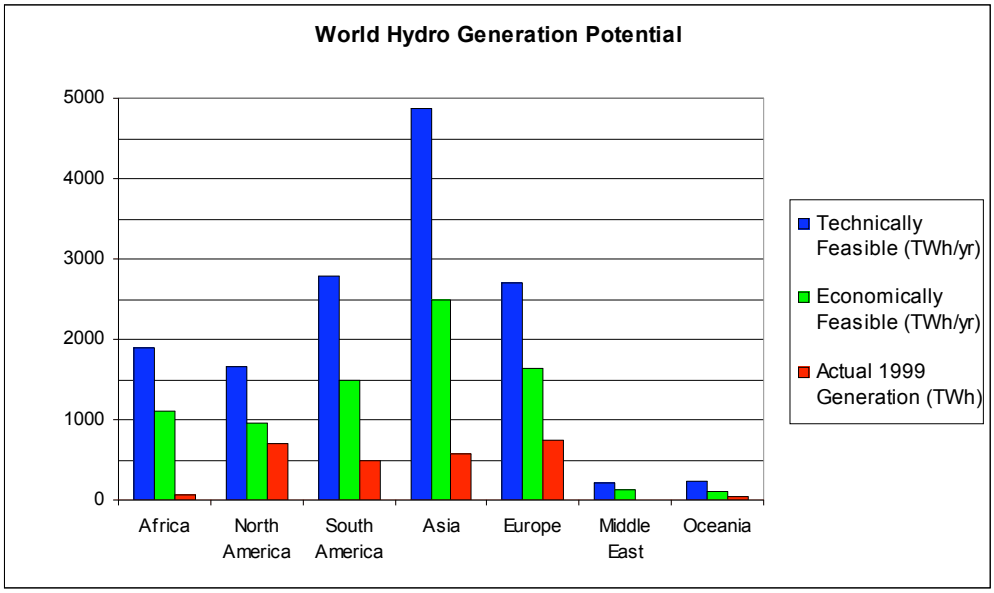

Figure 2-5: Potential and actual worldwide hydroelectric generation by region. (Source Data: WEC 2003)

2.3.1 Hydro in India

India is a country with high mountains and significant precipitation. As a result the country has vast hydroelectric potential; among the highest in the world with over 600 terawatt hours per year (TWh/yr) of economically feasible hydro potential (WEC 2003). Hydro's origins in India were with a 4.5 MW plant in the hills of Darjeeling in 1897 (Naidu 1996). Hydroelectric generation has expanded considerably, and in 1999 the country's hydroelectric generators produced over 82 terawatt-hours (TWh), supplying 17% of the country's electricity, mostly in large dams (Figure 2-6 for a summary of hydro in India) (WEC 2003). There are currently over 1500 small-scale hydro (up to 5 MW in design capacity) sites in India with a total capacity of 400 MW, additionally there

were 80 sites with a total capacity of 350 MW under construction as of 2001, and 1000 additional schemes for a capacity of 500 MW in the planning stages (Figure 2-7) (WEC 2003).

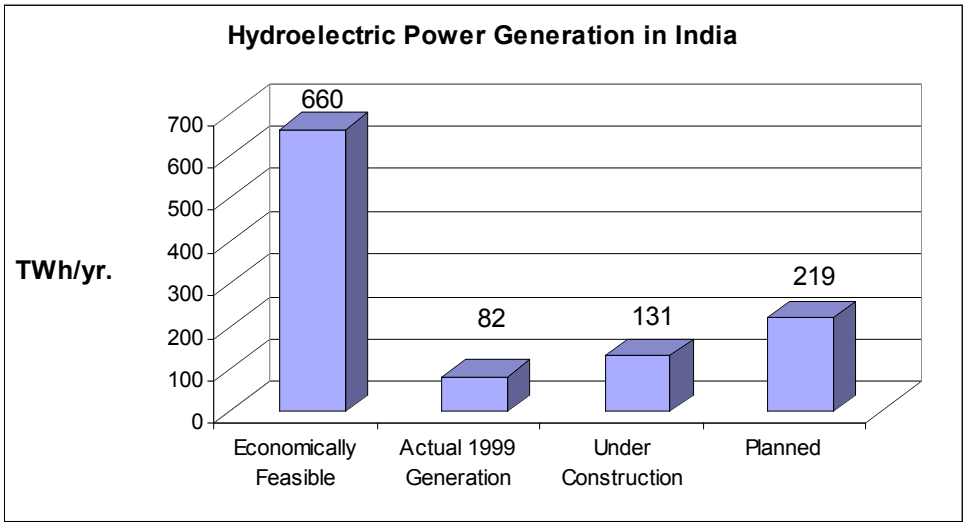

Figure 2-6: Theoretical, current and future hydroelectric generation in India (Source Data: WEC 2003)

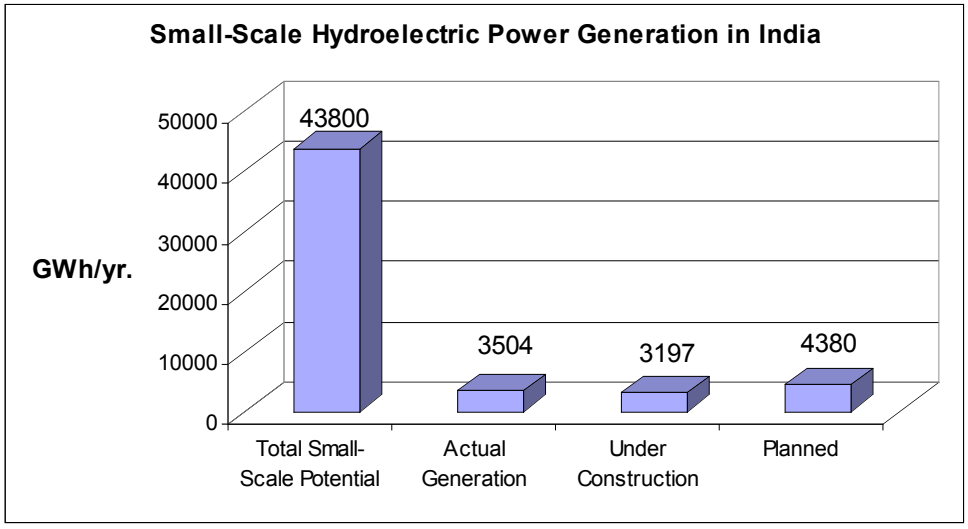

Figure 2-7: Small-scale hydro in India (Source data: WEC 2003)

Hydroelectric generation in India has followed a similar path to that of the rest of the world, however public resistance brought on by forced relocations has been a more prominent feature of hydro in India.

The earliest plans for hydro development date back to the British colonial period. The British had plans for all of India's major watercourses, however their dam building exploits were primarily limited to smaller run of river facilities (Khagram 2004). It was not until independence from colonial rule was attained in 1947 that dam building in India accelerated. Large dams were viewed as being a way for the new country of India to irrigate its fields and power its economy. Several hundred dams were constructed in India between 1950 and 1980 ranging in height from 15 to over 150 metres (Khagram

2004). Most of these projects were initiated immediately after independence. The projects that made up a significant portion of India's public spending were the Bhakra Nagal, Damodar Valley, and Hirakud projects. India's first Prime Minister, Nehru, described the large dams as "India's modern temples" (Khagram 2004).

The pace of dam building in India was maintained throughout the 1950s and 1960s, but in the 1970s the pace began to slow (Khagram 2004, IRN 2005). There were over 30 dams commissioned every year from 1950 to 1977, after which the pace of dam completion waned and only 35 were completed between 1983 and 1987 (Khagram 1987). There are several reasons for the slowing down of India's dam building. Many of the most easily developed sites were selected early on and the more environmentally challenging sites were less attractive for development. The dams that were under construction were experiencing significant time and cost overruns, draining resources. For example, the Dulhatsi project in Kashmir was to have been completed in 1990, but it remains under construction. The Loktak Downstream project is also behind schedule and is listed as being under construction, and costs have doubled from their initial estimates (IRN 2005). Often new projects are started, taking resources away from, and causing delays in projects already under construction. Also, government bureaucracy required for approval of the dams has increased significantly since independence, meaning that more approvals are required from all levels of government (Khagram 2004).

One of the most defining issues that has emerged with large dam building in India has been that of forced relocations. The flooding of villages is associated with most large dams in India, but in the early post independence years, this was viewed as a necessary sacrifice. The first outbreak of active resistance to a dam was to the Hirakud project in Orissa in the 1950s, where an organised campaign took place to oppose the project, which ultimately went ahead and flooded 264 villages. During this conflict Prime Minister Nehru was heard saying to the villagers "If you are to suffer, you should suffer in the interests of the country" (Khagram 2004).

Resistance campaigns became normal for India's dam projects, but it was not until the 1980s that a campaign successfully managed to halt a dam project. In this case the dam was proposed for the state of Kerala. The lands that would have been flooded now form Silent Valley National Park (Khagram 2004, IRN 2005).

The conflict surrounding the Narmada dam is perhaps the most well known of all Indian dam conflicts. The World Bank funded projects along the Narmada River in Madya Pradesh and Gujarat have been ongoing since the 1980s. These conflicts have cost hundreds of lives through demonstrations and hunger strikes (Independent Review Team 1997, Bhatia 1997, Khagram 2004).

In Uttaranchal, the Tehri dam on the Bhagirati River is the state's most contentious. The dam was first approved in 1972 and is still under construction. It will be India's fifth

tallest dam when completed. There is opposition to the dam from the estimated 100,000 people who will be displaced by the reservoir (Khagarm 2004). There is also intense opposition from environmental groups who recognise that the dam lies near a major fault line that has seen intense earthquakes in the past and that the dam may not be structurally capable of withstanding such an earthquake (Khagram 2004).

Also in Uttaranchal the Vishnuprayag project, currently under construction near the town of Joshimath, will divert water from the Alakananda River through a 12 km underground tunnel to a 450 MW generating station (See Plates 2-2, 2-3, 2-4, Appendix B). The Vishnuprayag project has resulted in profound impacts to the quality and quantity of water that is used by local villagers. The considerable amount of blasting that was required to construct the tunnel has damaged homes and may have caused landslides. Villagers are deeply divided about the impacts and perceived benefits from this project.

Again in Uttaranchal, there is a proposal by National Thermal Power Corporation (NTPC) to build another tunnel to divert water from the Dhauli Ganga through a tunnel that would pass beneath the town of Joshimath. Although this project is in its early planning stages, it has already generated considerable opposition from community groups (see Plates 2-5, 2-6, Appendix B).

2.3.2 Small Hydro in India

It has been estimated that there are 2 billion people in the world who do not have access to electricity (The Economist, Feb 8 2001). Almost one quarter of these people reside in India, a country where 45% of the population do not have electricity in their homes. This lack of access to electricity means that the energy available to these people comes in less convenient forms, such as wood, dung, and liquid fuels. These forms of energy are dirtier, and are more work to access and use. The majority of people who do not have electricity live in urban slums or remote rural areas, and are not able to access electricity due to a combination of poverty and isolation.

While most hydroelectricity generated throughout the world comes from large plants that generate power in the hundreds of megawatts, there is much potential for electricity to be generated in smaller facilities with lower outputs, often less than one megawatt in capacity (Wilson 1991). These small-scale hydro plants are well suited for isolated areas that cannot be easily connected to the power grid, but have a watercourse nearby. The cost of building small-scale facilities is much higher than larger facilities on a kilowatt by kilowatt basis, because of economies of scale. Most small-scale plants are run of river, and are unable to store water for managing the supply of electricity (Wilson 1991). Since these facilities are much smaller, and because they are typically run of river, these projects do not have large forebays with their associated flooding, environmental damage, and displacement of people (World Bank 1991; Wilson 1991; Frey and Linke 2002; Bartle 2002; Oud 2002).

Possibly because of increased emphasis on the environmental aspects of large-scale hydroelectric generation, there an is increasing drive for the development of small-scale projects. This is occurring because of the increased emphasis on the environmental and social aspects of large scale dams, and because of the increasing scarcity of economically feasible sites for large-scale projects (Wilson 1991). Of the 700 GW of energy that is generated globally through hydroelectric projects, approximately 18 GW comes from generating stations of 10 MW or less, with a further 8 GW available from small-scale hydro (Wilson 1991; WEC 2003).

While there are no generally accepted means of categorising hydro generating stations according to their output, in India micro-hydro is a generating station producing less than 100 kW, mini-hydro is under 2 MW, and small hydro varies in definition, but can include projects up to 300 MW (Naidu 1996, AHEC 2003). In this report the terms small hydro will refer to all projects under 15 MW.

Uttaranchal is the Himalayan state that is the focus of small-scale hydro development in this thesis. In Uttaranchal, over 32 micro-hydro projects are in operation, producing over 145 MW of power (Ministry of Information and Broadcasting 2004). The total hydro electric potential of the state is approximately 15,000 MW. Much of this power will be generated however, by large hydro dams, such as the Tehri Dam.

Himachal Pradesh is another state where small-scale hydro has become particularly prominent. In the Kullu Valley alone there were 55 potential sites identified by the Himachal Pradesh Energy Development Agency, and there were 18 sites in various stages of development in 2002 (Sinclair 2003).

The advantages of small-scale hydro are particularly well-pronounced in the Himalayas, due to the remoteness and ruggedness of the terrain, the availability of watercourses with sufficient flow and head for electric generation, and the need for development in many areas. There are many villages that do not have access to a reliable source of electricity, and this is often seen as a barrier to increased standard of living and economic prosperity.

The micro-hydro projects that have been implemented in the Indian Himalayas have met with varying degrees of public acceptance. There is the case of Malari, in Uttaranchal, where the project was spearheaded by a villager who recognised the potential benefit of micro-hydro for his village, and initiated a drive to have a micro-hydro generator installed in his town (Bhatia 2001). Much of the labour for construction of the project came from Malari villagers.

More common are cases such as those observed by Sinclair (2003) in the Kullu Valley, Himachal Pradesh. Sinclair observed the EA process at two micro-hydro plants: the 200 kW Kothi plant, and the 1000 kW Solang plant. It was universally indicated by residents of the two villages that they had not been consulted during the planning and construction

of the projects. Villagers also had little idea of how the projects could be of benefit, indicating only that they expect more reliable electricity in the winter (as they were already connected to the regional power grid). The villagers noted that all of the construction-related jobs went to outsiders, largely Nepalese labourers. The villagers also indicated that the likely cost of hydroelectricity would not cause them to switch from cooking with wood, one of the stated objectives of the funding initiative. If there had been adequate public consultation prior to proceeding with the project, it would have been clear that the project in its current form does not meet the funding agencies' criteria.

There are cases elsewhere in Himachal Pradesh described by Sinclair and Diduck (2000) where public consultation was deemed to be inadequate. During Stage 2 of the Parbati Dam on the Parbati River (a three stage project) public hearings were conducted as required by the Himachal Pradesh State Pollution Control Board. Public participation in the hearings was severely hindered by inaccessibility. In one instance the venue was changed on the day of the hearings to a location that required participants to travel over 50 km on two busses, followed by a 15 km walk; all at the participants' expense. Those who did manage to attend complained that there was little opportunity for them to voice their concerns at the hearings.

2.4 Garwhal Himalaya

The field research was conducted on small hydro projects in the Chamoli District of the state of Uttaranchal (see Maps 1 and 2, Appendix B) in a region known as Garwhal.

Garwhal has no recorded history of its own; what has been pieced together comes from an assortment of legends and traditions (Handa 2002), which often contradict each other. The outline presented in this report is a brief summary pieced together from various books on the history of Garwhal and Uttaranchal, and from information gathered during discussions with people in the region.

The human history of the region traces back thousands of years to the beginnings of civilisation. In its early beginnings, Garwhal was a collection of semi-autonomous village-republics (Handa 2002, Negi 1994). Around the first century BC one of these republics began to exert influence over its neighbours, and began to exercise control over the region. This period is now known as the Katyuri dynasty, and was based out of Joshimath. It is believed the inhabitants of this region at this time were of Kasha origin, and are thought to have originated from present day Afghanistan. The Katyuri people are believed to have inhabited the Himalayas before the Aryans arrived in the region. Around the 11th century AD the Katyuri dynasty fragmented into dozens of autonomous units villages and regions, called Mandals. These autonomous units constructed defensive towers or forts to safely store supplies as well as to act as defences. The presence of these forts on the landscape led to the region being known as Garwhal (meaning the land of the forts) (Handa 2002).

These Mandals gradually came together again, and a kingdom evolved from the many autonomous units in the region. The kingdom was based on the shores of the

Alakananda, at the town of Srinagar, and lasted for over 500 years. Over these years, the Kingdom of Garwhal withstood multiple advances from the Chand dynasty in neighbouring Kumoan, from the Mughals coming from the plains to the south, and from the Gurkhas to the east. It was not until the late 1700s that the Kingdom began to unravel after a damaging incursion by the Gurkhas, a severe famine, and a devastating earthquake in 1803 that entirely levelled Srinagar (Handa 2002, Negi 1994, Saili 1995).

In the years after the earthquake, the Gurkhas capitalised on the Kingdom's weakness and moved in on Garwhal, and assumed the role of occupiers. The Gurkhas had already ruled over neighbouring Kumoan for some 20 years, meaning that at that point they controlled all of present day Uttaranchal (Handa 2002).

Gurkha rule in Uttaranchal was short lived however. The British had begun incursions into the territory, and wrested it from the Gurkhas in 1815. The British brought Garwhal and Kumoan into their state of Uttar Pradesh. At the time, the East India Company was seen as relief from the brutal oppression of the Gurkhas. The British built roads and cantonments, which improved trade in the region, whereas the Gurkhas did little to develop their interest in the region during their rule. Uttaranchal also underwent development during British rule, which was made possible from British investment in the area. However the sentiment in the region was that it was largely overlooked in terms of development efforts, in favour of plains regions (Handa 2002, Negi 1994).

Compared to other parts of India, backlashes against British rule were rare. Few recorded events of clashes occurred, however the popular uprising of 1857 did have repercussions in the hills, as insurgents did make their way to Mussourie, but left peacefully. This instilled fear in the British who lived there, and there were instances of Indians being shot by the British for resisting arrest (Handa 2002). In 1929 members of the Indian National Congress organising the non-cooperation movement travelled to Dehra Dun (the present day interim capital of the state of Uttaranchal), and managed to bring about strikes and disobedience. In Uttaranchal, the independence movement was strongest in Dehra Dun. The movement continued until Indian independence was achieved on August 15, 1947. Kumoan and Garwhal continued to be part of the state of Uttar Pradesh in newly independent India (Handa 2002, Negi 1994, Saili 1995).

The movement to create a hill state traces back to British rule when there were demands from hilly regions for greater development assistance in order to address imbalances in development and standard of living between the hills and the plains (Handa 2002). These demands escalated after Indian independence in 1947 as calls for greater autonomy and development assistance continued to be ignored. The political movement strengthened in 1957 as an elected member of the Indian Parliament, Mavenendra Shah, spearheaded a movement for statehood. This movement fizzled and remained largely dormant until 1994 when the movement erupted, and violent clashes took place between security forces and demonstrators in various parts of Garwhal and Kumoan. Notable events in which lives were lost occurred at Khatima, Mussourie and Haridwar where protesters were

killed and raped by police, and at Srinagar when hunger strikers lost their lives from drowning in the Alakananda River while fleeing security forces. Eventually the governments of India and Uttar Pradesh were forced by public pressure to allow for a separate state to be formed out of the mountainous northern part of Uttar Pradesh. These bills received the assent of the President of India on August 28, 2000 (Handa 2002).

On November 9, 2000 the state of Uttaranchal was formed, with Dehra Dun as its interim capital. While the formation of a new state has placated many, there is some discontent about the capital being at Dehra Dun. With 88% of the state being in hilly areas, having a capital on the plains has led many to believe that the situation has not improved. Rather than the state government being run from the plains city of Lucknow, it is being run from the plains city of Dehra Dun and many feel that the dynamics are the same: the hill people are being ruled from the plains. There is a growing movement in Uttaranchal to move the capital to the town of Gairsain, which is in Bageshwar District, where the regions of Garwhal and Kumoan meet. This movement has been the cause of many protests, strikes and hunger strikes in which lives have been lost. As Dehra Dun is the largest and most cosmopolitan city in the state of Uttaranchal, it remains to be seen whether the capital will be moved or not.

The new state of Uttaranchal comprises 13 districts which were previously part of Uttar Pradesh. Uttaranchal has an area of 55,845 km^2, 88% of which lies in hilly areas, the remaining 12% is on the plains (Handa 2002). The population of Uttaranchal is 8.5

million, disproportionately distributed with the major population centres being in the plains, such as Rishikesh, Haridwar, Roorkee and the interim state capital, Dehra Dun. Literacy in the State is approximately 72%.

Uttaranchal is considered a sacred place by many religions, especially Sikhs and Hindus. The Sikh temple of Hemkund Sahib is the second holiest place in the Sikh religion behind the Golden Temple. It is located on the shores of a high mountain lake in the Mana valley of the Chamoli district. Four of Hinduism's holiest temples are located in Uttaranchal. They are Badrinath, Kedarnath, Ganghotri, and Yamunotri. The mountains of Uttaranchal are reputed to be where Hinduism's Vedas and Shastras were composed. Two of Hinduism's holiest rivers, the Ganges and the Jamuna, originate in the Mountains in Uttaranchal. The Ganges officially begins at the confluence of the Alakananda and the Bhaghirati Rivers at Devprayag, which is one of five holy Prayags (confluences) located along these rivers in Uttaranchal. The others are Rudraprayag, Nandaprayag, Karnaprayag, and Vishnuprayag. There are many holy mountain peaks in the Uttaranchal Himalayas, including Nanda Devi (7,816 m), India's second highest mountain. There are holy cities along these rivers in Uttaranchal such as Haridwar and Rishikesh where the devout immerse themselves at the many Ghats along the Ganges. Uttaranchal is a major pilgrimage destination, as people come from all over the world to worship and revere these sites (Handa 2002, Negi 1994, Saili 1995, Walton 1910).

Compared to other Indian states, Uttaranchal's population is very much rural and the level of development is somewhat lower (Handa 2002, Negi 1994, Saili 1995). The state has very much a rural agrarian economy, and many people live subsistence lifestyles. The landscape is very rugged and landslides are common, causing major disruptions in transportation and communication; the people of the upper reaches of the state remain highly isolated.

2.5 Chapter Summary: Public Participation in Small Hydro Development

The people living in the villages of the isolated regions of the Chamoli district in Uttaranchal are among India's poorest rural citizens. People in the isolated Indo-Tibetan border regions pursue livelihoods similar to the way that they have since they first settled these hills over 500 years ago, growing crops and herding flocks of sheep and goats. In order to bring the people of these hills out of a state of agricultural and economic subsistence, development needs to occur. The most obvious means by which increased development can occur is to capitalise on the existing resources that are available to these people such as berries, wool, and legumes, as well as abundant knowledge of these products and how to use them. Most development efforts centred on this area involve starting industries around these products. These industries all require a source of energy.

Most of the villages in the study area are unelectrified, and are separated from the state electricity grid by unstable terrain. The most viable way for these villages to gain access

to electricity would be small hydro using local mountain streams. These facilities can also be used to improve water supply to the villages, and to irrigate fields.

Research on small hydro from other regions of the Indian Himalayas has shown that affected people often excluded from EA planning and research (Sinclair and Diduck 2000; Sinclair 2003). This leads to the need to further examine ways of including local people in small hydro projects in the region. In order to maximise the benefits of such projects, it is of prime importance that local knowledge be gathered during the planning stage in order for these developments to have an enduring positive impact for the people of the villages. The main way for these projects to realise the maximum benefits to the targeted communities, is if the elements of effective public participation are present during their development.

One way of achieving this is through CBEA. By involving local people in determining the suitability and potential impacts of a project they are empowered and there is the potential to maximise project benefits and minimise adverse effects. As well, the literature shows that the more directly people are involved in dialogue and discussion about a project the greater the likelihood of learning being an outcome of the process – such learning may result in more sustainable decisions.

The use of CBEA to involve the public in the EA process to examine biophysical aspects of a proposed development can lead to measures that would ensure maximum benefit and

minimum adverse impacts for affected people. Research on CBEA will be carried out in order to further examine the potential for CBEA applications in development.

3.0 APPROACH AND METHODS

In this chapter, the methodological approach to the research is explained. The philosophy and limitations of a case study approach are explored and discussed. The methods of data collection and analysis are then presented. The chapter concludes with an outline of the major project steps and milestones.

3.1 Case Study Research Design

According to Yin (2003) the decision on what research strategy to use depends on the type of research question posed, the extent of control an investigator has over actual behavioural events, and the degree of focus on contemporary as opposed to historical events. Cases where the major questions posed are 'how' and 'why' type of questions, where the researcher has no control of behavioural events, and where the focus of the research is on contemporary events, demand a case study approach (Yin 2003). Case studies are carried out during research in many areas, including policy, political science, public administration, psychology, sociology, management studies, and community planning (Yin 2003; Riege 2003). Generally this type of research is qualitative, and fits within the interpretive social science classification (Neuman 1997, Creswell 1994).

In this project, the study of planning and development of small hydro plants was accomplished through a comparative case study of five projects in various stages of development. The research carried out was exploratory in nature, the researcher had no control over behavioural events, and the focus of the research was on contemporary

events that had recently unfolded, and are continuing to unfold. A comparative case study is the most appropriate approach for this type of research.

In addition to field work on the selected case studies, an extensive search of literature and relevant documentation was carried out.

3.2 Case Study Selection Criteria

The criteria for selecting case studies for this research were that the cases were to be all in Uttaranchal, and preference was given to sites in the Chamoli District (due to the fact that a research base was to be set up in Joshimath, in the Chamoli District). Five cases were selected: Malari, Bampa, Bamini/Badrinath, Niti and Jumma. The sites were also selected based on size, with only projects under 5 MW being selected. Malari was identified prior to the start of the fieldwork because reports touted the project as a successful example of public participation and community development. The remaining sites, particularly Bampa and Niti, were selected because they are villages with similar cultural and socio-economic demographics to Malari, which facilitated a comparative analysis. Jumma was selected because it was an opportunity to study a failed project. Bamini/Badrinath was selected because the project was being commissioned, and this was seen as an opportunity to gain insight on a project at this stage of its development. Table 3-1 is a summary of the projects studied.

Table 3-1: Case study projects.

	Name	Status (as of November 2004)	Capacity	Proponent
1.	Malari	Completed 2002	50 kW	Malari/NGO
2.	Bampa	Planning stage	25-50 kW	Uttaranchal state rural electrification agency
3.	Niti	Construction to be completed 2006	25 kW	Uttaranchal state rural electrification agency
4.	Bamini/Badrinath	Commissioned 2004	1.2 MW	Uttaranchal state electrical utility
5.	Jumma	Construction halted 1992	1.2 MW	Uttar Pradesh state electrical utility

3.3 Research Participants

Participants in the research included government and NGO officials, community members and leaders, workers who had a part in the project from when the development was initiated to its completion, as well as those who were active in the operation of these projects, and those who make use of the electricity generated. Data were gathered from these participants individually or in small groups with other participants of similar social standing whenever possible. A total of over 100 individuals participated in the research in the villages, primarily during 46 semi-structured interviews, two transect walks and three landscape analyses. Officials from NGOs and all levels of government who were not directly involved in the cases examined, but do have expertise in the fields of micro-hydro and rural development were also interviewed. Research participants at this level

included officials from the Uttaranchal state electrical utility, the state agency responsible for rural electrification, the Uttaranchal forest department, and two academics – one of whom is prominent in the field of rural electrification and small hydro development.

3.4 Methodology

The research began with a review of literature and documentation relevant to the research. The review continued throughout the course of the research.

Field research was conducted using PRA methods due to their applicability with the research conducted, and also because of their link with CBEA (see section 2.3). PRA is in use by many agencies around the world so it is not surprising that many manuals on PRA have been published. The PRA methods that were employed in the research include:

Semi-Structured Interviews (SSI) – also called conversational interviews. These are interviews that do not involve a formal list of questions to be answered, but instead use a flexible guide of themes or topics to be covered; other questions arise during the interview. Open-ended questions are asked (Pretty and Vodouhe 1997; Rietbergen-McCracken and Narayan 1997; Chambers 2002). SSIs can be carried out with individuals, key informants, or groups (Rietbergen-McCracken and Narayan 1997).

SSI were used to determine the roles that people played in the development, how the generated power is used, and the impact that the project has had on individuals in the village. In the case of the proposed projects, SSIs were used to determine how people anticipate that the project will impact on their lives, and how they envisioned participating in the project during the development process. Interviews were also conducted with NGO staff and government officials who may not have been active in either case. Forty-six semi-structured interviews were conducted in the villages, with approximately 100 people participating in the interviews. Interviews ranged in duration from 90 seconds to over two hours. A template of typical semi-structured interview questions and topics is included in Appendix A. Semi-structured interviews were also conducted with officials in NGOs, government agencies, and with academics. These interviews were slightly more structured. Three interviews (two in person and one by telephone) were held with the director of the Uttaranchal Renewable Energy Development Agency, two interviews were held with officials of the NGO Society for the promotion of wastelands development, three interviews and several informal discussions were held with officials form the Uttaranchal state electrical utility, and two interviews and several less structured discussions were held with the Chamoli District Forest Officer. One interview was conducted with the head of the Alternative Hydro Energy Centre and the Indian Institute of Technology in Roorkee, Uttaranchal. An example of typical questions asked in interviews with these officials is also included in Appendix A.

Participatory Mapping is used to provide researchers with information about the physical and sociological aspects of the community, as seen by community members (Mascarenhas 1991; Rietbergen-McCracken and Narayan 1997). Mapping can also be used to chart land use and local knowledge of the landscape (Mascarenhas1991; Chambers 1997). These maps are usually drawn by a large group of villagers, and can be drawn on large sheets of paper, on the ground using chalk, or in the dirt using sticks, to be transcribed later by the PRA practitioner (Rietbergen-McCracken and Narayan 1997).

Participatory mapping was used to determine how a project was expected to change the landscape, and to document land-use. Two mapping exercises were carried out, one in Malari and one in Bampa. The participatory map drawn in Bampa is included in Section 5.2.5.

Transect Walks involve walking with local guides through an area and identifying features, zones, areas of particular interest and importance, and mapping or diagramming the findings (Chambers 1997, 2000).

Along with participatory mapping, transect walks were useful for determining physical impacts. In the case of the completed project, the transect walks revealed physical changes on the land and changes in land use. In the case of the proposed project, transect walks revealed features of interest, land-use patterns, valued ecosystem components, and

potential changes to the landscape that the project may cause. Three transect walks were conducted in Malari, two in Bampa, and one in Niti.

3.5 Logistics

The research began in August in 2004. A research base was established in the town of Joshimath, in which accommodations were found for the duration of the field work. The case study villages were all within 100 km of Joshimath. A total of seven trips to case study villages were made, lasting from one to seven days in duration. One trip was made to Dehra Dun to meet with key informants. After the field research was completed, stops were made in Dehra Dun and Roorkee for additional meetings with key informants. Journeys were made by bus, share-jeep, chartered jeep, and by foot. The roads to the case study villages were frequently damaged by landslides, and it was not possible to begin the case study research until after the monsoon when the roads became more reliable. During the monsoon the 60 km trip to Malari took approximately 10 hours in several vehicles, and included 10 km of walking. After the monsoon the trip would take approximately 5 hours

The residents of the case study villages spoke Garwhali, and had varying abilities in Hindi. It was determined early in the research that local translators would be used. This allowed participants to speak in their own language, and because they were familiar with the individuals, may have been able to speak more freely on certain matters than if outside translators had been retained. A total of three interpreters were hired during the

research process (two locals, and one outsider). The drawbacks with this approach were that one of the local interpreters had limited abilities in English. This meant that questions often had to be explained carefully and repeated often in order for messages to be accurately translated. The other local translator had a psychological dependence, and was frequently 'under the weather' when work was to be done. Finding English speakers willing to work as interpreters was a challenge as English is not widely spoken in this part of India, and the majority of English speakers already had steady employment. Translators had to be shared with two other researchers working on related projects.

Access to all villagers was granted by the village headmen in each of the villages studied. Overall the villagers were conversant, and offered valuable insight. One exception to this was in Malari where the village women were reluctant to be interviewed, and offered only short responses. Interviews were conducted in the fields below the village on one morning in order to learn from them how the small hydro plant and associated irrigation canal has changed their lives. Their reluctance was likely a combination of the fact that they were busy in the fields at the time, and also because gender roles are deeply entrenched in their culture, and they would have been uncomfortable talking to a strange man.

During trips to the case study villages, accommodations were taken in village guesthouses, and in private residences. This presented challenges, as food was often in short supply in the villages. Also, there were health challenges related to spending

extended time in these villages where drinking water is gathered from mountain streams that pass through sheep grazing pastures. There was no bottled water for sale in these villages.

3.6 Validity

Measures were taken during the research to ensure validity and reliability of the results gathered.

Construct Validity

Construct validity is the concept that research be neutral and unbiased, that subjective judgments be minimised, and that the research design be appropriate for the concepts being studied (Riege 2003). In order to ensure construct validity, measures were taken to identify and minimise bias, and to draw conclusions in the most reasonable manner. These measures included using multiple sources of evidence in order to triangulate data during the field research and cross-checking information gathered in the field with other sources. Also the researcher attempted to identify biases, and how they might interfere with the research in order to treat the bias.

Internal Validity

As research findings can be interpreted in multiple ways, making research internally valid involves correctly identifying significant patterns, and the mechanisms that produced them, (Riege 2004). Steps were taken to ensure internal validity by discussing research

findings with participants and key informants, discussing ideas with other University of Manitoba researchers in Uttaranchal, and cross-checking results gathered in the field with other sources

External Validity

The accuracy of the generalisations drawn from research speaks to its external validity (Riege 2003). In this research, techniques to strengthen external validity included defining the scope of the research prior to the start of the field study in order to identify possible findings, replication using five case studies in order to identify common patterns and themes, and comparing findings with similar work done by other researchers.

Reliability

Reliability is the notion that the research could be replicated by other researchers, and that they would achieve similar findings (Riege 2003). In this research, steps to ensure reliability included recording actions and observations as concretely as possible, using a semi-structured research protocol, and following an interactive, adaptive approach when necessary, and recording all research steps in detail so that the research could be replicated easily (Nelson 1991)

3.7 Authorisation and Confidentiality

The names of the research participants were not recorded beyond field notes. Exceptions were made in cases of government officials and key informants who consented or asked to have their names included in published material from this research.

Necessary approvals and consent were obtained from the University of Manitoba, the Government of India, the state government of Uttaranchal, as well as from the participants themselves.

3.8 Data Analysis

The research was compiled and analysed both in the field, and upon return to Winnipeg. Data were analysed with NVIVO software. NVIVO is a software package used to facilitate the analysis of qualitative data. The software allows users to compile and code interview data, and create linked nodes to group common themes. NVIVO was used in this research for semi-structured interviews with villagers. Nodes were created to group selections from certain interviews into common themes. Thirty-two nodes were created during this analysis. There were five case nodes, one for each case study, and within each case node were sub-nodes for design, development, environment, sustainability, learning and roles for a total of thirty nodes. Two additional nodes were created, NTPC and JP, to compile data gathered on two large-scale projects that were in development in the study region.

The data were analysed with a variety of frameworks. Public participation in the processes observed was analysed and classified according to Arnstein's (1969) ladder of public participation, as well as the criteria for meaningful public participation that were detailed in Section 2.1. The results were examined against Shor's (1993) descriptors of critical education and Mezirow's (1994) ideal conditions in order to assess whether learning was possible. Learning was also considered in terms of Hall's (2004) list of outcomes that can be observed when learning has taken place.

4.0 MICRO HYDRO IN UTTARANCHAL

The summer monsoons and winter snowfalls that cover the hills of Uttaranchal have provided the state with a multitude of spectacular rivers. The energy potential of these waterways has been recognised for centuries as local inhabitants have built water mills to harness their energy to do useful work, such as milling grains. The first hydroelectric plant in Uttaranchal, at Golagi, was constructed in 1907 and was one of India's first (AHEC 2003). The overall hydroelectric potential of the state has been estimated at 20,000 MW. As of 2003 only 1100 MW were being generated, but this total will nearly triple as larger projects such as the Tehri Hydroelectric project and the Vishnuprayag project, which are currently under construction, come online.

While the bulk of the hydroelectric energy in Uttaranchal will be generated at larger plants with capacities in the hundreds of megawatts, many smaller projects have been built. The advantages of these smaller projects are that they require less capital outlay, have shorter planning and construction phases, can be operated without specialised operators, and can be used in the electrification of rural areas that otherwise have no access to electricity. There are 1127 villages in Uttaranchal without electricity. Of these 1127 villages, 353 have been identified as being prime candidates for hydro, 540 are candidates for solar energy, while the remaining 234 can be electrified by a combination of biomass and solar (A.K. Tyadi, UREDA, personal communication, November 17, 2004)

4.1 The Study Area

Five micro-hydro projects in five separate isolated villages in the Chamoli district of Uttaranchal were selected as case studies. The villages are Malari, Bampa, Niti, Jumma, and Bamini/Badrinath (see Mape 2). Four of the villages are in the Niti Valley (Malari, Bampa, Niti, Jumma), and one in the Mana valley (Bamini/Badrinath). Three of the five (Jumma, Malari, and Bampa) have intermittent road access to the rest of the state, one (Bamini/Badrinath) has more reliable road access, and one village can only be reached on foot (Niti).

The villages are all inhabited by indigenous Himalayan tribespeople. In the literature they are referred to as Marchas and Tolchas tribespeople (Berreman 1993, Handa 2002), however they referred to themselves as either being Bhotia, or of the 'Shudel' tribe. In this report all historic information on these people is as told to the researcher by the people themselves.

The residents of these villages are devout Hindus, although unlike more mainstream Hinduism these tribespeople eat meat regularly, often as part of a religious ceremony. These villages have been inhabited for around 500 years, and the locals believe that the original settlers came from Tibet, however literature suggests that they may be Mongol in origin from Afghanistan or Mongolia (Handa 2002). Historically the villagers had three main means of sustaining their lives: agriculture, animal husbandry, and trade. The main crops are beans, peas, lentils, potatoes, millet, and peppers. Goats are raised for meat and

sheep are raised for shearing. The men of the villages led mule trains across the high passes into Tibet where they would trade wool, sheep, grains and salt (salt is not found in the Chamoli district). After around five centuries of living in this manner, the trading livelihood came to an abrupt end in 1962 when India and China went to war. Since then there have been no trade expeditions into Tibet from these villages. Further erosion of their traditional lifestyle was brought about when a road linking the Chamoli district to greater India was built in 1964. According to local sources in these villages, populations declined by 50% in the years after the closure of the India/China border.

Traditionally it was the role of the women in the village to work the fields while the men were the shepherds and traders. When the trade collapsed many of the men ended up with little to do, and today many of them are underemployed, occasionally finding work as shepherds, shopkeepers or labourers. Since many of the village men have little to do during the day, alcoholism is a significant problem.

The inhabitants of the villages are migratory. They spend the summer in the villages, and in late October they migrate to villages in lower altitudes to spend the winter, returning the following May. While they spend much of the year in their winter villages, they tend to identify themselves more with the summer village; it is the village that they consider their home. Residents of the four study villages in the Niti Valley all travel hundreds of kilometres to their summer villages, many of them travelling by foot as they lead animals

in journeys that can take up to a month. Residents of the Mana Valley village of Bamini travel to a village only about 60 km away, in a lower part of the Mana valley.

Today life in the Niti Valley villages is pretty much as it always has been, only without the trade with Tibet. There is no electricity (hence no TV or electrical appliances), no telephones, no running water, no toilets or sanitary facilities, no heat; all cooking is done over an open fire, even indoors. Children attend schools in the villages until age 14, then either move away to Gopeshwar to further their schooling, or remain in the village to work. More frequently it is the women who quit school early to help their families in the fields. As such many of the women are poorly educated, and often illiterate, and may only be fluent in their native language (Garwhali), with some limited Hindi. Illiteracy in these villages is higher than in more developed parts of the Chamoli District.

Buildings are traditionally constructed out of stone, wood, and mud. There is often intricate carving in the woodwork on the exterior of the buildings (see Plate 4-1, Appendix B). While concrete buildings are increasingly common, concrete is still rarely used to build houses because of the high cost as compared with wood, stone, and mud, which are freely available. These villages continue to be isolated despite the existence of the road, as the road linking the Niti Valley with Joshimath is in bad condition, and is frequently hit by landslides, cutting off the villages for weeks at a time, and leading to the deaths of dozens of travellers every year. Typically only two or three civilian vehicles will travel this road per day.

Another fact of life in these villages is the presence of security forces. As the villages are near a border between two countries that have been at war, there is a sizeable military presence. The Army has two bases and the Indo-Tibetan Border Police have one base in the upper reaches of the Niti Valley. The military presence in this region is constantly being reinforced by the sound of gunfire and rockets being launched as training exercises. Many military vehicles travel in the region, and there are many soldiers in the area, often venturing into the villages to purchase cigarettes and alcohol.

The case study village of Bamini, in the Mana valley, is adjacent to the town of Badrinath, site of the revered Badrinath temple. The people in Bamini are also migratory, although they migrate only to a village lower down in the Mana Valley: Pandukeshwar. The people in Bamini have a less traditional lifestyle than those in the Niti Valley, largely because of their proximity to Badrinath. While many of the women work in the fields, the men mostly work in Badrinath in the massive tourism industry that the Temple has brought.

Bamini is the only case study village that had electricity prior to their micro-hydro plant being built, and as a result electrical appliances such as TVs, electric stoves, and radios could already be found in the village.

4.1.1 Malari

Malari was selected because of the presence of a micro-hydro generating station touted as being a model of successful participation, which made the case suitable for highlighting interactions among the roles undertaken by various sectors in community development. The plant is a 50 kW facility that provides light to 80% of the homes in the village, at a cost of 20 rupees per household per month (see Plates 4-2, 4-3, 4-4 Appendix B). The plant was partially developed and funded by the NGO Society for the Promotion of Wastelands Development (SPWD), a British-funded NGO that specialises in rural development. Malari was their first venture into micro-hydro in India. The remainder of the funding came from the village, much of it in the form of donated labour. No government agencies were involved in the development of the Malari plant. Design of the plant was done with significant input from the villagers, in particular the late former headman. All steps in the development of the plant had to be approved by the villagers of Malari in regular meetings. The plant is operated by two villagers who were trained at similar community-run hydro plants in Nepal. The plant has the combined benefit of providing irrigation. The tailrace from the plant is directed into a channel flowing to the fields, where it is used for bucket irrigation.

Malari residents speak of the psychological benefit of having electricity in their homes. No longer must they spend their evenings in the dim light of candles and kerosene lanterns because they now have bright light by which to do things at home in the evening. The people of Malari are very proud of their plant, and it is the envy of the other villages

in the Niti Valley that do not have electricity. However, there are some issues that remain unresolved: there is not enough flow in the summer months to adequately run the plant; the plant is currently losing money; and off-peak loads are low to the point that the plant is not run during the day. In order to overcome the problem of low flows, the village hopes to divert water from another nearby stream to augment summer flows through the plant. The plant's finances are expected to improve in coming years when a berry-processing factory is built. The construction of the berry-processing plant will also address the issue of low off-peak loads, as the plant will run during the day when the power generated is not being used for lighting.

4.1.2 Bampa

There are preliminary plans by the Uttaranchal Renewable Development Agency (UREDA), the state government agency in charge of rural electrification, to develop a site near the village of Bampa. The site is actually 2 km from the village, halfway between Bampa and the neighbouring village of Gamsali. Detailed plans for the plant have not yet been prepared, although it is likely that the project will provide electricity to both Bampa and Gamsali, and the water for the plant will be diverted from a mountain stream locally known as the Rishi Ganga. A community-based environmental assessment with the villagers of Bampa and Gamsali was carried out in order to determine issues relating to sustainability and community development (more information and findings on the CBEA carried out in Bampa is included in Section 5.3). It was determined that the benefits of the plant to the community could be augmented if it included irrigation of

nearby fields. Economic benefits identified included the potential to build a grinding mill, eliminating the need to travel to Malari to have grains milled. Environmental benefits included a potential reduced consumption of kerosene for lanterns of 2 to 5 litres per family per month. However, the villagers indicated that they were unlikely to switch from wood to electricity for cooking, because they would have to purchase an electric stove, and wood is free. There were no significant adverse effects identified by Bampa villagers, however many expressed concern that the plant could be susceptible to avalanche damage in the winter if it were to be sited in a certain location. The vast majority of villagers felt that the government agency responsible should consult them during project development. See Plates 4-5, 4-6, and 4-7 Appendix B for potential locations for the Bampa powerhouse.

At the time of the site visit, UREDA had been in discussions with the village on administrative issues and planning. No village meeting had taken place, yet the village headmen were planning to articulate the prevailing opinions to UREDA and IIT Roorkee.

4.1.3 Bamini/Badrinath

The facility at Bamini was commissioned on October 30, 2004 (Plates 4-8, 4-9, 4-10, Appendix B). The plant is a 1.2 MW facility that will provide power to the regional grid. Under normal operation, the plant's electricity will be transmitted to a transformer at Marwari, 60 km away, from where it will be used to feed the regional power grid.

The plant can also be operated in isolation mode, where it will supply power directly to the Badrinath area. The plant was developed by Uttaranchal's Small Hydro office, and construction was tendered to a local contractor. Most of the labourers used during construction were from outside of the region. Plant operators have also been brought in from outside the valley. As Badrinath is a major pilgrimage site, many residents work in tourism. Opinions differed between those working in tourism and those who farm nearby fields, with those in tourism generally feeling that the plant is a positive thing for the community, as it will provide more reliable power. Those in farming agreed that it will provide more reliable power, but also expressed concern about the availability of water for irrigation, as well as for operating two hydro-powered grinding mills. None of the villagers were aware that the plant was designed to provide power to the grid, and not directly to the community.

4.1.4 Jumma

The Jumma plant (Plate 4-11, 4-12, 4-13, Appendix B) was designed and constructed in the 1990s by the Small Hydro office of the State power company of Uttar Pradesh (UPJVNL). The plant was part of a plan to provide power to a portion of the Niti Valley extending over 35 km from Surejtota to Malari. While the plant was built and all equipment was installed, including all power distribution lines, the plant never operated because the diversion channel was damaged by an avalanche prior to the plant's inauguration.

The plant was designed with minimal consultation from nearby villagers, and construction was tendered to a contractor from Kerala, who used outside labourers. There was no evidence of the public having been involved in planning. There are plans by UJVNL Small Hydro office to repair and resurrect the plant in the future.

4.1.5 Niti

The Niti micro-hydro project was examined briefly. Niti (alt. 3700 m a.s.l.) is the last village in the Niti Valley, and is only 12 km from the Tibetan border. In depth study of this project was not feasible as access to Niti is by foot only because there are no roads leading to the village. Also, severe access restrictions are in effect by the Indo-Tibetan Border Police (ITBP). At the time of the visit, the site was in the early stages of construction. A transect walk was conducted with village leaders, and a group discussion was held. Villagers are proud of the project and its potential benefits, but expressed concern that flows may not be sufficient in the summer to operate the plant, and at the time of visit the flows did not appear to be adequate. The plant was designed by UREDA, in consultation with village leaders. The design was ratified by the community in two public meetings. Construction is being carried out by community members.

4.2 Sector Involvement in Small Hydro in Uttaranchal

There are many stakeholders active in the development of small hydro in the state of Uttaranchal. The following sections outline some of the roles of the stakeholders examined, including organisations in each of the public, private and civic sectors. Other

more minor stakeholders are active in the projects, such as equipment suppliers and regulatory agencies; only the major stakeholders are examined in this report.

4.2.1 Public Sector

The Government of Uttaranchal and the Government of India are highly involved in the development of small hydro in Uttaranchal. The government of Uttaranchal released a policy on small hydropower in 2002 in which it outlined sites for development by the private sector. The policy states that private sector companies can develop a site and operate it for a period of 40 years, after which time ownership reverts to the State government, or a new agreement on ownership is negotiated (Uttaranchal State Government 2002). As of 2002 when the policy was released, 404 small hydro sites were identified by the government, 47 sites were available for allotment to the private sector, 11 sites had been allotted by the UP government prior to the formation of the state of Uttaranchal, and 12 sites were in various stages of allotment by the Government of Uttaranchal (Uttaranchal State Government 2002). This policy defines small hydro as being any project generating up to 240 MW, so many of the projects that the policy applies to do not fall under most definitions of small-hydro (in comparison, the largest case study project has a capacity of 1.2 MW; all Manitoba Hydro dams on the Winnipeg River have capacities ranging from 70 to 150 MW, and the Grand Rapids generating station has a capacity of 470 MW).

While the government is active in recruiting the private sector to develop small hydro in the state, it also administers its own projects. The state power company in Uttaranchal, Uttaranchal Jal Vidyut Nigam Limited (UJVNL) has a Small Hydro office which administers and operates hydro plants up to 3 MW. Currently there are nine such plants under UJVNL's control, of which only five are operational. Included among UJVNL's plants are the Bamini/Badrinath and Jumma facilities, which were analysed in greater detail as case studies. UJVNL's Small Hydro Office was formed in 2000 from the small hydro department of the state power company of Uttar Pradesh when the state became independent. All nine projects of the UJVNL Small Hydro Office were inherited from Uttar Pradesh Jal Vidut Nigam Limited (UPJVNL). With the exception of the Bamini/Badrinath plant, all plants had already been constructed. The Bamini/Badrinath plant was in the planning stage at the time of the handover. It was formally commissioned in October 2004.

The second way the public sector is involved in small hydro development in Uttaranchal is through the Uttaranchal Renewable Energy Development Agency (UREDA). UREDA is funded by the federal Ministry of Non-Conventional Energy Sources, in response to the Ministry of Power's Rural Electrification Plan; a plan that mandates that all Indian villages be electrified by 2012 (AHEC 2003, AK Tyadi, UREDA, Personal Communication, November 10, 2004). The plan calls for 62,000 villages to be electrified by 2007 and 13,000 villages deemed 'remote' to be electrified by 2012 (AHEC 2003). UREDA has catalogued 1127 villages in Uttaranchal that do not have electricity. The

state plans to have all 1127 villages electrified by 2007 (A.K. Tyadi, UREDA, personal communication November 10 2004). To date UREDA has completed 34 projects, has 4 projects under construction, and has 3 projects in the planning stage. Of the 34 projects completed, fewer than 12 are in operation, the rest being unused and are in various states of disrepair.

In the past, UREDA's policy was to select a village that required electrification, then survey and plan the plant. Construction would be tendered to outside contractors. Once construction was complete the plant would then be turned over to the local community for operation. Often plant operators were inadequately qualified or trained to operate the plant, and it would fall into disrepair. Ongoing financial support was not provided by UREDA, so plants would fall into disuse because necessary repairs were not being made.

In response to the failure of its earlier plants, UREDA has changed its policy to give villages a greater sense of ownership of their plants. The new policy is for the villages to contribute to the development of the plant. This contribution is to come in the form of labour during construction equivalent to 10% of the capital cost. The villages are then required to set up a management committee for the generating station. The committee is to consist of members from the community and 30% are to be members of the Sirul (lower) caste, 20% should be women, and the village chief is required to be a member. Board membership is to be ratified by the village in community meetings. Under this new policy, engineering and design continues to be done outside the village, usually by

the Alternative Hydro Energy Centre (AHEC) at the Indian Institute of Technology in Roorkee, Uttaranchal (IIT Roorkee). IIT Roorkee also prepares the Detailed Project Reports (DPRs), and provides training for people involved in construction and operation of the plants. While the village is in charge of building the plants, construction is monitored; UREDA personnel visit the site monthly, and IIT Roorkee engineers visit three times over the construction period, which is typically scheduled to last two years.

The academic sector is involved in small-hydro in Uttaranchal largely through the AHEC at IIT Roorkee. The head of AHEC is a world-renown small-hydro expert who is actively involved in both the technical and social aspects of small hydro. He recognises that many of the failures of small hydro in Uttaranchal are social, not technical (Arun Kumar, personal communication, November 17, 2004).

4.2.2 Private Sector

While the government carries out some small hydro development through UJVNL and UREDA, the state government's Policy for the Development of Small Hydropower makes provisions for private sector development (Uttaranchal State Government 2002). Twelve agreements were signed between the government of Uttar Pradesh and various companies to develop small hydro projects, and these agreements were updated in 2001 (following the creation of the state of Uttaranchal). Typically the projects that are developed by the private sector are larger projects as Uttaranchal's small-hydro policy

defines small hydro to be any project up to 240 MW (Uttaranchal State Government 2002).

The private sector is also involved in small hydro as construction contractors. Construction of UJVNL-administered projects is tendered, as were UREDA-administered projects under their old policy. Contractors may or may not be from the local area, and typically they use hired labour from outside of the local area. Many of the labourers encountered during this research were from Nepal, Bihar, or other districts in Uttaranchal.

4.2.3 Civic Sector

Depending on the project, civic sector involvement in small-hydro in Uttaranchal ranges from none to very high. Projects such as those of UJVNL have thus far not involved the local public at any point in their development or operation. The other extreme is projects such as the Malari case study where involvement at the village level was high; Malari was the proponent of the project. In UREDA projects, the civic sector is now involved in the construction and operation of projects, but remains largely excluded from the development and planning of the project.

Non-governmental organisations (NGOs) are in a position to facilitate small hydro development by providing technical expertise, and funds. In Uttaranchal there is only one case of an NGO assisting in the development of a small-hydro plant for a village, and

this is the Malari plant. The NGO involved is SPWD. The Malari project was their first foray into small-hydro in India. There is an NGO active in the Kumoan region of Uttaranchal working in the development of traditional water mills, and they are studying the applicability of using these traditional mills to generate electricity.

Interestingly, SPWD was invited to assist UREDA with the development and implementation of their new policy in light of the success of the Malari project, but SPWD chose to remain independent of the government (YS Bisht, SPWD, Personal Communication, September 16, 2004).

4.3 Small-Hydro in Community Development

In order to bring about a significant improvement in standard of living, micro-hydro plants must be used to develop industries that can make use of the power. Without this industrial development, better light is the only improvement that the villagers experience. One of the major problems with isolated small hydro plants is that off-peak loads are quite low, typically around 25% of peak loads (A.K. Tyadi, personal communication, September 16 2004). This implies that at off-peak times, the electricity may be used to perform useful work that can be used for a marketable good or service. As the villages studied in the Niti Valley have limited means to earn cash, this would be a way for the villages to increase their participation in the regional economy. The best type of development is one that capitalises on existing local expertise or resources.

In Malari, this process is already under way with the development of a plant to make products from locally gathered berries. The village will once again carry out this undertaking with support from SPWD. Other viable possibilities for the valley include making incense from local plants, and getting machines to spin wool or make garments. In October 2004, it was announced that some funds had been allocated by SPWD to proceed with the berry plant. SPWD very much took the lead in this area. The other villages in the upper Niti Valley would require similar guidance in order to pursue a similar ambition. As these villagers typically have subsistence livelihoods, they have little experience with the cash economy and do not have aspirations of industrial development. Most of the suggestions offered by the villagers during the field work dealt with making their lives easier, such as building mills so that they would not have to travel so far to mill their grains. After further discussion, some respondents eventually saw the advantages of selling goods that they milled, but this was typically not something that they considered. However, some Bampa villagers did have some ideas, such as opening a shop to repair flat tires. A disproportionate number of these responses came from members of the Sirul Caste. The fact that they are landless may make them better suited to consider learning new skills and pursuing new livelihoods and opportunities for providing for themselves and their families. It was the higher Castes who have land, who tended to be more concerned with making their current lifestyle easier.

Another simple way of integrating these small hydro plants into a larger plan for improving livelihoods is to direct the outflow from micro-hydro plants to farmland to

irrigate crops. This is being done at Malari, and has been discussed for Bampa. Neither Niti, Jumma, nor Bamini/Badrinath do this; as the tailrace at these plants is or will be directed to rivers.

4.4 Sustainability

The sustainability of these plants is directly tied to their success, and is affected by social and economic as well as environmental factors. The Malari, Niti and Bampa facilities are in different categories from the other two cases in terms of sustainability in that there are factors involved other than electricity production.

Currently, the Malari plant is not economically viable and is subsidised with money that the village receives from leasing land to the army. The plant pays its two operators Rs. 2600 per month each (for a total cost of Rs. 5200), and takes in around Rs 2400 per month. It is currently running a deficit of Rs 2800 per month, validating the suggestion that these plants are not economically sustainable on their own. It is anticipated that the impending development of industry should help to balance the plant's budget. Environmentally, the Malari plant is sustainable as it is sited in a location that the villagers believe is safe from landslides and avalanches, although some minor repairs to the concrete diversion channel are required periodically. The plant is run of river, and as such the water is drawn from high mountain streams. There are no aquatic communities being adversely impacted, as these streams are intermittently flowing and the flows are diverted approximately 100 m above where they would enter a larger watercourse. It was

mentioned in Section 4.1 that the plant sometimes has water problems in drier months. This should be rectified when the diversion channel is extended to a second watercourse.

The Bamini/Badrinath plant was inaugurated only in October of 2004 and would have been shut down for the season only a few weeks afterwards. The sustainability of this facility will likely be a factor of the cost to repair the power lines linking it to its power customers in the south as they will likely be frequently damaged by landslides.

The Jumma plant is not operating because it was damaged by a rock fall in the winter months before it began operation. If the plant is ever repaired and run again its sustainability will certainly be a factor of whether or not the cost of repairing seasonal glacier damage can be offset with operation revenues.

The Niti plant has yet to begin operation, so its sustainability cannot be assessed. The fact that village leaders expressed concerns about low flows does indicate that the plant may face environmental and associated economic challenges to its sustainability.

The Bampa plant design has not been completed, so sustainability cannot be assessed. However it is likely that the sustainability of the Bampa plant will be a factor of the extent to which the designers incorporate the knowledge bestowed to them by the villagers. Once the plant is up and running, the biggest challenge to its sustainability will

be the extent to which the electricity generated can be used to generate revenue, since its residential customers are not likely to be able to afford to cover the plant's costs.

Long-term assessments of the sustainability of these plants are not being carried out by proponents, however it is likely that the development and operation of the plants will be monitored by the proponents and by outside agencies. In the case of the UJVNL plants, sustainability will be monitored by UJVNL itself, and elements of the successes and shortcomings of the new plant at Bamini will be continually evaluated, and noted for future undertakings. It is likely that the elements that led to the failure of the Jumma plant have been documented and will not be repeated in future.

The process of development for the Niti and Bampa plants has come out of the failure of UREDA's earlier undertakings. In a drive to emulate the success of Malari, the process that led to these earlier failures was scrapped in favour of a new policy designed to incorporate some of Malari's successes.

The Malari plant is already deemed to be a success, however its long-term sustainability has yet to be secured. This will likely become clearer once the berry-processing plant is completed. Once this is completed, other similar undertakings may follow, further ensuring the plant's long-term sustainability. Since the Malari project is considered a model of community hydro in India, it is likely that the sustainability of this undertaking

will continue to be evaluated by SPWD, by other NGOs, by government agencies that are interested in emulating its success, and by academic projects such as this one.

4.5 Chapter Summary: Sector Involvement in Small Hydro in Uttaranchal

The field research into the five case studies revealed that there are no typical standards for sector involvement in small hydro plants in Uttaranchal. The public sector acts as the proponent of some projects, and as the regulator of others. The private sector's role in small hydro can vary greatly also – it may be involved in construction of a plant, or it may be responsible for the entire development. The private sector may even reach an agreement for ownership of a plant, under the state's small hydro policy. The civic sector may have no involvement in the design, construction, or operation of a plant, such as the Jumma and Bamini/Badrinath plants; or it may be fully involved in all aspects of the project's development, such as at Malari.

The probability of success of the plants in Uttaranchal is not necessarily a factor of sector involvement, however the anecdotal evidence of UREDA and UJVNL's failed plants would suggest that greater success could be had with greater civic sector involvement. Sustainability of these plants is not simply environmental; the economic sustainability of these plants needs to be given great consideration. The Malari plant is not economically sustainable, largely because it is not being used to capacity. The expectation that the Malari plant would be economically self-sufficient immediately upon completion was not realistic because of the economic reality of the village and the fact that Malari residents

have limited disposable income. The development of industry should improve the economic fortunes of the plant, but there will remain the issue of inadequate flows. The flows in the Malari plant, and the flows expected for the Niti plant are not adequate for proper plant operations. The hydrological unsustainability of these plants indicates that the plants were being designed with an inadequate understanding of the local hydrology.

5.0 COMMUNITY INVOLVEMENT IN THE SMALL HYDRO SECTOR

The five cases examined during the field research were all at different stages of development. The Bampa project was in its early planning stages, the Niti project was in the early stages of construction, the Bamini/Badrinath project had been constructed and had been running in test mode for several weeks prior to its official inauguration in October 2004. The Malari project had been in operation for one year, and the Jumma project had been mostly completed in 1994 but was damaged prior to becoming operational. The Malari, Niti, and Bampa plants were intended as rural-electrification community development projects. The Bamini/Badrinath and Jumma plants were intended to be state run projects that would feed power to the state electrical grid. The proponent of the Malari project was the village of Malari itself with the support of the British funded NGO SPWD. The Niti and Bampa projects were spearheaded by the Uttaranchal State Government agency charged with bringing electricity to all unelectrified villages in Uttaranchal, UREDA. The Jumma and Bamini/Badrinath projects were efforts of the UPJVNL, the state electrical utility of Uttar Pradesh but were transferred to UJVNL when Uttaranchal attained statehood in 2000. The process by which these agencies plan and administer these projects was described in detail in Section 4.0.

The public, private and civic sectors have all had different roles in each of the projects, leading to differences in the degree of success and public acceptance of these projects.

Table 5-1 lists which stakeholders have filled which roles in the development of the five projects.

Table 5-1: Stakeholder roles in the five case studies.

	Name	Planning	Construction	Operation
1.	Malari	Civic (facilitated)	Civic	Civic
2.	Bampa	Public	Civic (projected)	Civic (projected)
3.	Niti	Public	Civic	Civic (projected)
4.	Bamini/Badrinath	Public	Private	Public
5.	Jumma	Public	Private	N/A

5.1 Community Involvement Practices

The overall impact that the small hydro developments had on the case study villages varied depending on the community's involvement. Following is a synopsis of public involvement for each of methods by which the plants were developed.

5.1.1 SPWD Method: Malari

The 50 kW hydro plant in the village of Malari was carried out as a community development exercise. The development process began when the NGO SPWD came to Malari as part of a PRA rural development project. The people of Malari expressed the desire for their village to be electrified. The villagers had been relying on kerosene lanterns, solar-rechargeable lanterns, and candles for lighting, and this lighting was felt to be inadequate. A design for a small hydro project was then formulated in collaboration with SPWD and the villagers. The plant was entirely constructed using local labour. It

features a 1000 m rock and concrete diversion channel, approximately 400 m of steel penstock, a turbine and 50 kW generator, and a concrete tailrace channel exiting the plant and flowing through the village into the fields below where it is used for irrigation. The plant is operated by two villagers who have been trained at a similar community run facility in Nepal. Operation is administered by a manager, and a committee consisting of seven villagers. Customers pay 20 Rupees per month, and 80% of village homes have an electrical connection. The plant was first put into operation in 2003, but operation has been sidelined by low flows in the two mountain streams from which water is drawn. There are plans to construct a diversion channel from a third stream in order to provide sufficient flow. The process by which this plant was developed is referred to in this chapter as the Malari/SPWD method.

5.1.2 UREDA Method: Bampa and Niti

The process by which the Niti and Bampa plants are being developed is referred to in this chapter as the UREDA method. The Bampa plant is in its early development stages, and the Niti plant is in the early stages of construction. Both projects are the product of UREDA's rural electrification initiative. UREDA is a department of the Uttaranchal Government with a mandate to electrify all 1127 unelectrified villages in the state by the year 2007. To date 34 community hydro plants have been constructed by UREDA, and a further 6 are in various stages of development (including Niti and Bampa). UREDA's current development policy involves funding 90% of the cost of development, leaving the remaining 10% to come from the community in the form of construction labour. The

plant is then operated by the community and no further support from UREDA is provided. The design of the plant is administered by UREDA and technical aspects are carried out by AHEC-IIT Roorkee. Niti is the first UREDA project to be structured in this way. As described in Section 4.0, UREDA's previous planning policy was to design and construct the plant using their own staff and hired labour, then turn the plant over to the community. Under the old policy the involvement of the community did not begin until after the plant was built. Most of the plants built under the old policy failed in their first years of operation. The new policy was implemented after learning of the success of the Malari project.

5.1.3 UJVNL Method: Bamini/Badrinath and Jumma

In this chapter, the process by which the Bamini/Badrinath and Jumma plants were developed is referred to as the UJVNL method. The Bamini/Badrinath and Jumma projects were developed by state electrical utilities. These projects were not intended to have any community development benefits beyond the provision of electricity (Jumma) and the provision of more reliability with the electricity supply (Badrinath). Work ceased on the Jumma plant in 1994 prior to it becoming operational after the diversion channel was damaged by a rock fall. The Badrinath plant was inaugurated in October 2004. There was no effort to involve the public in either of these projects. The design of these plants was carried out by the state power company, and construction was tendered out. The plants are to be operated by UJVNL staff.

5.2 Community Involvement in Planning

The most crucial time for gathering public input on a proposed undertaking is before the plans are drawn up. It is important to gather the opinions of all stakeholders and affected parties during the planning process, so that their needs, opinions, and insights can be taken into account. The following sections detail the public involvement practices at the planning stages of the three development processes examined.

5.2. SPWD Planning Process

The process by which the Malari project was undertaken involved a collaboration between an NGO and village leaders. The program was administered jointly between the village and SPWD. Ideas were exchanged, and deals were negotiated. As stated in Section 4.0, much of the impetus for the project came from the late village headman, and support was provided by SPWD. As SPWD operates using PRA tools, of which sharing of information is a cornerstone, information flowed in two directions: between the village (with many of the ideas coming from the late village headman) and the SPWD project officers. The village was responsible mainly for local arrangements, while SPWD handled the business end of the project, negotiated deals with suppliers and obtained necessary regulatory approvals. Information was shared between village leadership and SPWD regularly, and village meetings were held where the village population was updated on progress.

> "*There was a meeting with [the NGO] in August 1999. Everyone expressed interest in going ahead with the project. The project was agreed to in the year*

2000. It was approved by S. P. W. D. headquarters in Delhi. The money was then released. The total amount was 26 lakh, 10 lakh from villagers in contribution of work."
(Malari Village Leader, September 8, 2004)

"The community were willing participants"
(Former Malari Resident, August 28, 2004.)

"There was a meeting held in May, there's a meeting every year."
(Malari Resident, September 8, 2004)

"Firstly there was a public meeting. There were 60 persons at this meeting."
(Malari Energy Committee President, September 8, 2004)

"[Former Village Headman] *was the main guy who brought the micro hydro into to the village, credit should go to him."*
(Malari Villager, August 27, 2004)

"*The late* [Former Village Headman] *brought the micro hydro to Malari.* [Former Village Headman] *was chief from 1992 to 1999."*
(Malari Villager, August 27, 2004)

"The development was spearheaded by [Former Village Headman]*"... "He was very mechanically inclined. First he went to Dehra Dun with his idea, then to Delhi, then he was brought to Nepal where many similar projects exist."*
(Malari Villager, August 27, 2004)

SPWD had initially come to the village in order to explore options for diversifying agriculture from its current state of being done on a subsistence basis; the purpose of

SPWD's mission to Malari was not for electrification, and SPWD had no previous experience with rural electrification in Uttaranchal.

> "*SPWD first went to Malari in June of 2000 while conducting a village study. Seven or eight village meetings were conducted prior to the selection of Micro-Hydro."* (SPWD Project Officer, September 16, 2004)

In the beginning it was noted that there was opposition to the idea of building a hydro plant from some villagers, however as major decisions in these villages are made by consensus, the dissenters reluctantly agreed to follow the popular opinion. It must be noted that none of the research participants in Malari admitted to being against the project in the early-going:

> *"In the beginning there were only five or six people who were pushing hydro. Later up to 50% were actively pushing the idea. Around 25% of the village were not convinced that it would work, but they were convinced after the lights came on. Before that they thought they were wasting money"*
> (SPWD Project Officer, September 16, 2004)

The decision by dissenters to go along with the project may have been cultural:

> *"One good thing about Malari is that meetings are thorough and argumentative, but always end in agreement - this is traditional in Bhotia management systems – community cohesiveness is very strong"*
> (SPWD Project Officer, September 16, 2004)

While the researcher was not present for any community meetings related to hydro, meetings between town officials were witnessed which would support the SPWD project officer's description of Bhotia meetings being argumentative. These meetings were very animated, and although at the time no translator was present to provide insight, appeared hostile. While voices were raised and fists were pounded, the meetings were ended in good humour, seemingly after agreement was reached. If this was the nature of the interactions on the subject of small-hydro development, then it can be inferred that opinions would have been expressed (adamantly) and consensus reached after discussing these arguments.

The opportunity to participate was given to all attendees at the meeting, and all meeting attendees (regardless of gender or caste) were invited to participate and offer opinions. However as no researchers were present during these meetings, only inferences as to the meetings' openness can be made. The social reality of these villages is such that people are divided along gender and caste lines. It is unknown whether the opinions of each section of the village were given equal weight, or whether preference was given to one group, for example higher caste men. It is also possible that the opinions of certain sections of the village could have been given higher weight based on their socio-cultural role. For example, women would have been better placed to offer opinions of irrigation as they are primarily the ones who work in the fields; also the lower castes' opinions on tools could have been sought as they are traditionally the toolmakers.

The decision to proceed with micro hydro was made early, and few other alternatives were considered. This is perhaps because of the regulatory, economic, and practical barriers to other options. The project was intended to have the combined benefit of irrigating the fields. The streams that were diverted for the hydro project were the only flowing streams of any significance in the hills above the fields. While there have been water shortages noted at certain times, this could not have been prevented by using another stream. The solution to the water shortage will come from the diversion of a second stream into the first one. However, the fact that the project was constructed and currently faces water shortages suggests that greater investigation into the hydrology of the streams feeding the plant should have been carried out, and the plant could have been designed more appropriately.

While the process that was followed in Malari was iterative and the course of the process was not charted early, in the case of Malari and SPWD it was clear that the villagers were able to direct the development process. In early meetings with SPWD, it was the villagers who decided upon micro-hydro as the undertaking to embark upon. This was the prime decision that shaped the course of things to come. It is important to note also that this decision was not taken immediately; that the villagers needed time to come to a consensus whereby they had all agreed to proceed with small hydro. The fact that micro-hydro was a village idea and not an idea presented to them by SPWD further re-enforces the notion that it was them who were in control.

The process that led to the development of the Malari small hydro plant was not predetermined, and was highly iterative, yet it was guided by the will of the villagers, and was driven by their ideas.

5.2.2 UREDA

Under the UREDA model, projects are designed by UREDA and AHEC-IIT Roorkee. The design team visits the site several times during its development to conduct surveys and site assessments, and there may be meetings with villagers in which the villagers may have the opportunity to express their opinions. The villagers will have no say on specific details beyond this stage as final decisions are made by AHEC-IIT Roorkee and UREDA. The villagers do not have the opportunity to comment or reflect on ideas or plans once they have been drawn up. In the case of Niti they were only given copies of relevant documents once they had been finalized.

> *"..[the project] is administered by UREDA, Gopeshwar. The general manager is Mr.* [name withheld]. *It will be completed in two years."*
> (Niti Villager, September 10, 2004.)

At the time of the site visit to Niti, the village headman was concerned about flows in the watercourse that would be diverted. The flows were merely a trickle, and did not appear sufficient. The Headman indicated that they had not been consulted about flows. He was supervising construction at the plant at the time of this conversation. If the village had been given a clear understanding of the project and been allowed to comment on the plans, he would have expressed his doubt about the flows.

The Bampa project was in its early stages during the field research and several alternatives were being considered by UREDA. The villagers were considering these alternatives also; however the alternatives are largely going to be decided through financial dealings and not from careful consideration by the villagers. The decision to proceed with a project in Bampa came after the headman (a former high-placed government official in Gopeshwar) contacted UREDA to recommend that the village be electrified.

> *"The idea of a plant in Bampa started when I wrote a letter to UREDA proposing 50 kW plant near Gamsali on the Amrit Ganga. The proposal is to take water from the Amrit Ganga at Dampodhal. There are buildings that were going to be used by an inter-college, but the inter-college set up in Chhinka instead, so the buildings are now vacant. My proposal is to use these buildings for a powerhouse."*
>
> (Bampa Headman, October 8, 2004)

While most residents were aware of the project and its potential benefits, they held no preconceptions of how a project should be developed or operated, aside from knowledge of the plant down the valley in Malari. Villagers did not expect to be consulted, and it appeared during the field research that the villagers were content to simply allow UREDA to tell them what to do. There had been no formal meetings between the people of Bampa and UREDA in which village opinions could be expressed. Bampa villagers remarked that they had not been consulted on the design.

"UREDA came and went to Niti, and stopped in Bampa on the return journey. They had a meeting with four or five villagers. It was a casual meeting."
(Bampa Headman, October 8, 2004)

"They visited the site and explained that the micro hydro would be on the Gamsali side of the river."
(Gamsali Headman, November 10, 2004)

"There is a proposal for a micro hydro for Bampa and Gamsali jointly. They have finished the program for the micro hydro in Gamsali, [UREDA Officer] *will be traveling to Gopeshwar on the sixth and to Gamsali on the seventh. In Gopeshwar he will be meeting with the headmen. The proposal is to send the village headmen of Gamsali, and one or two other villagers from Gamsali. I cannot go unless it is postponed by 10 to 15 days."*
(Bampa Headman, November 5, 2004)

"*Mostly they were talking with the son of the head man. They promised that they would provide light, solar light. Mostly they fixed the lights in Gamsali. They didn't talk to local people, mostly with the son of the headman."*
(Bampa Village Woman, November 5 2004)

"The government has a plan to consult with local people, but local people have no knowledge of the technical sides. They should work together. They will work together in construction, then it will be handed over to the village."
(Bampa Villager, November 5 2004)

"They should work together before construction, because the villagers have no knowledge about these things, there is nothing that IIT can't learn from the

villagers about glacier points and other hazards. UREDA can ask the villagers about canal construction, IIT will do the powerhouse by themselves."
(Bampa Village Leader, November 5 2004)

Despite having no expectations of being consulted by UREDA, the residents did express the opinion that they should have a greater say in the development.

5.2.3 UJVNL

The UJVNL projects featured no public involvement. In many cases, the public were not aware of the project until construction started. The DPR was prepared by UPJVNL, and there was no public consultation during the preparation of the DPR.

As the majority of respondents did not report having been provided with information by UJVNL, either in a meeting or otherwise, the provision of information was done through rumours which were neither entirely accurate nor complete. It was concluded that accurate and complete information was not provided. The only meetings that were held with local stakeholders were with landowners, and with the Badrinath Temple Committee. The meetings were called in order for UJVNL to make an offer to purchase land. Many other area residents were unaware of any meetings.

"Three years ago the power Corporation held public meetings for planning where they asked: "if we are generating power, how will this benefit you?""
Badrinath Temple Committee Official, October 28, 2004.

"There were public meetings, I was at the meeting, he said the powerhouse will benefit the community. In the meeting they asked for my land, and they paid in advance for it. I am satisfied with the price they gave for the land... There were three or four meetings for the land, the last meeting was December 3, 2003."
Bamini grinding mill owner, October 29, 2004.

"I first learned about the powerhouse at Bamini when a man came from the Department to buy land. The paid compensation for the fields and 2 lakh 70,000 for the powerhouse land. The powerhouse land was owned by Jai Ram."
Bamini resident and local contractor, November 3, 2004.

"*There were 50 villagers from Bamini and Badrinath at the meeting. The meeting was for compensation for land."*
Bamini headman, November 3, 2004.

Villagers who did not own any land required for the hydro project, or who are not affiliated with the Badrinath Temple Committee were excluded from the meetings, and in some cases were not aware that meetings had taken place.

"There were no meetings that I'm aware, I did not attend any."
Badrinath Business Owner, October 28, 2004

"There was a meeting but it was only for the land owners."
Bamini Village Woman, October 28, 2004.

"I don't know about any meetings. It is a government project, maybe the only meetings were with landlords."
Bamini Villager, October 30 ,2004

"yes I have fields in Bamini. I don't know much about the new powerhouse I don't see well and don't know what's going on"
Bamini woman, November 3, 2004

The comment: *"It is a government project; maybe the only meetings were with landlords"* suggests that the respondent has a preconceived notion of how government projects are developed, and the manner by which this project was undertaken did not cause the respondent to re-examine this presupposition.

The opportunity for public participation was very limited in this case. Those who were participants in the process were those who owned land that had been earmarked by UJVNL for the plant. Their level of participation was limited to the land transfer transaction.

The people of Bamini are relatively unconcerned about the development of their plant, possibly because they have greater issues with hydroelectric development. The winter village of Bamini is Pandukeshwar, a village heavily impacted by JP's Vishnuprayag project. There have been considerable negative impacts on Pandukeshwar, including water quality degradation, litter, blasting, and landslides. The people of Pandukeshwar have mounted civil disobedience including a blockade of National Highway 58, the main thoroughfare between Delhi and Badrinath. These protests have led to some concessions from JP, however the overall attitude remains one of suspicion.

"Nobody from JP came to talk to us. Why would they come? For Lambargarh it is good, new hospital, new school, houses, water; but for us it is a loss - a loss of water, silt in the water. They think that people in Pandukeshwar are rich because we never complain. Chaiin is also getting benefits. The compensation we receive is nothing compared to the losses that we've experienced. They've cut many trees, our permanent water sources have dried, the water has oil, cement, and fuels in it, and people and animals still drink the water. Labourers are shitting and doing laundry in the water. For us there is no benefit."
(Bamini landowner and winter Pandukeshwar Resident, November 3 2004)

"Our community staged a strike after one landslide. Traffic on NH 58 was stopped for 2 or 3 days. SDM and JP directors came up and promised that they would remove the landslide. They also helped by providing ambulances, repairing bridges. They allowed traffic to go through the tunnel when the road was closed due to landslides, they removed the landslide. The landslide did not damage houses, but it brought down powerlines"
(Bamini/Pandukeshwar Resident, November 3 2004)

People who reside in Bamini are greatly affected by what is going on in their winter home. This experience makes them particularly adamant when they express that they should be consulted in developments on their property.

"They should consult but they didn't."
(Bamini/Pandukeshwar Resident, November 3 2004)

"Consultation should be done by asking the leaders and gentlemen of the area. They should ask the main people of the village – they never do"

(Bamini/Pandukeshwar Resident, November 3 2004)

The failure of the Jumma plant is widely seen as being a failure of planning due to a lack of understanding of local conditions. This understanding of local conditions could have been provided to the planners by local residents familiar with the area.

"It is a badly designed project, done in too much hurry without studying the natural prevailing conditions. That is a landslide zone. Without studying it, they have kept the intake in the form of a channel. They have made the channel at least twice, and in the next year, it gets wasted away by landslides... Transmission lines: At what point of time should the lines be raised? They raised the lines at the same times as the plant was being built. It is a fault of the design, of the people who made it. It can be rectified at any time. The building is also under threat. It is important to have a visionary plan; this was lacking... these [planning] systems do not work"

(Forest Department official, Joshimath, November 8 2004)

"We are actively pressuring the government to get these inoperational plants back into service, I have written several letters to the state government"

(Joshimath Activist, October 2004)

5.2.4 Detailed Project Reports (DPRs)

Pre-project government assessment of small hydro plants is done by reviewing DPRs. The DPRs are prepared or contracted out by proponents, and are essentially screening reports detailing the project features, benefits, and impacts. The DPRs are vetted by the government, and the projects may proceed once approval is granted. As an incentive for

increased development of hydro resources, financial assistance is available from various government agencies for the preparation of DPRs (AHEC 2003).

The copies of relevant sections of the DPRs of three projects (Malari, Bamini/Badrinath, and Jumma) were obtained. The DPR for Niti was reviewed in brief and notes were taken. Table 5-2 lists the DPR authors for the five case studies examined.

Table 5-2: Roles at the planning/assessment stage.

	Name	DPR Author	Villager Involvement in Planning	Villager Involvement in DPR Preparation
1.	Malari	Hired Engineering Consultant	Village fully involved in planning	DPR prepared on village input
2.	Bampa	IIT Roorkee (projected)	Village leaders consulted	none (projected)
3.	Niti	IIT Roorkee	Village leaders consulted	None
4.	Bamini/Badrinath	UP State Power Corporation	none	None
5.	Jumma	Hired Engineering Consultant	none	None

The Malari DPR was prepared by an engineering consultant brought in to provide detailed engineering services, based on the parameters that were agreed to by the leadership and community of Malari, in particular the late village chief.

One of the main opportunities for gathering public opinion of a proposed undertaking is during the regulatory approval process, such as an environmental assessment. None of the case study plants have undergone, or will undergo, a comprehensive environmental assessment; but in all cases a Detailed Project Report (DPR) is required. If the public are not involved in the planning of a project, then the DPR stage is one possible stage when public input on the proposed design can be gathered. Typically DPRs include information on the design of the facility, the layout, engineering assumptions, and anticipated benefits and impacts. DPRs are typically prepared by proponents, or may be contracted out.

While the village of Malari did have ultimate authority in the design of its project, villagers did not play a role in the preparation of the DPR. The DPR was prepared solely by the consultant, and as such some people in Malari were unable to corroborate some of the statements made in the DPR with respect to anticipated benefits (Composite Engineers, 2001). Some examples:

- The DPR predicted that illumination of the village at night would reduce instances of attacks by wild animals (Composite Engineers, 2001). None of the village members interviewed were aware of attacks on villagers by wild animals, either before or after the project's inauguration

- The DPR asserted that deforestation would decrease because the burning of wood would decrease as villagers begin cooking with electric stoves (Composite Engineers, 2001). To date no villagers have begun cooking with electric stoves.

- The villagers do not see the point of purchasing electric stoves when they can cook for free using gathered wood. Also, the gathering of wood in the villages of the upper Niti Valley does not accelerate deforestation because the villagers gather trees that have been knocked down by landslides, avalanches, and glaciers in the winter months.

- The DPR stated that greenhouse gas production would decrease in the village as people begin using electricity for cooking and lighting (Composite Engineers, 2001). As previously mentioned, the use of wood for cooking has not changed as a result of the Malari project, however use of kerosene for lighting has almost been eliminated. The villagers reported that previously they used between 2 and 5 litres of kerosene per month. Kerosene was obtained at government subsidised rates in Joshimath, or on the black market. The reduction in kerosene use in Malari results in approximately 300 litres of kerosene that is not being burned to the atmosphere every month. Lower caste families continue to light their homes with candles, and some limited use of kerosene.

- The DPR predicted that the project will bring about industrial development for the village (Composite Engineers, 2001). While this has not occurred yet, it would appear that the village will soon be developing a facility to process the hippophae berry that is gathered locally.

- Electric light offers better quality light than solar-rechargeable and kerosene lanterns (Composite Engineers, 2001). It was predicted that the plant would allow for longer working hours, and thus greater productivity. While local women who

make rugs from wool agree that they can now work at night, they state that their production has not increased and that it still takes them around 20 days to make a rug. They did say, however, that there is more time to do other things now that their working hours are not restricted to daylight hours.

The Malari DPR was prepared based on design parameters set by the village in consultation with SPWD and the consulting firm contracted to do the engineering.

There was no opportunity for non-residents of Malari to participate in the development process, however the Malari project did not have any impact upon people from outside the village (with the possible exception of black-marketeers in Joshimath who sold kerosene to Malari residents).

It is widely known in the villages of the upper reaches of the Niti Valley that the Malari project has problems with its water source, and flows in drier months are often not enough. The residents of Niti were aware of this, and had also expressed concern about flows in the stream on which their plant was being constructed. Had the village of Niti been adequately consulted, it is unlikely that the plant would have been sited at its current location, and that a more appropriate place would have been chosen. The plant was designed by AHEC-IIT Roorkee and UREDA engineers based on an inadequate understanding of the local hydrology. The DPR was prepared by AHEC-IIT Roorkee (2003b).

As the Bampa project was visited before the site had even been selected, the opportunity was taken to gather community information and opinions about siting, what the benefits and drawbacks of the project would be, and the environmental aspects of the project. Because this project will likely be a joint project with the village of Gamsali, opinions were also gathered from leaders of that village. Some of the major findings were as follows (Please note that these findings are explored in greater detail in Section 5.3):

- The project should be sited on the south bank of the Rishi Ganga;
- The penstock should be buried underground as a seasonal glacier covers the location in the winter;
- There is sufficient water in the Rishi Ganga to operate the turbines;
- The plant, if sited in the location identified, will not take water from other uses;
- The plant should also include a hydro-mechanical mill for milling grains;
- The project will not be used to displace wood as a cooking fuel unless electric stoves are provided free of charge; and
- The project will almost completely displace the use of kerosene for lighting.

The residents of Gamsali who were interviewed expressed similar thoughts as the Bampa residents, although they were more intent on siting the plant on the opposite side of the river so that the water could be used for irrigation of fields after it exits the plant. In November 2004, village leaders from Bampa and Gamsali accompanied officials from UREDA and IIT Roorkee to the site. These opinions were expressed to them. It remains to be seen whether this advice will be acted upon, as the DPR has yet to be prepared. AHEC-IIT Roorkee will author the DPR.

The villagers of Niti did not have any input into the DPR at their facility. There were several visits from UREDA and AHEC-IIT Roorkee staff, however these visits were mainly for gathering physical data about the site. UREDA was keeping Niti abreast of the situation with their plant, however they solicited no input. A copy of the Niti small hydro Detailed Project Report (in English and Hindi) (AHEC-IIT Roorkee 2003) was given to the leadership of the village of Niti, however it must be noted that English is not spoken by any Niti villagers, and Hindi is not spoken by everyone. Additionally, literacy skills are low in the upper reaches of the Niti valley, so the information in the DPR would have been inaccessible to many in the village.

The DPRs for Jumma and Bamini/Badrinath did not feature any public input, and the public was not consulted during DPR preparation. As stated in Section 5.2.3, Bamini villagers were not aware of the project until construction began (with the exception of a few landowners). The Bamini DPR is relatively accurate in its environmental predictions. It does make two assertions in the introduction of the environmental section that turned out not to be entirely true, namely that the project will not involve (UJVNL 1999):

- "*Deforestation and the mandatory compensatory afforestation thereof*" – Deforestation did occur, and compensation provisions are being made to the local Vann Panchayat.

- *"Reservoir-induced seismic activity"* The statement is technically true in that it is a run of river facility and as such does not have a reservoir, however considerable seismic activity did take place in the construction of the diversion channel.

The Bamini/Badrinath plant is intended to supply power to the grid. There were no community development objectives related to the project. The Badrinath DPR does not address socio-economic impacts.

The DPR for Jumma was prepared by hired consultants from Jaipur (Haq Consultants 1993). There is no information on anticipated environmental impacts in the sections obtained. It is unknown if public consultation occurred, although the statement "*It is observed that some of the inhabitants already have the facility of electricity and some of them are anxious to avail this facility"* implies that some form of observation took place. As the plant ultimately failed because of rockfall damage, it is unknown whether improved public consultation could have prevented this outcome. It was clear to a visiting geographer that the plant is sited in a location that would make it vulnerable to rock falls and avalanches (Gardner, personal communication, October 18, 2004). It is likely that local inhabitants would have had previous experience with glacier damage. This experience ought to have been drawn upon by UPJVNL.

> *"The failure of the Jumma plant was a great disappointment for villagers in the area."*
>
> (Former Jumma Resident, Joshimath, October 2004)

Overall, the degree of public input into the planning of the projects examined was greater for the projects that were intended as community development exercises, and public involvement at the planning stage was certainly greatest in the project where the community was the proponent. There was no community involvement in UJVNL projects.

Greater public involvement in DPR preparation is crucial for the sustainability of all projects, as local knowledge can provide background information that is not always available during short survey and reconnaissance visits, such as whether or not there is sufficient flow in a watercourse, or whether or not a plant will get obliterated in a rockslide. In the case of the UJVNL projects, public input should be required to determine if the plant would have a negative impact on their livelihoods, as was the case with the Bamini mill owner.

The fact that the project in Niti was designed and is being constructed without adequate hydrological knowledge could have serious implications when the project is completed and reaches operation. The flow conditions in the stream that is being used should have been given greater study. The fact that the villagers are aware that flows are insufficient is evidence of a serious failure in the gathering of information. The flow conditions were estimated using crude means. Simply asking the opinion of the villagers could have

prevented what has the potential to become a waste of money and a great disappointment for the people of Niti.

5.3 Community-Based Environmental Assessment

As part of this research, a Community Based Environmental Assessment (CBEA) was carried out on the hydro facility to be located near Bampa (see Section 2.2.1).

Ideally the CBEA would have been conducted in conjunction with UREDA, however UREDA has a pre-existing memorandum of understanding with AHEC-IIT Roorkee that made such an arrangement impracticable. It was thus decided though a verbal agreement with the UREDA director that the CBEA would be carried out independently, and findings would then be communicated to UREDA by the researcher, and the headmen of the villages of Bampa and Gamsali.

As the project was in its pre-design stage, CBEA activities were limited to exploring the benefits, impacts, and implications of various design scenarios under consideration. Essentially, one watercourse was being considered for development, a watercourse locally known as the Amrit Ganga, which is a stream descending from the high mountains. It flows into the Dauli Ganga approximately 1 km below the village of Gamsali. As this is a fast moving mountain river, suspended solid levels are quite high. This watersource is used for bucket irrigation, but its use for drinking is largely avoided in favour of better quality sources.

Although the hydro plant was initially described to be situated at Bampa, as the CBEA progressed it became evident that the plant would also affect the neighbouring village of Gamsali, 4 km away, and there was also speculation that electricity could be sent to the village of Farkiah, 6 km below Bampa. Accordingly, the CBEA was expanded to include these villages, while Bampa remained the prime focus.

The two proposals that had been considered by UREDA at various times both included diverting Amrit Ganga flow several hundred metres above where it enters the Dauli Ganga river. One proposal would have the plant located on the Gamsali side of the river, the other possibility would be to locate the plant on the Bampa side of the river where some existing unused buildings could be used as the powerhouse.

5.3.1 CBEA Approach

The CBEA was conducted during a five day visit to the area. Residence was taken up in Bampa when possible, however lack of accommodations and food in the village meant that residence had to be taken up in Malari and Kalashpur on two occasions. At the time of the CBEA Bampa was busy with a government work project, the seasonal harvest, and preparation for the annual migration to lower altitudes. Two side trips were made to Gamsali which included one overnight stay. The first trip to Gamsali was prior to the commencement of the CBEA in order to collect more background information on the

proposal. Farkiah was visited once, and the visit was limited to attending a village festival and conducting a semi-structured interview with the village headman.

The CBEA was carried out largely through semi-structured interviews (individual and group), meetings with village leaders, landscape analysis, as well as through participatory resource mapping and transect walks.

The sequence of information gathering took place as follows:

- Identification of suitable CBEA case study project through telephone interviews with the UREDA director and informal discussions with residents of the Niti valley;
- Preliminary visit to Gamsali and semi-structured interviews with Gamsali headman;
- Visit to Bampa, semi-structured interview with Bampa headman;
- Visit to Bampa, semi-structured interviews with various Bampa residents and headmen;
- In-depth interview with Bampa leaders;
- Group interview and discussion with approximately 20 Bampa residents on the site of a work project;
- Transect walk of potential hydro site with two Bampa residents and two Gamsali village leaders;
- In-depth interview with Gamsali vice-headman;
- Semi-structured interviews with Bampa residents;
- Landscape analysis and discussion of water resources and environmental hazards with Bampa resident at a high vantage point with a view of the study area;

- Visit to Farkiah for semi-structured interview with headman;
- Final visit to Bampa for some follow-up discussions with Bampa officials and residents;
- Visit to Chhinka (Bampa's winter village) for follow-up discussions with Bampa officials and residents;
- Second visit to Chhinka to get update of recent site visit by two UREDA officials, Bampa vice-headman, and Gamsali headman
- Meeting with UREDA director to communicate CBEA results

The son of the Bampa headman, a student of electrical engineering in Gujarat, was visiting Bampa during the CBEA. This individual proved to be an excellent resource, providing assistance in identifying key informants, and arranging meetings. This individual's English skills were superb, and he provided assistance with translation (as his skills were superior to that of the hired translator). He refused compensation for his efforts.

5.3.2 Screening

The selection of a suitable site was among the first orders of business once the fieldwork began in August 2004. The possibility of a small hydro plant being developed in Bampa came to light during a telephone conversation with the director of UREDA. At this time, the researcher had already visited the village of Malari and become familiar with the plant there. As Bampa is close to Malari, is also a Bhotia tribal village that was without electricity, and has many social, cultural and economic similarities to Malari, the decision was made to conduct a CBEA on the proposed Bampa development.

5.3.3 Scoping

This phase of the CBEA took place after the site had been selected, and once arrangements had been made to visit Bampa. This stage included the first visits to the village, and interviews with village leaders and residents. This phase also included a transect walk around some of the key locations relevant to the hydro project, as well as a landscape analysis, where from a point at the edge of the village some residents described points of interest such as cultivated fields, major streams from which water is drawn, grazing pastures, and trails.

At this point it was decided to expand the scope of the CBEA to include Gamsali and Farkiah since the project would have implications for these villages as well, however Bampa remained the focus of the study.

The people of Bampa live in a region known as the Himalayan Desert. It is not surprising that their greatest concern with having a small hydro plant in their midst was water. Also, as these people largely subsist on food that they grow and raise themselves, the vitality of their crops was a major concern. The Valued Ecosystem Components (VECs) in this CBEA are agricultural crops and water.

5.3.4 Impact Prediction & Mitigation

The field investigation continued once the preliminary data had been gathered. Potential effects were considered in terms of the VECs, and other environmental variables such as winter avalanche and ice damage, slope stability issues, and water flows.

The water in the Amrit Ganga river is too turbid for villagers to use for drinking, so it was determined that there would be no negative impact on the villagers' water use from the plant. It was also determined that the plant, if situated as discussed, would have no adverse impact on the crops of Bampa residents. The project could have a positive impact on the crops of Gamsali residents if it were situated on the Gamsali side of the river, as the tailrace water exiting the plant could be channelled to Gamsali's fields and used for irrigation.

People in Bampa are well aware of the hydrological shortcomings at the Niti and Malari plants, and would like to prevent such problems in their plant.

> *"The Amrit Ganga would be a reliable water source; no water problems would be anticpated if the Amrit Ganga were used"*

> *"Diverting Amrit Ganga water will not detract from other water uses as the water is not widely used by residents due to water quality"*

> *"Micro hydro may take water away from irrigation, but this can be avoided with proper design."*

The potential site of the plant along the shores of the Amrit Ganga is in a valley that sustains considerable disturbance during the winter months. The residents believed that the plant could be situated in this location as long as precautions are taken. Generally, it was felt that the pipes should be buried in order to prevent damage to them in the winter season.

> *"There will be no environmental effects from the project."*
>
> *"There will be little risk of damage to the plant during the winter time if it is situated on the Gamsali side of the river."*
>
> *"If the plant is situated on the opposite side of the Amrit Ganga from Gamsali, the penstock should be buried as it may be damaged by seasonally advancing glaciers in the winter."*
>
> *"This plan is dangerous because of the glacier points. It will be damaged every winter. However, if the pipe is buried, it may not get damaged."*

People in Bampa cook with LPG or wood over open fires, often inside their homes. People use kerosene lanterns, solar-rechargeable flashlights, and candles for lighting. The villagers recognise the environmental and health dangers from using these fuels. While they acknowledge that they would use electricity for light, for the most part they felt it was unlikely that they would switch to cooking with electricity since that would require them to buy an electric stove. With wood being free, they do not see the

necessity of cooking with electricity. Unless electric stoves are provided free of charge, emissions from wood burning will continue. However what is likely to stop, is the 3 to 5 litres of kerosene that each village household typically burns every month.

"Micro Hydro is not a problem for the environment. If they build a micro Hydro they can have heaters and blowers and stoves. Then they won't have to cut so many trees."

"Electricity is more powerful than kerosene. It will be cleaner than kerosene if the power will come regularly. It is not good to use wood and kerosene. Sometimes the wood is not good, but the taste of food cooked over wood is better. Otherwise wood is bad because it makes everything black."

"Electricity is better than gas for lights and for streetlights, and for cooking and for keeping warm. It is easier than carrying wood or gas cylinders."

"Micro Hydro will mean decreased reliance on kerosene and LPG. We will give first preference to electricity. We aren't sure if the power supply will be reliable so we will keep kerosene and LPG on hand."

"I don't expect that electric stoves will be used, because of the cost. Wood is free"

"Nobody sees themselves using micro hydro for cooking."

"I cook mostly with wood. The wood comes from 3 km away, but it feels like 8 km because it is a zig-zag road upstream. In the beginning the place was called

Rewalbuggar, now it's called Gurgati. Now it is not bad to collect wood because the road is better and the glaciers knock down trees in the winter."

"If I had electricity, I would use it for light. For cooking, why not?"

"We would use an electric heater if the electricity is reliable. If the power is unreliable, we'll use wood and dung."

One of the objectives of a community hydro plant is to spur economic development and diversification. While some residents of Bampa saw that energy could bring development to their village, the majority of CBEA participants were looking to it as a means to make their subsistence lifestyles easier, and not as a means out of them. The notable exception to this were the lower caste respondents who are landless and more likely face greater struggles to maintain their livelihoods than their Rajput neighbours.

"The powerhouse could also feature a hydro-mechanical grinding mill which is run during the day when electricity is not needed. This would eliminate the need to travel to Malari to have grains milled"

"Electricity could be used to power TVs and radios. Also, having light could allow villagers to work longer hours at night."

"Currently it takes approximately 20 days for village women to weave a rug. Having electricity would allow village women to weave at night, meaning that more could be done during the day. It would still take 20 days to weave a rug, but more time could be spent in the fields during the day."

"We can sell electricity to the ITBP station, maybe at the same rate that we sell to locals, maybe more."

"The energy generated can be used to power grinding or weaving machines."

"We could get a wool carting machine and a little tractor."

"We don't have any way to generate money in Bampa, that is why the power should be used for carting machine."

"Micro hydro is good for the village as it will provide some employment for local people. If the electricity is supplied regularly, it will be good. It will be very good if you advise to the Uttaranchal government. We can establish little industries. I don't know what kind of industries."

"Certainly micro Hydro can be used for economic development, why not? This could mean that maximum people will migrate up in the summer. They can have TVs, CDs."

"We can use the light for the shops, compressors, or inflating tires."

A resource map was drawn with the participation of local villagers. This map is included as Figure 5-1.

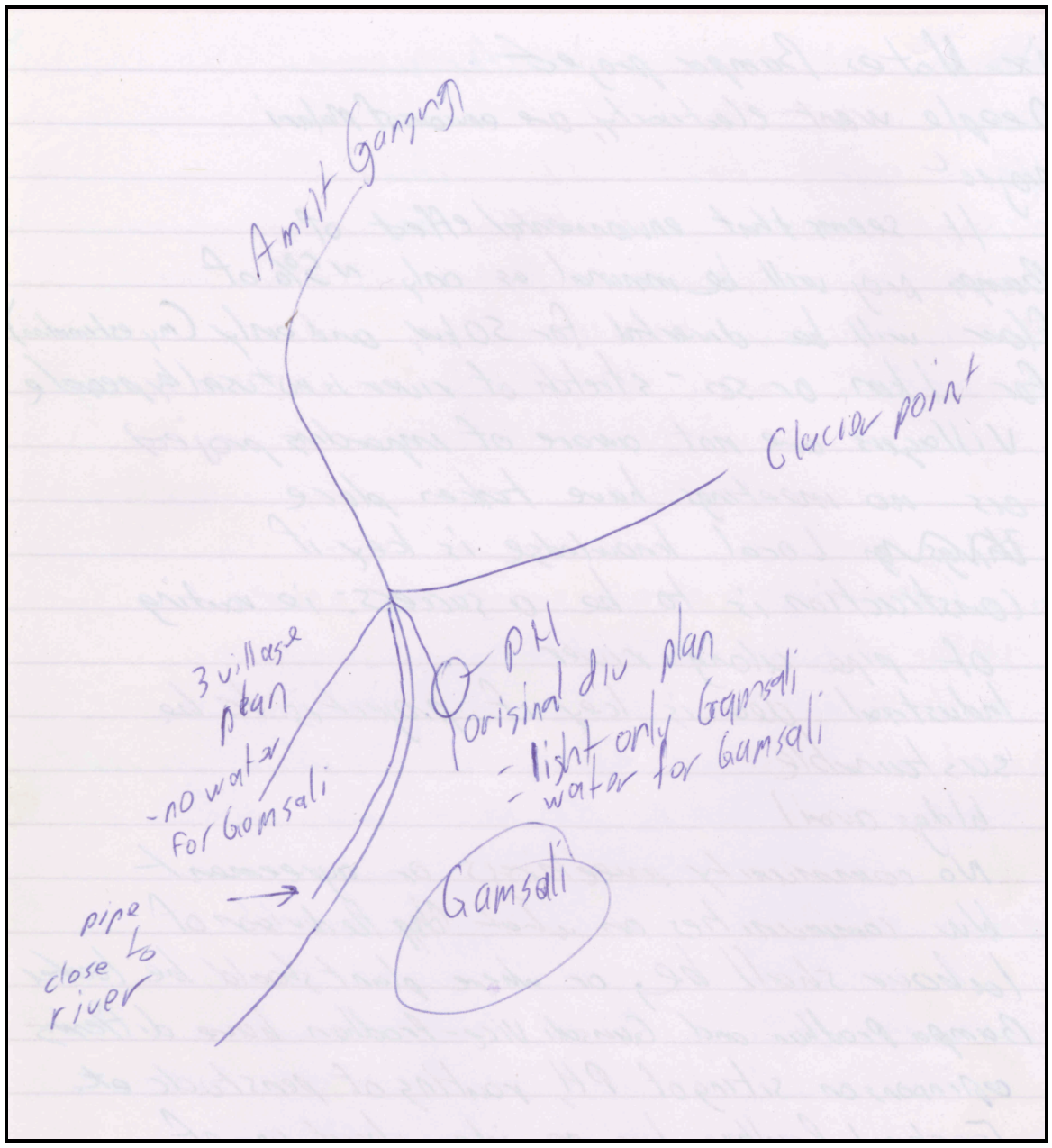

Figure 5-1: Participatory map created on October 8, 2004 in the village of Gamsali.

From the responses and findings of the CBEA work that was carried out, local information would suggest that if the project is sited on the Bampa side of the river, the penstock should be buried in order to protect it from winter damage.

Electricity would displace the 3 to 5 litres of kerosene that is burned per household every month for lighting. However, the overall consensus within the village was that micro-hydro would not displace wood and petroleum products for cooking and heating, as the residents do not want to spend money on an electric stove, as wood is free. If the use of electricity for these purposes is to be encouraged, then UREDA should follow up construction of the plant with providing residents with electric heaters and stoves, at a price low enough to encourage them to stop using less renewable fuels.

5.3.5 Management and Planning

The management plan of a project would likely be written once a project design has been finalised. Some preliminary management planning scenarios are presented based on analysis of the opinions expressed by the villagers. The environmental management of the proposed plant was discussed with the villagers, mainly in later meetings once data on the environmental concerns of the villagers had been collected.

The residents all generally felt that the project could be damaged in the wintertime if situated on the Bampa side of the river, but they felt that a mitigation strategy could be devised whereby the villagers repair this damage every spring. As discussed in Section

5.1, the villagers of Bampa all felt that they should be consulted during all phases of project development and operation.

Future discussions are being held among the village leaders and UREDA in order to decide upon the arrangement that best suits the three villages of Bampa, Gamsali and Farkiah, as all three villages are unelectrified, and are close enough to each other that they could all be electrified by a 50 kW plant on the Amrit Ganga. The capacity of the plant will affect where it is sited, and the siting of the plant would have implications for irrigation. Both the villages of Bampa and Gamsali would like to see an irrigation scheme incorporated into the project. The Amrit Ganga is the most suitable watercourse in this part of the Niti valley for a small hydro plant. If the plant is constructed, and is not used for electrification of the three villages of Bampa, Niti and Farkiah, then this would be a significant opportunity missed.

5.3.6 Reporting

Verbal reporting of the CBEA activities was done in a meeting with the UREDA director on November 14, 2004. Gamsali and Bampa leaders also reported results and opinions to UREDA officials during visits to the village. Reporting of CBEA activities is also carried out in this thesis.

5.3.7 CBEA Challenges

The major obstacle to carrying out a CBEA in a village like Bampa is its isolation. Bampa is situated two full travel days from Dehra Dun, the state capital, and the roads are

frequently cut by landslides and washouts for weeks at a time during the summer monsoon season. Also, there is a shortage of accommodations and food in these villages, meaning that a CBEA team may have to take adequate provisions for an extended stay. Simply offering money in exchange for food may not be an option either as there may be no food available for purchase in the village, and the villagers may not have the time or the means to travel to Joshimath to replenish their stores after providing for outside visitors. Through experience a suitable CBEA protocol could be developed.

The challenges encountered in Bampa would likely be encountered in CBEAs in similar villages throughout the world. The main challenges being that the villagers were busy with their lives and did not always have the time to devote to a CBEA practitioner.

One challenge that a CBEA could encounter is that expectations could be unduly raised. The presence of a CBEA practitioner during a scoping assessment may lead to the expectation of impending positive developments, which, due to a successful scoping exercise, may prove to be unworkable. The presence of a CBEA researcher (as well as the presence of UREDA officials) has led to the expectation in Bampa that the village will soon be electrified. At the time of the research, electrification was far from being a sure thing.

5.3.8 CBEA Outcomes

Public acceptance of such community development initiatives is contingent on appropriately tailoring the development to local conditions. Using CBEA as a planning and assessment tool for such community development initiatives would increase the success rate of these projects by ensuring that they are appropriate. If the CBEA is used as the basis for a DPR, then some of the DPR inaccuracies that were noted in Section 5.2 could be prevented. Spaling (2003) asserts that CBEA should be an iterative tool. The experience in Bampa would suggest that the process should continue throughout the planning and design of a project.

The expense of conducing CBEAs in places such as Bampa is considerable. Presumably the CBEA practitioners would be well-paid consultants and/or NGO officials. The expense of repeated visits to isolated regions would have to be borne by the development agency, however if CBEA leads to more successful projects with sustained outcomes, then this could simply be part of the price of successful community development.

5.4 Community Involvement in Construction

Community involvement in the construction of the plants examined ran the spectrum from 0 to 100%. Of the five projects examined, Malari and Niti involved the public in construction, whereas there was no public involvement in the construction of the Jumma and Bamini/Badrinath plants (Bampa had not reached the construction stage at the time of the research).

There were at least three contracts tendered for the construction of the Bamini plant. One of the contractors hired was local, but he hired labourers from outside the region, largely from Nepal. One Nepali labourer stated that he was involved in paving for this contractor, and that he was not aware of any local people being hired as labourers in the project.

> *"I worked on concrete for steps at the powerhouse for a Joshimath based contractor. That was my own work for the powerhouse. I work in Pandukeshwar the rest of the year doing labour, but not for JP. The JP [Vishnuprayag] project is good in terms of employment, but more so for outsiders, less so for labourers"*
> (Nepali labourer, Bamini, October 31, 2004)

None of the villagers spoken to in Bamini expressed concern that there were no locals employed in the construction of the plant, as most of the locals are already busy working in the fields or in the tourist sector in Badrinath. They indicated that working as a construction labourer did not appeal to them.

Malari featured the highest degree of civic engagement in construction as the majority of labour was carried out by the villagers. Outsiders were only brought in for highly specialised tasks, such as for the final installation of the generator, and installation of the control panel. The work was done by villagers as a communal effort. Villagers were given nominal compensation by the village for their contributions during construction. One difference in civic engagement in construction between the Malari and Bamini

plants, is that local villagers were better able to contribute their time because they generally have lower-level employment commitments than people in Bamini.

> "*I helped in building the channel. Everybody was a part, everybody was involved in rotation, someday some people, some days others."*
> (Part-time Malari resident, Joshimath, August 23, 2004)

> *"The community were willing participants in the construction, everyone was a part of it, including myself."*
> (Malari resident, August 27, 2004)

> *"The work included building, and hauling materials over landslides on the road."*
> (Malari resident, August 28, 2004)

Niti is the first project to follow UREDA's new policy of increased public involvement. At Niti, construction is being carried out by 20 community members. They are involved in a similar way to Malari, only their involvement is much more structured, following UREDA's policy. The 20 workers hired at Niti are to become permanent employees of the construction effort, whereas at Malari the conditions of employment were much less formal.

Jumma was also a government undertaking, and construction was tendered out. Construction of the Jumma plant was tendered to a Kerala contractor who hired labourers from outside Garwhal. There was no local involvement in the construction of the Jumma plant. Unlike the case at the Bamini plant, there would have been plenty of opportunity

to use local labourers as the socio-economic conditions at Jumma are similar to those at Malari and Niti.

5.5 Community Involvement in Operation

Only one of the five case study projects was observed in operation. The Malari project has been in operation for over one complete operating season, in addition to its trial period the year before. The Bamini/Badrinath plant has been operating in trial mode for several weeks at the time of the field research, but its official unveiling and the start of regular operation was not to begin until 2005. The Niti project was at the beginning of a two-year construction phase at the time of the field research. The Bampa project was in the early stages of its development and was not expected to be operational for a few years. The Jumma project was mostly completed in the early 1990s, but was damaged before becoming operational.

Because of the status of the five case study projects, only Malari was observed in operation. At Malari, civic involvement in operation is 100%. The plant is administered by an elected committee of villagers, and the plant operators and manager are community members. The general manager is a local shopkeeper, and the two plant operators are local village men who were selected and hired by the management committee. Training for the operators was organised by SPWD. As part of the training, the operators were sent to a similar community micro-hydro in Nepal, where they observed operations, and learned basic repairs and maintenance. Since the plant was inaugurated, there has been

no outsider involvement, and SPWD has no role in the operation of the plant. All plant operations are handled by the village.

> *"Power in Malari costs 20 rupees per month per bulb. The money collected goes to maintenance. The money is enough to cover operations. 40 to 50 houses have electricity. There was no electricity before."*
> (Part-time Malari resident, Joshimath, August 23, 2004)

> *"Two people work full time on the plant, Mr* [name withheld] *and Mr* [name withheld] *Mr* [name withheld] *is the president of the Malari Micro-hydro"*
> (Malari resident, August 27, 2004)

> *"The power is turned on and 6 p.m. and turned off at 6:15 a.m. the plant is run at 31 to 32 kW"*
> (Malari plant operator, August 27, 2004)

As described in Section 4.0, UREDA's revised policy on small-hydro development is modelled after the process followed in Malari. Villagers selected by an elected committee similar to that in Malari will carry out operation of the Niti and Bampa plants. The intent is to have the plant operate by the village without outside support. Training will be provided to the plant operators at IIT Roorkee. It remains to be seen whether this model can emulate the success that Malari demonstrated in their first two years of plant operation.

Bamini/Badrinath will feature no civic involvement in its operation. The plant is not as simple as the smaller projects at Malari, Niti and Bampa, and requires skilled trained technicians to oversee its operations. Repairs and general maintenance will be carried out in-house by UJVNL staff, or by hired contractors. A full-time plant operator was interviewed at the time of the plant's inauguration. This plant operator is an employee of UJVNL, and is not from Garwhal. There are no plans for local involvement in the plant's operation.

The Jumma plant never made it to operation, but the plant would have been operated exclusively by in-house staff, with no local involvement, similar to the Bamini/Badrinath plant.

5.6 Effectiveness of Public Participation

When public participation is solicited, the ultimate outcome of having gathered the opinions and suggestions of members of the public can be highly variable. Arnstein's ladder of public participation was an attempt to rank public involvement based on the contribution that the civic sector is allowed to make to the overall direction of a project or undertaking.

Going beyond simply quantifying and ranking public participation has been the subject of extensive study in the NGO world to maximise the benefits of public participation in community development projects. This work has undergone scrutiny from the academic

world, and principles of meaningful public participation for EA have been developed (World Bank 1999, IUCN 2005, IADB 2000, Sinclair and Diduck 2005, Stewart 2005). These are:

1. Notice. Early and adequate notice of all major steps in project planning and decision-making
2. Access. Fair and reasonable access to registry and project information
3. Assistance. Financial assistance to groups in the civic sector so that they can adequately represent their interests in project planning and decision-making
4. Meaningfulness. Meaningful opportunities to comment on and influence decisions regarding the project, alternatives to the project, and key project features and impacts
5. Openness. Open and fair public hearings when the project proposal generates significant conflict and controversy
6. Inclusiveness. Inclusive and adequate representation engaging interested and affected parties
7. Transparency. Integrity and accountability, including transparency of process and follow-up on input given by the public.

The process by which the Malari project was undertaken involved collaboration between an NGO and village leaders. The program was administered jointly between the two stakeholders. Ideas were exchanged, and deals were negotiated. As stated elsewhere in this thesis, many of the ideas came from the late village headman. As SPWD operates using PRA tools, of which sharing of information is a cornerstone, information flowed in two directions: between the village (with many of the ideas coming from the late village headman) and the SPWD project officers. The village was responsible mainly for local

arrangements, while SPWD handled the business end of the project, negotiated deals with suppliers and obtained necessary regulatory approvals. Information was shared between village leadership and SPWD regularly, and village meetings were held regularly where the village population was updated on progress.

Malari was the proponent of the project, so the principles of effective public participation do not apply directly to this case as they would if it had been an outside proponent. In order to analyse public participation of the Malari project, it is necessary to examine the internal process within the village to assess whether all villagers fully had the opportunity to participate. Another public participation issue is to determine how stakeholders from outside the village who might have been affected by the project could have participated in the process.

The evidence presented in Sections 5.1 to 5.4 would suggest that participation by the village was meaningful, and that opinions were heard from all villagers who chose to express them. The main issue of contention with the Malari project would have been the issue of inclusiveness. Because no researchers were present during the meetings, it cannot be concluded that the process was inclusive. Malari is highly divided along gender and caste lines, and it can be inferred that these divisions were at play during the community drive to develop the project. Some evidence of this would be the unequal participation rate between the two castes of the village. Over 80% of the higher caste families have electricity in their homes, whereas only 25% of the lower caste families

have electricity. Had the process been truly inclusive, means could have been worked out so that the lower caste families were not barred from this standard of living by their depressed social and economic status.

It was not determined whether non-village stakeholders had any opportunity to participate in the process, but no non-village stakeholders in the project were identified. The project affects only a localised area, and the water that is intercepted does not flow past any other homes or villages.

Malari had the highest degree of public engagement, largely due to the fact that the village was the proponent of the project. The village was involved in planning, development, construction, and continues to be involved in the operation of the plant. While the vision and impetus for much of the project came from the late headman, there were consultations in the village and the project was endorsed in these consultations. There was even dissent, although the dissenters in the end reluctantly decided to go along with the project trusting the wisdom of their leader. As the village has ownership of the plant, and has complete control, citizen participation in the Malari project is on the highest of the eight rungs on Arnstein's (1969) ladder of public participation: citizen control.

Under the UREDA model, the village had certain opportunities to participate in the process, but these opportunities were limited. There was limited notice of major project

steps beyond the visits from UREDA. The villagers of Niti did not have access to project documentation until after it had been finalised. They were not given the opportunity to conduct their own investigation into the project. The process was not transparent, as all decisions were taken without the input of the village. The Niti project was intended as a community development project, yet the community had limited opportunity to participate in the direction of the development. If Niti had been properly informed and had been asked for their input, they would likely have expressed doubt that the stream selected for the plant has sufficient flow. The participation of the people of Niti during the planning process was limited to deciding whether or not to agree to UREDA's terms for the project to proceed.

The process will likely unfold the same way for Bampa as it had for Niti, as it was during the field research when negotiations were underway between the headmen of Bampa, Gamsali, and Farkiah on an arrangement on how to make the project work to the benefit of all three villages.

UREDA's system incorporates elements of Arnstein's (1969) second and third highest levels of public participation: delegated power and partnership. The overall arrangements being partnerships in that both the villages and UREDA have stakes in the project, but delegated in that the villages' roles in the project are pre-set by UREDA, and the villages must agree to UREDA's arrangement as a pre-condition.

One aspect of UREDA's projects that is not so transparent is the process that leads up to the selection of villages to electrify. It was stated by the director of UREDA that the 1127 villages requiring electricity are not prioritised, which appears to leave the selection process open to interference.

The CBEA that was conducted in Bampa as part of this research would be an example of proper public participation for this type of development. Efforts were made to connect with the villagers, to understand their lives and to understand their needs. This type of information gathering exercise is meaningful public participation. It could easily be expanded to the point that the villagers are collaborating on preparing the DPR, or to a point where the process is used to steer the development.

Public involvement at the Bamini plant was limited to compensation meetings with landowners. The process did not meet any of the conditions for ideal public involvement for the remainder of Bamini citizens. There was no evidence of public participation having taken place at the Jumma plant either. This may have been the cause of the Jumma facility's failure if in fact local residents could have advised the proponents that the facility was being sited in an environmentally unstable location. The state electrical company's public participation strategy has been one of non-participation.

5.7 Public Participation and Implications for Learning

It has been demonstrated that learning can occur through public involvement in environmental assessment (Sinclair and Diduck 2001; Fitzpatrick and Sinclair 2002; Diduck and Mitchell 2003; Fitzpatrick 2001; Webler et al 1995). Most of the existing work was carried out in developed countries, so it is worth examining the implications of this research in terms of learning in order to gain insight into the potential for learning in developing societies.

Learning in EA has been assessed by evaluating public involvement processes against conditions under which learning can occur. The criteria against which learning is assessed are Mezirow's (1994) ideal conditions of learning and Shor's (1993) descriptors.

As described in Section 2.2, transformative learning (Mezirow 1991, 1994, 1997, 1997a, 2000, Cranton 1994) remains largely a theory-in-development. The theory has grown and become more comprehensive as it is further analysed, and in many cases, critiqued. Professor Mezirow frequently issues clarifications in response to comments and criticism of the theory by peers. Many of the theory's assertions remain untested, and in some cases, untestable.

In 1994 Mezirow further refined the theory by identifying six conditions that are required for learning to occur. To quote Mezirow:

> *"The ideal conditions of learning are also the ideal conditions of education. They are never achieved in real life but are important as standards against which to judge educational efforts and for setting norms that protect participants from the inequalities in power and influence that commonly corrupt discourse."*
> (Mezirow 1994 p 226).

These are the standards by which the processes of small hydro development in Uttaranchal were examined in this research analysis. The conditions are (Mezirow 1994):

1. Provision of accurate and complete information;
2. Freedom from coercion;
3. Openness to alternative perspectives;
4. Ability to reflect critically upon presuppositions;
5. Equal opportunity to participate; and
6. Ability to assess arguments in a systematic manner and accept a rational consensus as valid.

As public involvement was greatest in Malari, it follows that the ideal conditions for learning were most directly observed in Malari. Accurate and complete information was exchanged between the villagers who were spearheading the project and the rest of the village, and these villagers had the opportunity to reflect and comment on the information. There was no evidence of coercion having taken place. There were no alternatives considered, however there were some dissenting opinions which were expressed freely. The decision process was made by consensus as the village agreed to proceed with the project.

What could not be inferred from the research was whether or not there was an equal opportunity for all villagers to participate, as there are divisions along caste lines, and as the women may have been more likely to be absent from meetings as they tended to the fields.

While the same inferences can be made about the interactions at Niti, it was shown in Sections 5.2, 5.4 and 5.5 that the elements for public involvement were not present in the UREDA process. It follows that fewer of the ideal conditions for learning were present. The provision of information was neither accurate nor complete, and there were no alternative perspectives considered.

Similarly, under the UJVNL model, public involvement was limited to those villagers who owned land that was bought for the project. Their involvement was simply to conduct the real estate transaction. The lack of involvement for the rest of the villagers meant that the conditions required for transformative learning to occur were unfulfilled. There was no provision of information, no openness to alternatives, and no opportunity to participate.

From this analysis, it is clear that the conditions for transformative learning to occur were observed primarily in the Malari case. There was limited opportunity for learning in the remaining cases due to lack of public involvement. While it may appear that learning

was not possible in the UREDA and UJVNL cases, further study could be done to determine whether transformative learning can occur through exclusion.

The second major learning theory that has been used to assess learning is critical education, using Shor's (1993) descriptors. Critical education is the type of learning that results when students are taught by Freirian methods, namely, taught using Friere's (1972) critical pedagogy, where they learn through making discoveries on their own, by asking questions, and by challenging conventional systems and authorities (Taylor 1998, Friere 1972, Shor 1993).

Through extensive academic analysis of Freire's critical pedagogy, it has been widely accepted that Freirian methods can be used in all forms of education. Shor's descriptors were developed as a means to identify situations where learning can occur. These descriptors are often used for formal education, but have been used as tools to analyse whether or not critical learning can occur in certain non-formal learning situations. The processes that were examined as part of this research were not learning exercises, but learning may have occurred with participants during the processes examined.

Shor's Descriptors:

1. Participatory: the learning process should be interactive and cooperative;
2. Situated: Subject matter based in student thought and language;
3. Critical: the students reflect on their own language and knowledge, on the subject matter, and the relation of their knowledge to society;

4. Democratic: discourse is constructed equally between the instructor and the students, and among the students;
5. Dialogic: the students are doing education rather than having it done to them;
6. De-socialisation: previously learned social dynamics of learning and instruction are challenged, the teacher is no longer domineering, the students are no longer passive;
7. Multicultural: all racial, ethnic, regional, age-based, and sexual cultures are recognized and there is a critical attitude towards discrimination;
8. Research oriented: students are encouraged to examine their own speech, behaviours, and conditions;
9. Activist: the learning dynamic is active through problem posing and solving, co-operative learning, and participatory formats;
10. Affective: The problem-posing, dialogic method includes a range of emotions from humour to compassion to indignation.

In comparing these descriptors to the series of events that are understood to have taken place in Malari, it is speculated that the conditions of Shor's descriptors were largely fulfilled. Villagers in Malari were involved in the early stages of the development process, were involved at the planning stage, and were able to provide input during meetings. In the case of Malari the meetings were facilitated by SPWD and the ideas and thoughts collected were used as input in the design.

The issue of multiculturalism that is singled out by Shor (1993) relates primarily to peoples that have been oppressed, and to the prejudices that perpetuate this condition. The main cultural differences in the Indo-Tibetan border areas of the Chamoli District, as previously mentioned, are gender-based and caste-based. The social and economic

hierarchy in these villages is based on these differences. Because the prejudices are self-imposed and rooted in centuries of tradition founded on religious principles, they cannot be challenged in the ways intended by Shor. Ignoring these differences, as may have happened in Malari, can lead to the outcome of electricity being less accessible to the lower caste families. If there had been a greater effort to recognise and accommodate the social and economic differences between the castes, then their decreased ability to participate could have been emphasised and special provisions could have been made for these families. Similarly with gender, as women and men occupy different roles in the community, then special provisions could have been made to gather the opinions of women.

Participation under the UREDA model is believed to be less pronounced, and as such there were fewer opportunities for critical education. Unlike the Malari model, in the UREDA model, the development path is predetermined. In this model, the villages are presented with a development process and they have the choice of two options: to opt in and develop a project following UREDA's predetermined conditions, or to say no and for the village to remain unelectrified for the foreseeable future. In the UREDA model, it would appear that the villagers do not have the option to control the direction of the process. In this respect, it is not participatory.

In UREDA development projects, the design is carried out by engineers, and the only opportunity for the villagers to convey their thoughts and ideas to UREDA is during

visits from officials and survey crews. These crews may not be well versed in community development and PRA and may not have the skills to situate the conversations in the local vernacular. The opportunity for people in UREDA villages to influence the content in the DPR is much more limited than it was under the Malari model, and the interaction is not situated in their thought and language. The UREDA process does not place particular emphasis on public participation during the design and development process beyond the tasks that it allocates to the villagers. There is little input requested from village participants, and discussions relate to financial and technical issues. There is no capacity within the process for the participants to reflect upon these interactions. Essentially UREDA approaches the villages with a list of tasks, and the villages must then determine how to best carry out the process. The UREDA process is democratic only in that it was developed by an agency of a democratically elected government. The UREDA model tends towards more of a one-way flow of information, and as such the dialogue was rather limited.

There was no opportunity for critical learning in the UJVNL method as it was described, as it was not participatory. As Shor's descriptors were not met, any learning that may have been spurred by the development of the Bamini facility (alone or in combination with the JP's Vishnuprayag facility) would have taken place by means that are not covered by Shor's (1993) descriptors or Mezirow's (1994) ideal conditions of learning.

While there may be limited opportunity for the residents of Bampa to learn through their interactions with UREDA, the CBEA that was carried out may have contributed to expanded awareness in a way that UREDA's methods do not. CBEA uses PRA tools, and a conceptual link between PRA and learning was described in Section 2. The CBEA that was carried out in Bampa was a research exercise and had limited impact on project development, although results were communicated to UREDA's director. In the CBEA that was conducted, all available information was shared with the community; there was no coercion; all perspectives were considered; participants were given the opportunity to reflect critically and showed evidence of having given careful consideration to the subject in the time between the researcher's visits to the village. All villagers were given equal opportunity to participate.

There was a genuine attempt to situate the subject in local thought and language and technical terminology was largely avoided wherever possible. There was a constant dialogue between research participants and the researcher. The CBEA was de-socialised in that interactions were primarily with small groups (although in one case the interaction was with a group of 20 or so people). The researcher made an attempt to interact with people of all castes and both genders, and challenged the accepted caste conventions by interacting closely with the lower caste villagers, who were not accustomed to such attention. The CBEA was research oriented in the sense that their opinions were asked of a variety of scenarios, such as on environmental hazards, hydrology, and slope stability, and their careful consideration was solicited.

Opportunities for learning were present in the CBEA that was carried out in Bampa. The CBEA had challenged villagers to give thought to the potential for electrification, and how this electrification might affect their lives. These were thoughts that could spur the residents of Bampa to think beyond the day-to-day struggles of their subsistence livelihoods, and to a future with electricity that could not just make their lives easier, but change their lives altogether.

The benefits of learning are many. Learning leads to an increased capacity to deal with similar events in the future, and this increased capacity is a form of empowerment. Hall (2004) has determined through extensive study of environmental projects that when learning occurs, positive outcomes ensue:

- The development of new practices;
- Increased participation or mobilization;
- Changes in gendered roles or behaviours;
- Linking between local and global contexts;
- Production or recovery of knowledge;
- New legislation or policies;
- Increases in self-sufficiency and bio-regionalism;
- Increases in co-operation; and
- Existence of new alliances and networks.

This research does not definitively conclude whether or not learning has occurred in any of the case study villages. However in Uttaranchal, several of Hall's (2004) phenomena

have been observed, both within the village of Malari, and with UREDA, which has changed its policy after observing the success of the Malari process.

New practices have been developed. UREDA has changed the way it develops its small hydro rural electrification projects. The process changed from being a process whereby the village is not involved, to one where the village is an active partner in the process.

There is evidence of increased participation having taken place. People in Malari learned, through SPWD's guidance, how to embark on a large undertaking, and how to mobilise the people of the village to participate.

There has been a link to global contexts in the sense that the Malari process is being studied in order to boost the participation and success in other small hydro project. There are now also links between Malari and Nepal, as the operators of the Malari plant travelled to Nepal to tour similar projects and learn how they work.

The new UREDA policy is perhaps one of the paramount outcomes that have evolved. UREDA has learned from observing the success of the Malari project, and has adjusted its policies in an attempt to emulate this process.

The self-sufficiency and bio-regionalism of the village of Malari has increased. They now tap into a local energy source rather than bringing fuels from elsewhere. Also, they

are now developing a local resource (berries) using this generated energy as a means to increase their economic self-sufficiency.

While it is not possible to determine whether learning has actually occurred, the outcomes from the Malari model suggest that in fact, learning did occur in Malari and at UREDA as a result of Malari's success.

5.8 Chapter Summary: Community Participation in Small Hydro

Community participation in the development and operation of small hydro in Uttaranchal varies greatly. Projects developed by state electrical utilities do not feature meaningful public participation, with the involvement of local residents limited to real estate transactions. Projects developed by UREDA, the state agency responsible for rural electrification involve the public during the construction and operation of the plants, but participation during design and planning is limited. In the NGO facilitated project that was examined in this research, Malari, the public were fully involved at every stage of the development.

The quality of public participation was rated according to established principles of public participation, and ranked using Arnstein's (1969) ladder. The Malari project, whose development was guided by the NGO SPWD, reached the highest rung of Arnstein's ladder: citizen control. The UREDA development process, followed at Bampa and Niti,

has elements of Arnstein's rungs of delegated power and partnership. The development process that was followed at the state electrical utility's plants was non-participatory.

Public participation can lead to learning among participants. Learning was assessed using Mezirow's (1994) ideal condition's of learning and Shor's (1993) descriptors. The Malari project most closely met the conditions for learning. The outcomes of the Malari project are consistent with Hall's (2004) observations of outcomes that occur when learning has taken place. The UREDA project featured fewer of the prerequisite conditions for learning, and as the UJVNL process is non-participatory, did not feature elements required for learning.

A CBEA was conducted of the Bampa project. It was determined through the CBEA that the project can benefit from having villagers assess the project. The villagers posses knowledge of the local environment going back hundreds of years. The knowledge and advice that was conveyed by the villagers could be missed by surveyors and engineers who conduct only short physical surveys of the area that may not capture the dynamism of the trans-Himalayan environment. The CBEA was also able to more accurately establish environmental benefits and social acceptance of the project – environmental benefits and the social acceptance of the Malari project was inaccurately predicted in its DPR assessment that was conducted by outside consultants.

6.0 CONCLUSIONS AND RECOMMENDATIONS

People in the hills of Uttaranchal (now Uttarakhand) are among India's poorest rural citizens despite living in a region rich in natural capital. The development of the natural resources in their region can greatly benefit them by improving their livelihood security, or it can be a detriment and cause them to lose access to resources. Given the potential for a variety of project development outcomes, the purpose of this research was to determine the potential capacity for improved participation in small hydroelectric development in the Indian Himalayas. The research objectives were (1) to establish the current roles of the private, public and civic sectors in small hydro development; (2) to examine the potential for learning through participation during the development of small hydro projects; (3) to determine the potential for using CBEA in future projects; (4) to investigate the benefits of community-driven micro-hydro development; and (5) to determine the implications of the findings for environmental policy and decision-making.

Five projects were selected as cases studies. Of the five cases, the two that have the highest likelihood of continued success were developed by vastly different means, however their successes are quite separate and distinct. The Badrinath plant was designed, constructed and will be operated entirely by the public sector with the private and civic sectors playing only minor roles. While the plant is a technical success, it will have little positive impact on those who live near it except they may have more reliable power.

The Malari plant, on the other hand, was a community development initiative and was a successful model of more balanced roles. Electrification through hydro was a vision that was instilled in the village by the former headman and all villagers worked to see the vision through to reality. Villagers were involved in the planning and construction of the plant and continue to be involved in its operation. The recipe that allowed Malari to be successful will be difficult to emulate. Malari happened because there were funds available, skilled people from an NGO to help facilitate the development process, and a visionary leader.

The development of the Niti and Bampa plants emulated the process that Malari followed to some degree, except the villagers did not direct the process as they did in Malari. It may be that UREDA's development policy is not yet as participatory as it needs to be in villages lacking Malari's civic capacity and leadership. UREDA's policy must continue to evolve to the point where their process is one where engineers are working for villagers and not one where villagers are working for the engineers. Had the villagers played a larger role in Niti, the design of the plant would likely have been significantly different, as the villagers all know the stream chosen to run the plant does not have adequate flow. Irrigation and water supply may have also been integrated into the Niti project. It remains to be seen whether the Bampa and Niti plants end up as successes like Malari, or whether they end up in failure.

The Jumma case illustrates how a project can fail due to bad planning. Had the plant been located in a different area, or if it had been better designed for the local conditions, it could be operational today. As the geological instability of the ravine would have been known by locals, public consultation may have alerted designers to the ravine's vulnerability and if they had listened the risk of serious damage could have been mitigated.

As outlined above, over the course of this research, many aspects of small hydro in Uttaranchal were examined through analysis of these five case studies and through meetings with key players in small hydro in the state. In drawing findings data were gathered through PRA methods such as semi-structured interviews, landscape analysis, transect walks and participatory mapping. A community-based environmental assessment (CBEA) was conducted with community members on one of the plants in early stages of development. Residence was taken up in the villages wherever possible. As these villages are isolated and residents are unaccustomed to outsiders, their curiosity made it possible to get to know them not just as a researcher but on a personal level as well. Having this personal connection made it possible to relate more closely to the villagers and understand their issues and problems in a way a more rapid observation would not. Being able to participate and observe in daily life in the villages allowed the researcher to see and experience things, like a potential impact from a hydro plant that the villagers were unaware of or had overlooked. Often these are important issues and would

be missed during a more rapid appraisal. These techniques were employed for all case studies but to a lesser degree in Jumma due to logistical constraints.

This research featured dialogue with officials and policy makers. This dialogue was largely to gain valuable information for the research, but in the case of the CBEA carried out in Bampa, the exchange of information was two-way. The purpose of this two-way dialogue was not to act as an advocate, but to inform the UREDA director of the CBEA results and to communicate the perspective of Bampa residents. Because this was a research exercise into the practice of CBEA that required the UREDA director's consent, it was not possible to assume more of an advocacy role. An NGO CBEA practitioner may wish to take on a more active role.

6.1 Conclusions

6.1.1 Roles in Decision Making

In the cases examined, the roles of the public private and civic sectors differed. The public sector was the proponent for all but the Malari plant (which was undertaken by the civic sector). It is clear that the public sector is taking on a significant role in the planning and development of the small hydro projects.

The private sector was involved in two of the projects where outside contractors were hired to perform tasks. The private sector's role was not instrumental in the planning of any of the projects, nor is the private sector involved in operation. Uttaranchal's small

hydro policy allows for the private sector to develop hydro projects at designated sites, however the policy defines small hydro as being any plant with a capacity up to 240 MW. It is likely the private sector will choose to develop higher capacity plants with more profit potential. To date, the private sector's role in small hydro in Uttaranchal is primarily as construction contractors.

The involvement of the civic sector varied greatly from project to project. The civic sector was not involved in the Jumma or Bamini/Badrinath plants in any capacity, nor were they involved or consulted prior to the start of these developments. In the Bampa and Niti plants, the civic sector's role has been delegated by the public sector. Accepting this role was a precondition to having the plants set up in the villages. They are charged with the task of building the plants they will eventually take ownership of and operate. However, they were given limited opportunity to participate during the planning of these projects. Malari featured the highest degree of civic sector involvement, where the village was involved with the project from the beginning.

The findings did not reveal evidence of the sectors working together to plan and develop these projects. Planning and development of these projects was largely dominated by one sector, the public. The findings also revealed that there are benefits to working together, especially in ensuring that the public sector has a voice. The project with high civic sector involvement is also the most successful from a community development perspective.

6.1.2 CBEA Approaches

The experience and knowledge the villagers of Bampa and Gamsali shared during the CBEA indicates that these people have a wealth of useful information that should be communicated to those who may be designing micro-hydro plants in these regions. This knowledge comes from 500 years of migrating to this land and working in the fields. Knowledge of the local conditions should be communicated to developers in order to ensure their designs are adequate. This knowledge could be used to enrich a DPR, or it could form the basis of a DPR.

The research proved that CBEA is an effective way for the needs of villagers to be assessed, because it allowed for a high level of civic engagement, and it provoked a critical evaluation of relevant issues. It can be determined through such engagement whether a project will be beneficial, and it can also be an effective way of assessing the level of support communities are able to provide. For example, it can be determined through CBEA whether the villagers will use the proposed development and whether they have the skills and knowledge to construct and maintain it properly. Of course, as an environmental assessment, the underlying benefit of CBEA is that the community can provide local insight into the environmental effects the developments will have.

6.1.3 Learning Through Participation

It was determined in this research that there is potential for learning through the development of small hydroelectric projects. Some elements required for both

transformative learning and critical education, were found to have been present in the Malari case. Villagers in Malari were involved in the early stages of the development process, were involved at the planning stage, and were able to provide input during meetings. In the case of Malari the meetings were facilitated by SPWD, and the ideas and thoughts collected were used as input in the design.

The UREDA model of development features less village participation in the early stages of project development. As many of the elements of learning that were found to be present in Malari were the result of public participation, it follows that fewer conditions for learning were present in the UREDA model. The UJVNL model, which did not feature any public participation, did not lead to learning according to the standards that were measured against in this thesis.

Effective public participation should encourage learning, as learning can lead to many positive outcomes, as described by Hall (2004). Some of the possible outcomes that Hall listed were observed to have resulted from the Malari experience. These outcomes included UREDA's new development policy, new alliances and networks such as Malari's links with SPWD and small hydro plants in Nepal, and increased self-sufficiency through the availability of power and control over how that power is used.

6.1.4 Community-driven Micro-hydro Development

The psychological benefit of having light at night, as described by the residents of Malari, is profound. The governments of India and Uttaranchal have made bold plans to see that all Indians can have this benefit. If these plans are followed through, it is important that the most participatory approaches are used in the planning of community electrification projects to ensure their continued success. Efforts should also be made to incorporate other community development benefits into the plant such as irrigation and water supply.

One hurdle community plants face is economic. These plants are expected to be financially self-sufficient from the day they begin operation. The economic conditions of the villages may not be sufficient to operate the plant sustainably, so it is important these plants not be seen as being self-sustaining from the moment of completion. There should be ongoing financial support to ensure the plants continue operation. Only as the economy in the villages improves may these plants become self-sufficient.

6.1.5 Future Decision-making

The major shortcomings that were identified in the research could have been prevented with more thorough planning and DPR preparation. The two major technical shortcomings are that projects were not adequately designed for local environmental conditions, and they were designed based on inadequate understanding of local hydrology. The major social shortcoming is they do not always (with the exception of Malari) account for the livelihood concerns of the local villagers.

The benefits of community small hydro also depend on sound planning. There needs to be extensive hydrological analysis prior to the construction of the plants, only then should they be built. At Malari and Niti, flows are not sufficient to run the plant for the whole season. Had more thorough hydrological analysis been conducted, this problem could have been foreseen and prevented.

Future small-hydro planning should feature a higher degree of public participation, and there should be greater attention paid to gathering site-specific geological and hydrological information. Knowledge of site-specific environmental factors can prevent technical shortcomings, such as projects being designed for higher flows or projects being situated and designed in such ways that make them vulnerable to environmental damage. Greater understanding of local aspirations can lead to the integration of other livelihood improvements, such as the water supply and irrigation schemes that were designed into the Malari project. The gathering of site data can be integrated with public participation as locals can provide insight into local conditions that may require further study.

6.2 Recommendations

It is recommended that field hydrological measurements be carried out before small hydro plants are designed. Clauses on hydrological assessment could be added to both the State and Federal small hydro policies requiring that such studies be done. In the case

of the State policy, there is a clause on due diligence that should be expanded to include hydrological assessment.

It is recommended that proponents of small hydro projects be required at a minimum to consult with and gather opinions from local inhabitants of a region to determine their specific energy requirements, as well as to attempt to gain from them an understanding of local environmental conditions. Public consultation clauses should be written in both the State and Federal small hydro policies. In the State policy, this should be done with an expanded due diligence clause.

It is recommended that government agencies set an example for private companies by carrying out CBEA for the projects that they initiate. This could prevent instances where facilities are built in geologically sensitive areas, or it could prevent the environmental benefits of projects from being overstated, such as expecting electrification to stop villagers from cooking with wood. It would also empower local people and create buy-in and positive outcomes for small hydro.

It is recommended that further funding be made available to these projects to sustain them until economic conditions in the villages reach the point where they become economically self-sufficient.

6.3 Closing Remarks

Small hydro has the potential to bring electricity to many unelectrified villages throughout Uttaranchal. By the state's own analysis, 353 of the 1127 unelectrified villages are viable candidates for small hydro. In order for future rural electrification community development initiatives to be successful, it is imperative the public be involved in these projects at all stages. If small hydro is carried out properly, the technological successes of the Bamini/Badrinath plant and the community development successes of the Malari plant can be emulated in all future plants.

India is a large country with a rapidly developing economy. The country already has over one billion people and has some of the world's largest cities, with new urban dwellers arriving daily from rural areas. Coupled with this population growth is the increasing emergence of a middle class who aspire to western standards of living. Finding the natural resources to fuel this growth has been a challenge for India. Today much of the country's electricity is supplied by polluting coal power plants. There are discussions of having oil piped to India from either the Middle East or Central Asia, but no suitable arrangement has been found. While tidal power and offshore oil and gas reserves are being examined, attention is increasingly focused on the country's water resources as a domestic supply of cheap energy. Much of this hydroelectric potential is in the mountains of northern India, including the state of Uttaranchal. Having their state as the focus of so much development has thus far yielded mixed results for the state's residents. Some are able to find employment and opportunity, while others find their

fields degraded, their slopes unstable, their livestock frightened, and their water fouled as the power of their rivers is harnessed and transmitted thousands of kilometres to power-hungry metropolises in the plains. There are still people who live just a few kilometres from facilities that generate hundreds of megawatts of electricity, whose villages have never been connected to the state electrical grid.

The Bamini/Badrinath facility exemplifies this phenomenon. A small hydro project was constructed on public land that was accessible to the entire village. The plant's capacity far exceeds the power needs of the local population, and this generated power is fed into the state electrical grid. Some land was taken up for the project. While landowners were compensated for the land that was expropriated, their tenants who farmed this land were not. The adverse impacts the villagers experienced after the plant was completed included reduced flow to power the village mill and reduced water in the stream for irrigation. In a village that relies heavily on local food production the loss of farmland, irrigation water and milling capacity will have serious implications. While the mill owner and the landlords were compensated, there were no provisions made to the mill owner's customers or to those who relied on the steady flow of water through the stream for irrigation. As well, the local people have to contend with intermittent power, while all the power from the new plant is sent south. This is an example of the sacrifice India's poorest rural citizens are forced to make in order to power burgeoning economies thousands of kilometres away. Sacrifices that would not have to be made if the

developers took into account the needs and aspirations of local resource users prior to the exploiting the resources.

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APPENDIX A: Semi-Structured Interview Guidelines

The questions presented in this appendix are typical questions that were asked during semi-structured interviews. These questions were not asked in all interviews, but served as a guide for the interviews. The responses to the questions may have lead to other topics of discussion.

Questions for development agencies

What are the main functions of your agency?

Where does your agency's funding come from?

Does your agency have an operating policy or statute? May I see it?

How many projects has your agency been involved with?

What projects is your agency involved with in the Chamoli district?

What interactions do you have with other agencies?

What future plans does your agency have?

How do you select which projects to proceed with?

What field investigations does your agency conduct?

Do you consult the public? How?

Who prepares the DPR?

Is local knowledge incorporated into the DPR?

Who will build the project?

Who will operate the project?

Questions for Villagers

Are you aware of the Small Hydro that will be built in your village?

Do you know who initiated the project?

Where will it be constructed?

When will it be constructed?

Who will build it?

Have there been any meetings to discuss the plant?

Did you attend? What was discussed?

Were you consulted on the proposed plant?

Should you be consulted during the development of such projects?

At what point in the process should you be consulted?

How do you light your house at present? How much do you use? Are there any problems with lighting this way?

What do you use for cooking/heating at present? Where do you get this fuel? Are there any problems with using this fuel? How much do you use?

Will you use electricity if it is supplied? What if you have to pay?

What would be a fair price to pay for electricity?

How will having electricity affect you?

What will be the environmental effects of this project?

What do you think about the selection of the XXXX River for development? What will be the implications of using this waterway? Do you currently use the water from this waterway for any reason (drinking/cleaning/irrigation)?

Will the construction of a powerhouse and penstock take land away from other uses (grazing/agriculture)?

What opportunities will having electricity provide? What about other opportunities?

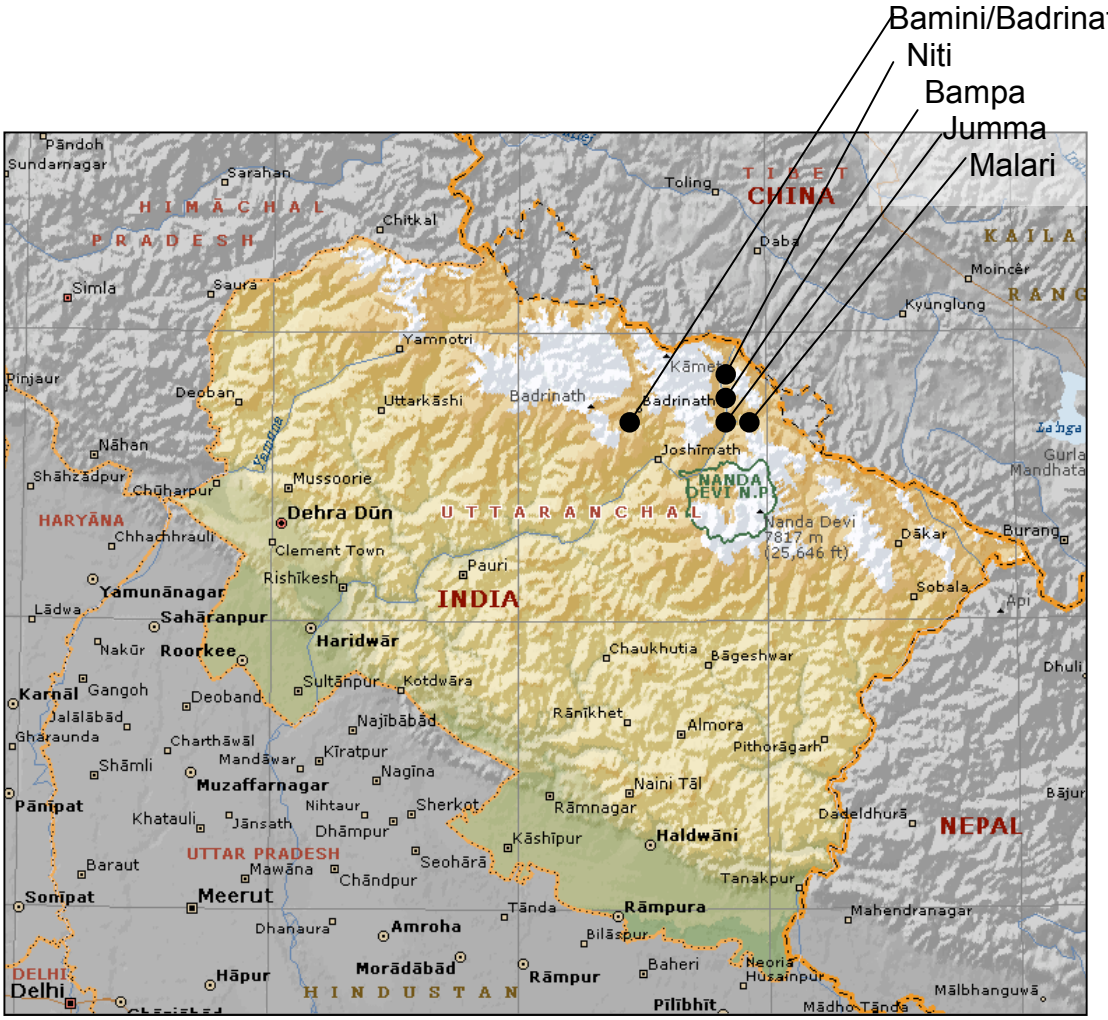
Are you aware of any other projects like this one?

What kind of development would you like to see in your village?

Do you have any questions to ask me?

APPENDIX B: Maps and Photos

Map 1: India, with the state of Uttaranchal highlighted. © Microsoft



Map 2: Map of Uttaranchal, with case study villages labelled. © Microsoft

Plate 2-1: The Chilla Dam on the Ganges near the City of Haridwar in Uttaranchal.

Plate 2-2: The Vishnuprayag Project Outflow.

Plate 2-3: Vishnuprayag Diversion at Lamboragh .

Plate 2-4: Vishnuprayag Tunnel. .

Plate 2-5: Beginning of a protest against NTPC project in Joshimath.


Plate 2-6: Protest against NTPC project in Joshimath.

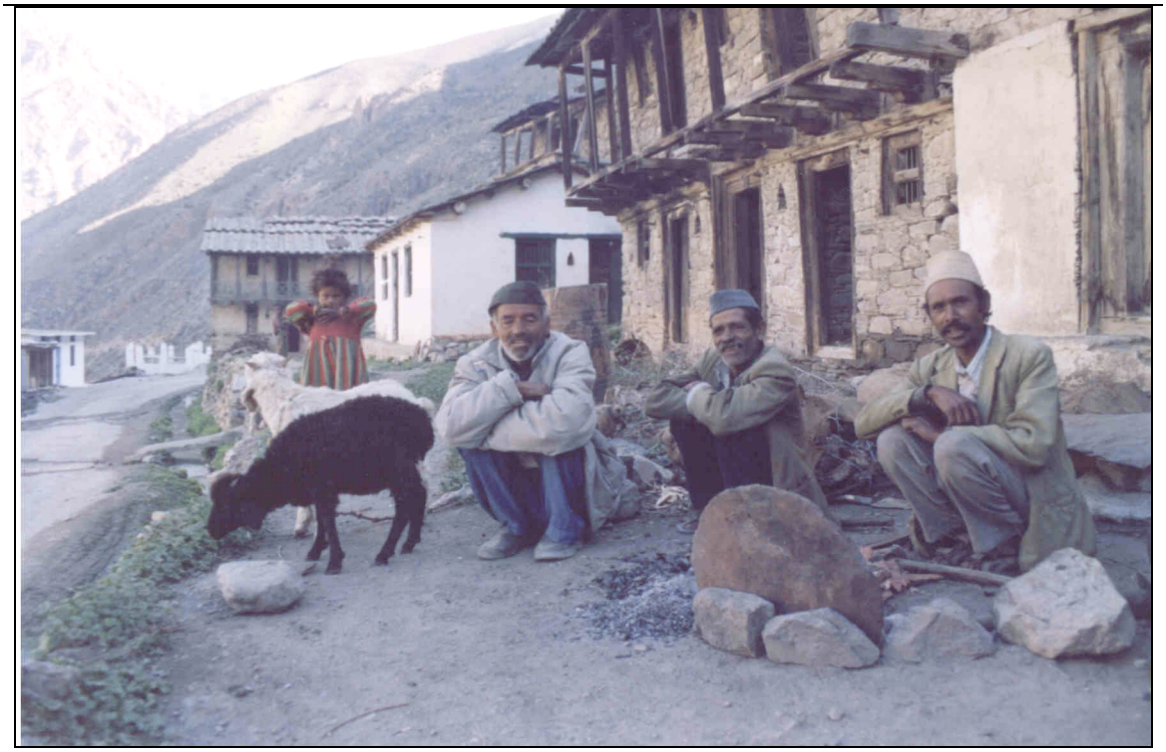


Plate 4-1: Low Caste men and child in front of Traditional House in Malari.

Plate 4-2: Malari Hydro Station diversion channel.

Plate 4-3: Exterior of Malari Powerhouse showing outflow.

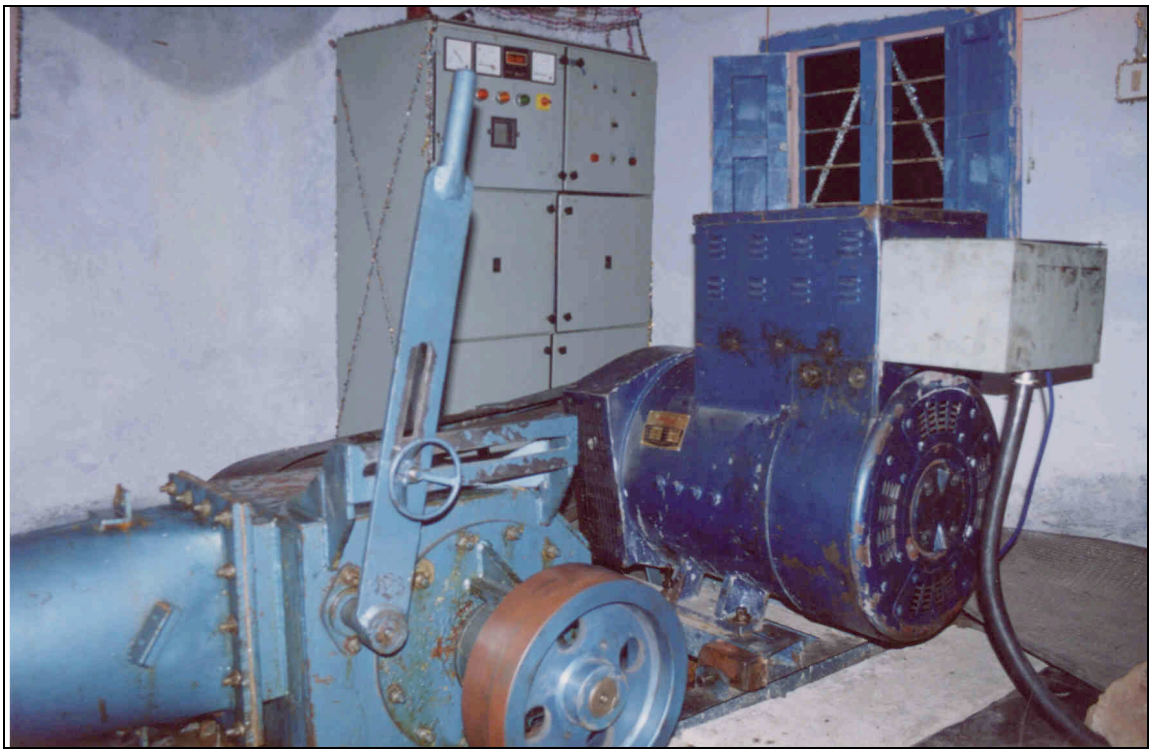


Plate 4-4: Interior of Malari Powerhouse showing turbine, generator, and control panel.

Plate 4-5: Abandoned buildings near Bampa, suggested for use as powerhouse.

Plate 4-6: Fields and irrigation canal at Gamsali, adjacent to Rishi Ganga.

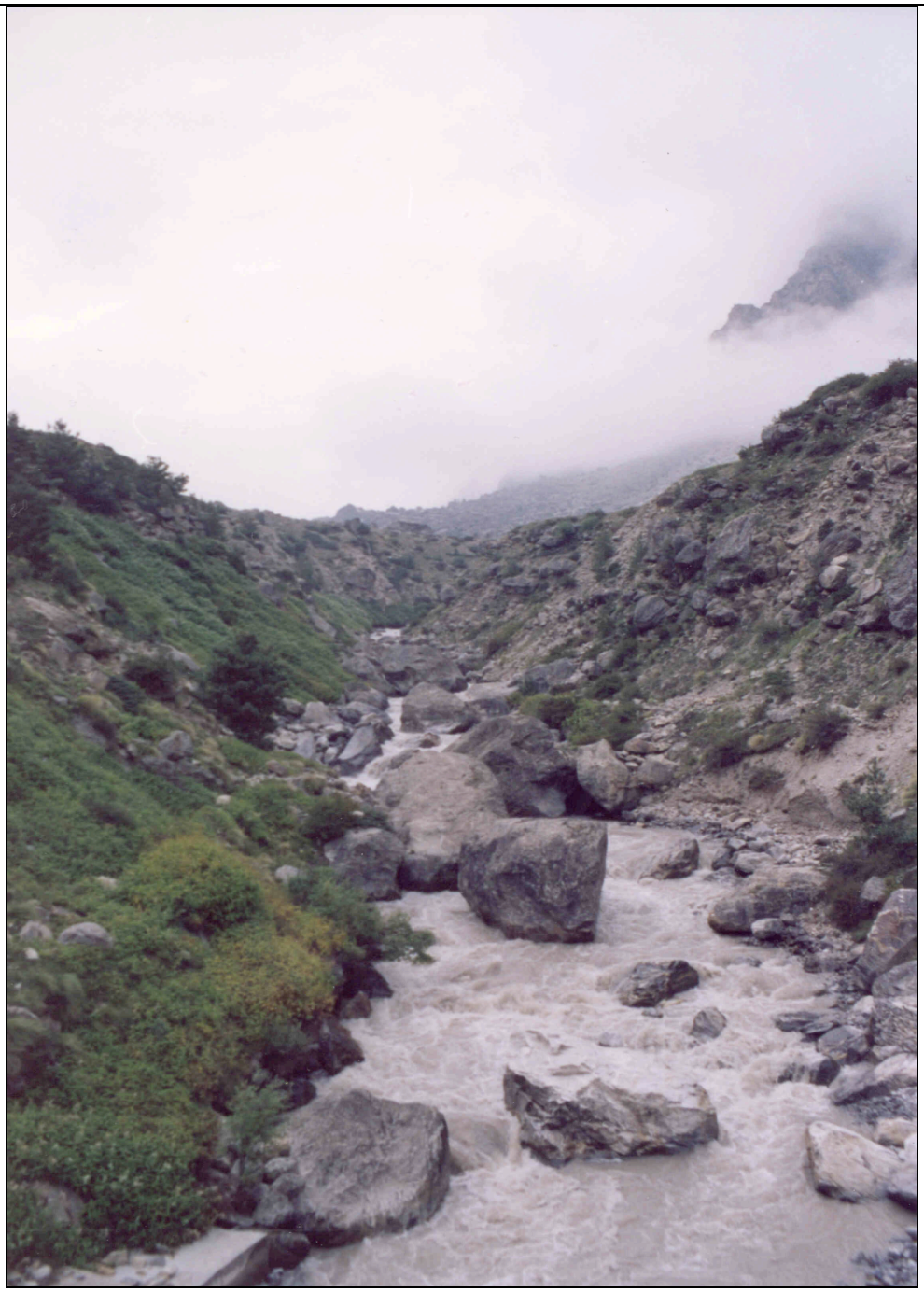


Plate 4-7: Rishi Ganga, proposed for Bampa hydro plant.

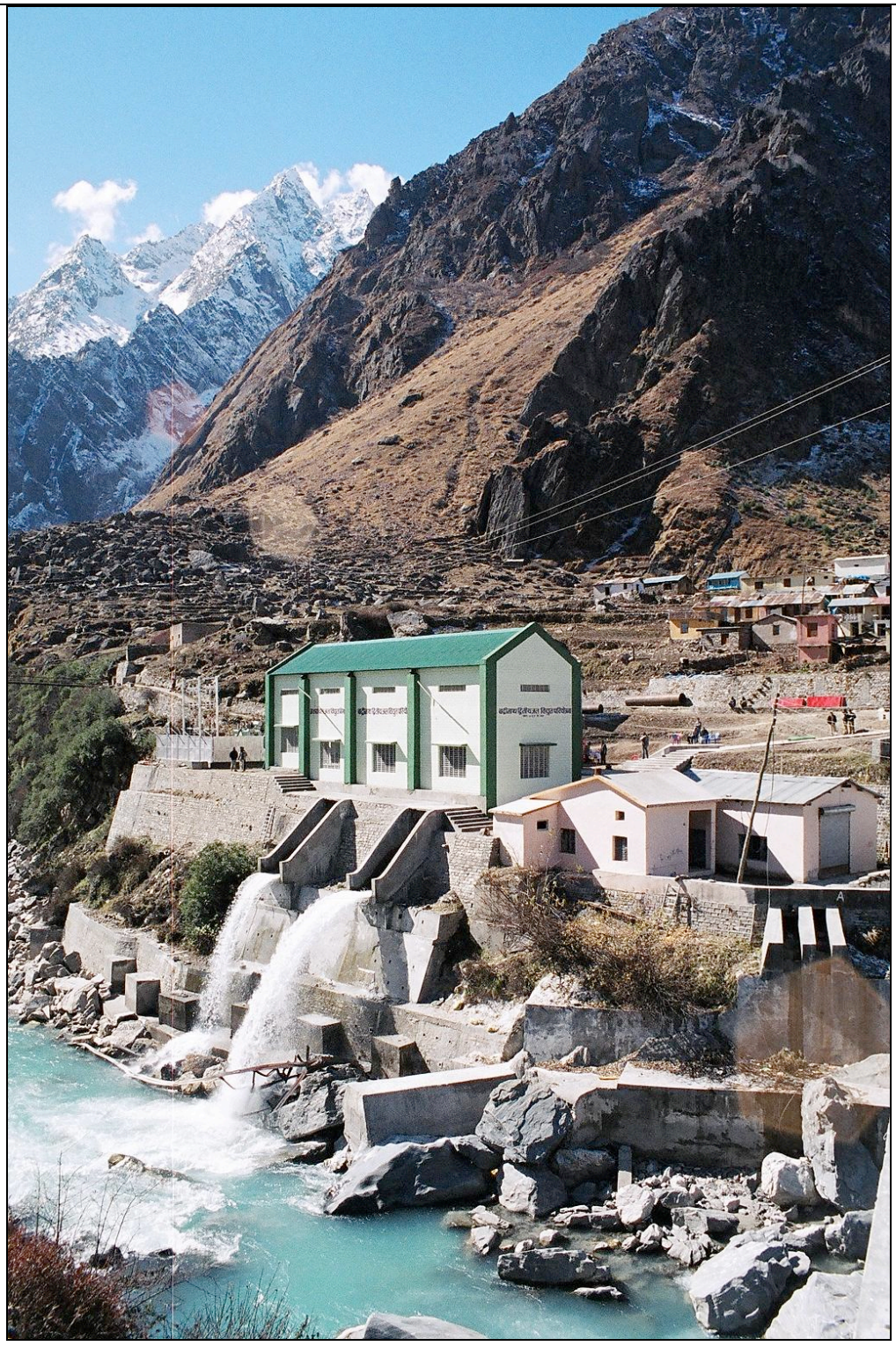


Plate 4-8: Badrinath powerhouse, surrounded by village of Bamini.

Plate 4-9: Interior of Badrinath powerhouse.

Plate 4-10: Energy Minister and her husband at official inauguration of Badrinath plant.

Plate 4-11: Jumma hydro plant.

Plate 4-12: Jumma hydro plant interior.

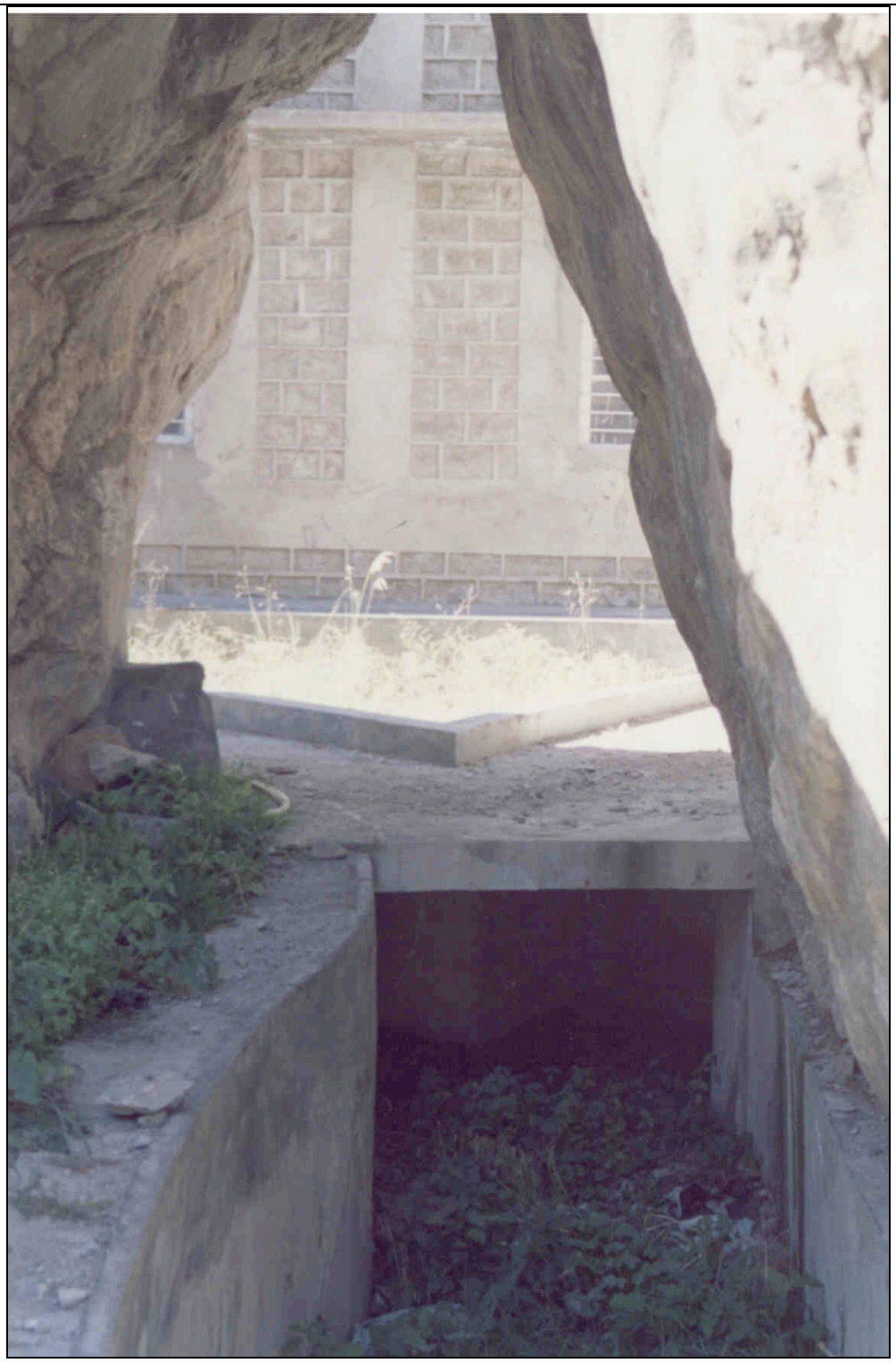


Plate 4-13: Jumma hydro plant spillway.