LOCAL BENEFITS FROM HYDRO DEVELOPMENT

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Introduction

This paper will examine the prospects for economic development in regions of Nepal where water is a major resource. While water is the natural resource, electricity generation, achieved by damming water and running it through turbines, is the natural resource industry under consideration. Hydropower is taken here to be a form of industrial rather than infrastructural development (such as the construction of a highway) because the product—electricity—can be transported and sold outside of the region in which it is produced.

The paper will first argue that hydropower displays characteristics of an extractive rather than, as is often implicitly assumed, a transformative industry.[1] Next, I argue that, like other extractive industries, hydropower (especially the larger schemes developed in the more remote areas) is unlikely to result in economic development in the region where it is produced. Industrialization of peripheral economies is unlikely to result from the development of what is essentially an extractive industry.

As the larger and more remote hydropower sites begin to be developed in Nepal, people in those regions need to be informed about what economic changes they can realistically expect. While road transportation may seem to be the one tangible residual local benefit from the development of hydropower, studies show that local people will need to acquire new skills to be able to interact effectively with the larger market-place made accessible to them via road construction, even to maintain their previous income levels. The paper will suggest that remote regions may need to be prepared to demand for themselves investments in infrastructure which benefit them directly (such as irrigation) and/or a portion of the resource rents collected by the central government, through licensing and royalty payments, in order for them to gain from

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1 Extractive industries are natural resource industries such as mining and agriculture where the primary product can not be reproduced solely through the use of human labour but requires input from nature whereas transformative industries are those involving manufacturing production which in turn stimulates further economic development. For an example of work which assumes that hydropower falls in the latter category, see Verghese (1990).

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hydropower development. Districts might also be interested in investing in and developing their own small hydropower schemes in order to achieve rural electrification and increase the opportunities for industrial development.

The recently canceled Arun III (Phase I) Hydroelectric Project, which was proposed to be built in east Nepal, will be used to exemplify a purely extractive form of hydro development. It will be compared with the smaller Andhi Khola project which promises better prospects for rural industrial development. Phase I of Arun III, also known as “Baby Arun”, was to receive multilateral (World Bank and Asian Development Bank) and bilateral (Germany, Japan, France, Sweden, Finland) funding to produce 201 MW of power.[2] The Andhi Khola project, in Syangja district in west Nepal, funded by NORAD, is a smaller scheme, generating 5 MW of power. This project has been implemented. The comparison between the two projects teaches us that while large hydropower schemes, such as Arun III, provide few opportunities for economic development in the region where they are developed and do little to enhance hydropower capability in the country, smaller projects like Andhi Khola directly increase capability of the national hydropower industry and are able to make positive, if limited, impacts on the local economy through rural electrification.

Theories of Regional Development and Extraction of the Staple

Hirschman's *The Strategy of Economic Development* (1958) popularized the idea that development is accelerated through investment in projects and industries with strong forward or backward linkage effects. Linkage theory still continues to be used to justify economic policy all over the world. In a bold challenge to prevailing paradigms of the time, Hirschman argued for "unbalanced growth": that economic growth could be most efficiently achieved by planners identifying those dynamic sectors or enterprises in the country whose unbalanced, or relatively accelerated, development could be expected to stimulate the most amount of linked investment. Investment in highly linked sectors would spread widely and rapidly to other sectors of the economy.

Hirschman’s idea has not gone unchallenged. Bunker expressed concern that the indiscriminate extension of the linkage theory to natural resource

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2 The author of this paper is a member of the Alliance for Energy, a group which argued against Baby Arun on economic grounds.

industries by Hirschman (1977) and other scholars such as Watkins (1963) and North (1961) had led to serious errors in the theory of regional development. Bunker tied the Brazilian government's justification of its 1974 strategy for the development of the Amazon, which was based on a growth pole[3] model for the promotion of mining, lumbering, ranching, fishing, agriculture and hydroelectric energy, directly to the theoretical grounding provided by these scholars and by Perroux (1955).[4]

Bunker first argues that while Hirschman had demonstrated sectoral spread with impeccable precision and powerful reasoning within an urban-industrial model, he wrongly extended the analogy when he argued that investments will similarly spread across regions, from more to less prosperous ones. Bunker shows that spread of industrial investment across regions is, in fact, unlikely to occur. He does so by pointing to Hirschman's own observation that backward and forward linkages become concentrated around existing industries because of the entrepreneurial perception that investment opportunities are greatest in already developed regions. The second part of Bunker's argument is that because industries involving the extraction of staples[5], such as mining and timbering, have low levels of linkages, forward or backward, there is likely to be little spread in investment even to the other productive sectors within the region. Bunker thus concludes that extractive industries with low levels of linkages contribute relatively little to further development in their own regions, across either economic sectors or geographical space, even if they themselves expand through demand derived from growth in the industrial center.

This paper makes a novel argument that hydropower exhibits many characteristics of an extractive industry. It then goes on to argue that like extraction of other staples, the development of water resources for power production cannot be expected to create a spread in investment to other sectors within the immediate region or in other regions. It further argues that small-scale hydropower developments to be used primarily for consumption of energy in the region can yield important local benefits. This discussion is particularly important for Nepal as the nation's

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3 Though this plan, called POLAMOZONIA, was proclaimed for the whole nation, its greatest impact would be on the two least developed regions of the country, the Northeast and the Amazon (Bunker 1989:599).

4 Hirschman appropriated Francois Perroux's (1955) term "Pole de croissance" or ‘growth pole’, to argue that spatial inequality was only temporary and that it was necessary for growth.

5 Staples are natural resources found only in particular geographical areas.

development aspirations for both local and national development are intimately linked by the popular press as well as policy makers to the development of its water resources. The arguments presented challenge the widespread assumption that hydropower development in a particular region leads automatically to its economic development. It counters the easy link between hydropower and area development made by the likes of Indian scholar B.G. Verghese (1990:169) when he asserts that hydropower development (in Nepal) will bring income, employment, and multiplying effects through regional development and manpower training, in addition to considerable export earnings.

Water as a Natural Resource: Hydropower as an Extractive Industry

Generating electricity from water displays many attributes of a natural resource industry and few if any of transformative industrial development. For one thing, the production of energy from a hydropower plant is firmly embedded in nature. The annual production of electricity depends on the amount of natural precipitation. Hydrology determines how much water is available to run through the turbines each year. The topography at a particular site will determine how much of a difference in elevation can be exploited and thus how much power can be produced[6].

As with agriculture, the application of labour and the natural process of production are not coincident in time in hydropower development. Construction of the facilities is generally completed in four or five years. Electricity is produced over the life of the plant, fueled by rain or snowmelt each year. As in mining, sites where hydro can be developed have themselves been created by geological forces over a much longer time frame.

Unlike a diesel, gas or nuclear power plant, but similar to other renewable energy resources such as wind, a hydropower scheme can generally not be located right where the demand for electricity exists (unless by happy coincidence). Each site is unique and fixed in geographical space. The most attractive sites which can exploit the largest drop in elevation and where reservoirs can be built at low cost are often found in difficult, mountainous terrain—areas which are inevitably in the economic periphery of a country or region. Like other extractive

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6 Power refers here to the capacity of the plant, i.e., so many kilowatts or megawatts. The term energy takes into account the amount of time the plant runs with a particular power output; it is measured in kilowatt hours or megawatt hours.

enterprises, this means that hydropower is unable to agglomerate with other industries to take advantage of shared infrastructure and labour pools.

For all but the smallest hydropower schemes, motorable roads are the major infrastructure that need to be built in order to transport the turbines, steel pipes, generators, transformers, and construction material (such as cement and steel) needed during construction. Distance from existing roads and difficult mountainous terrain commonly make the transportation requirement a major expense for hydro development. Difficult access can often undermine the feasibility of otherwise attractive sites.

Like agriculture, hydropower can in theory be renewable because it is based on solar energy and the renewable hydrological cycle. Run of river schemes which do not store water to compensate for seasonal variation in river flow can be considered fully renewable. However, where reservoirs are used, the particular site is essentially "used up" once the reservoir is filled up with sediment transported into it with the river water and can henceforth only be operated as an unregulated run of river scheme.[7] The filling up of a reservoir is the functional equivalent of depletion of the resource in other natural resource industries such as mining. The silt burden in the river is determined both by ongoing natural processes in the watershed and the use that those living in it are putting it to. Ives and Messerli (1989:145) have concluded that in the Himalayas, even at the scale of the micro-watershed, periodic catastrophic rainstorms will tend to over-ride the effects of human activity. However, they also point out that human intervention does have the potential for significant landscape changes at the scale of the micro-watershed or individual mountain slope.

As in other natural resource industries, a boom and bust cycle inevitably accompanies the construction of a hydro project. At the start of the construction of the power project, entrepreneurs, often from outside the immediate area, rush in to the locality to build tea shops, *bhaṭṭīs*[8], and living quarters in the vicinity of the power plant or at the dam site. Many of the hastily erected structures are temporary, built with corrugated

7 Most modern reservoirs are designed with a ‘dead storage’ component which allows them to lose some storage capacity without their performance being impaired. After a certain ‘economic life’ of the reservoir (and in many cases well before), the sediment starts to fill the ‘live storage’ as well. Though reservoirs can, in theory, be dredged, this is seldom done except in very small reservoirs because of the prohibitive cost. The sediment can also, in theory, be removed by flushing it through the dam. An inexpensive method of doing this without losing substantial amounts of stored water remains to be developed.

8 Drinking establishments where customers also get free accommodations for the purchase of an evening meal.

sheet roofs and flimsy bamboo walls and partitions. Some construction is more permanent in anticipation of a more established bazaar possibly being set up in the area in the future. The rush to serve construction workers results in soaring land prices. Fortunes are made by those buying property one day and selling it the next. Many illiterate, would-be entrepreneurs are duped by cheats selling fake land certificates. However, as the construction comes to a close, the plant begins production, and the workers go to other construction sites or back to their villages, there is a bust with a more or less complete collapse of the supplemented economy.

The boom and bust cycle accompanying hydropower construction is generally on the order of five years, with some variation depending on the size, complexity, and construction method of the individual scheme.[9] This is different from most other extractive industries where the boom generally tends to be longer and can last as long as the industry is productive. The cycle is shortened because an operational hydropower plant, unlike other natural resource industries, does not need a large labour force; it can run with a small number of qualified technicians. These technicians generally come from outside the remote area where the power plant is operating as the area is unlikely to have adequate trained manpower. The few people from the area who may have received relevant training in the cities are likely to already be working outside the area. Once completed, a hydro project thus creates very few jobs for local inhabitants. While the construction of a hydropower scheme makes for a very short boom and bust cycle, the production from the plant lasts much longer: over fifty years in most cases.

Water as a Staple in Nepal

For much of mountainous Nepal, holding close to half the population of the country, water is one of the few natural resources on which residents can hope to base their economic development. The dramatic change in elevation from the high Himalayas in the north of the country to the start of the Gangetic plains in the south, all within a short distance of around a hundred miles, makes for many promising hydropower sites. Heavy monsoon rainfall and a reservoir of water stored as ice and snow in the mountains provides for many perennial rivers in the country. With a few exceptions, all the mountain districts (around half of the total of 75)

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9 Labour intensive construction can take eight to ten years as in the Andhi Khola example while capital-intensive construction generally reduces construction time of the power project to four or five years. Though of the latter variety, Baby Arun was to take eight years because of the 40 months required for road construction.

have potential for substantial hydropower development of a range of sizes beyond their own needs. Physical limitations to the development of hydropower projects are: little free land in river valleys for the placement of reservoirs and few roads. An additional factor which threatens the life of reservoirs that are built, is the generally high levels of sedimentation coming from the geologically young Himalayas.

At present, only about 14% of the population of the country has access to electricity, with urban residents consuming the bulk of the produced energy. The growth in demand from areas already electrified is acknowledged to be over 10% each year. While a comprehensive demand forecast for the whole country has not been compiled, clearly the market for electricity sales within the country is substantial. Though a large number of hydropower projects, with a total generation capacity of over 28,000 MW, have been identified and studied to various levels of detail, a total of 356 hydroelectric plants of a range of sizes generating around 250 MW have been developed to date (Shrestha 1995).[10] Neighboring India, with an increase in demand for electricity estimated to be 10,000 MW per year by the year 2000 (Dhaul 1994:1) is seen to be the target for Nepal's future surplus power production.

The financial resources for hydropower development in Nepal have thus far come from multilateral banks and bilateral donors with most of the schemes being built by the government-owned utility, the Nepal Electricity Authority (NEA). The government has, in the last few years, invited investment from the private sector, both domestic and foreign, to build power plants to supply the national power grid in Nepal as well as for sale of energy to India.

Rural mountain areas in Nepal are, by and large, in the economic periphery. Close to 100% of the inhabitants are engaged in subsistence agriculture and most live in communities of less than 500 (Gyawali 1989:56). The few bazaar areas, interspersed between agricultural communities and positioned along travel routes, sell essentials imported from the cities and abroad: salt, kerosene for lights, textiles, aluminum pots and pans, plastic buckets, cigarettes, and packaged foodstuffs like biscuits and instant noodles. Travel is almost exclusively by foot along age-old routes that generally run north-south alongside the rivers, across the contours of precipitous slopes, and through passes. District headquarters and areas frequented by tourists have air transport. Other than trekking tourism and some agricultural products, the mountain districts

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10 This figure includes off-grid micro and mini hydro schemes.

have few things to sell to the market economy. Every year thousands of young men and sometimes some women travel to the cities, plains and abroad in search of seasonal work.

Why is it important for local people to be concerned about whether they might benefit from hydropower development in their district? The errors in the theory and practice of regional development based on the failure to understand the very different determinacies in space, time, and topography between industrial development and extraction (Bunker 1989:590) afflict both policy makers and district residents in Nepal. It is widely expected that the development of hydropower in a remote area will lead, automatically, to economic development in that region. It is thus important that local people are aware from the start that the economic development of their districts that is promised (though its precise mechanisms are never specified) to result from the development of hydropower for export, will most likely not materialize. District residents will need to plan accordingly their alternative strategies to get the benefits from the hydro development that they seek. It may have to come as a demand for investment in local infrastructure, such as irrigation or a local road, alongside the hydropower development. Or it may be in the form of demands for payment of rent for the use of the resource. Districts may also decide to invest in and develop their own 'District Hydro' (discussed later in the paper): small hydropower projects built primarily for the purposes of rural electrification and for powering industrial development within the districts where they are built.

Residents have good reason to demand benefits from power development in their districts. In certain watersheds, the development of hydropower can directly and negatively impact prospects for tourism by drying up picturesque waterfalls and by putting dams in the way of white water rafting. A dam will almost always impact negatively the fish population both above and below the dam by standing in the way of fish movement.[11] Ongoing or future irrigation projects can be compromised

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11 Bayley and Li (1992) outline the major harm that can be caused to riverine fish populations by disruption (by a dam) of 'riverscape' processes. They state, "impoundments in tropical river systems, where extant floodplains have demonstrated high fish yields, can devastate fish production, in particular downstream where the flood pulse is affected." Though mitigation is often carried out through the introduction of exotic fishes from hatcheries, the authors point out that these can cause more problems than solutions and that this treatment is irreversible. In particular they claim that "Exotic species have caused defaunation of many areas and the role of fish disease can be insidious" (Bayley and Li 1992:270-1).

by the diversion of water to turbines. On the other hand, land use choices by residents in the watershed can impact the hydrology and sediment load of the river from which the project draws water. Deforestation, for example, can lead to less flow in the dry season as well as to landslides.

The interdependence between the health of the hydropower scheme and the subsistence and economic activities of the residents in the watershed provides a compelling reason for why local people should receive benefits from hydro development. Local residents will have little loyalty to a scheme which provides them no ongoing benefits but which impinges on their current economic activities, or ones that they may take on in the future.

Hydropower and Regional Development

Hydropower is by its nature highly capital intensive, yet it will be developed mostly in remote areas with difficult access. It will be constructed there by the national utility or by private capital, national or foreign. Once constructed it has a low capacity for employment. Except for the smallest schemes which are built for local distribution of electricity, the low levels of existing industrial development in the targeted regions and lack of commitment to rural electrification on the part of project developers will mean that hydropower schemes built in remote areas are unlikely to have significant economic linkages with the regional economy.[12] Once constructed, such a hydropower scheme is likely to be a "cyst disconnected from the socio-economic context in which it is inserted"[13] to an even greater degree than other extractive industries such as mining. It will effectively be an enclave.

There is unlikely to be significant spread of investment from hydro development into other productive sectors in the region as a result of a process initiated according to the "unbalanced growth" model that Hirschman (1958) advocated. Forward and backward linkages are likely to be very limited and the short construction time associated with hydropower implies very limited transfer of investments to the local economy. The gradual spread of economic development to neighboring regions (spatial spread), as anticipated by Hirschman, is even less likely.

Since regions do not, in fact, receive benefits via spread effects into other economic activities from hydropower development, it is necessary to

12 Reasons for why both forward and backward linkages are likely to be limited are presented in the following section, Hydropower and Linkages.

13 Monteiro da Costa uses this phrase to describe the proposed development of mining industries in the Brazilian Amazon (Bunker 1989:602).

capture benefits in alternative ways. It has been suggested above that this might be done through demands for investment in local infrastructure such as irrigation and rural electrification which directly benefit the region, and through the capture of resource rents.

Access to rents alone is not sufficient for regional development, however. Local authorities must be able to correctly identify the real needs and invest these financial resources effectively to support other economic activities that the region has potential for. Specific activities might include infrastructure development such as airports to support tourism, road and ropeway access to market fruits and vegetables, and milk-chilling centres to support a dairy industry. Other support activities may be assistance in developing export markets for high mountain herbs, *lokto* paper, *allo* cloth, and local arts and crafts from the region. Training of entrepreneurs involved in these activities, and organizing co-operatives for joint purchases of inputs and marketing are yet other needed investments. One word of caution here is that there is a risk that local authorities will misappropriate funds or misspend on glamorous infrastructure white elephants such as airports and roads when the real needs may be elsewhere. The only antidote is strong local democratic institutions and transparency and participation in decision making. These last two elements may be more possible in locally initiated and executed projects than in those coming from the central government.

Hydropower and Linkages

Hirschman has argued that economic development is accelerated through investment in industries with strong forward and backward linkage effects.[14] He does recognize, however, that when the technology is alien to a region, very few linkages are likely to result. The construction of hydropower schemes is a specialized and capital-intensive industry. The absence of even the most rudimentary industrial infrastructure in most remote mountain economies makes it very unlikely to have either forward or backward linkages to any significant extent.

Temporary job creation during construction does not really fit the definition of Hirschman's backward linkages, though this is the most obvious linkage into the local economy. The influx of money into the

14 Hirschman (1958:98-116) defines linkage effects as investment generating forces that are set in motion, through input-output relations, when productive facilities that supply inputs to that line or utilize its outputs are inadequate or nonexistent. Backward linkages lead to new investment in input-supplying facilities and forward linkages to investment in output-using facilities.

local economy can be substantial even if it is only available for a limited time.[15] To what extent backward linkages into the national economy are possible depends very much on the size of schemes built. Judith Tendler in her comparison of hydro versus thermal power in Brazil points out that a hydroelectric project, whether private or public, draws on local resources and population much more than a thermal project. She argues that "the investment in hydro is also an investment in the production of conditions favoring the growth of the local equipment industry" (Tendler 1965:250).

However, the impact of hydropower development in Nepal has not accorded with Tendler's picture. The development of large hydro schemes built by the NEA with foreign aid have fostered few if any backward linkages even into the national economy in Nepal, never mind into regional economies. The need to have international competitive bidding on civil construction contracts (the dam, tunnel and power house) with grants for the purchase of electro-mechanical equipment being contingent on purchases being made from companies in the donor country[16], provide a very limited role for the Nepali hydropower industry. Both measures work to send back work to the countries of the aid-givers. International competitive bidding procedures are so complicated that it is generally only a handful of the largest companies even in the donor countries who bother to make a bid (see example of Arun III below). The question of scale is very important in the issue of backward linkages. Companies in Nepal such as the Butwal Power Company are able to compete effectively to bid to build schemes in the range of 20 MW or so, but when the schemes being proposed are in the 200 MW range, their capabilities are completely bypassed. As is the trend internationally, hydropower schemes funded by the private sector in the future are likely to be smaller than those being built by the NEA with the assistance of international aid. Says the World Bank "there is considerable evidence that investors are interested in smaller, less complex power projects in which the risks are considered more manageable" (World Bank 1989:75). The involvement of the Nepali hydropower industry can be expected to be significantly increased in these schemes. In fact, Butwal Power Company is a partner in the first hydropower project being built in the country with private international finance, the 60 MW Khimti Project, with substantial contracts going to

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15 The consumption linkages that this new money will generate are discussed later in this section.

16 This is often referred to as tied-aid.

two Nepali companies Himal Hydro & General Construction Co., and Nepal Hydro & Electric Company.[17]

Hydropower will, of course, have plenty of forward linkages into the urban and industrial sectors of the national economy. It is the demand derived from growth in the industrial center that push for its expansion in the first place.

Because of the versatile nature of electricity as an energy source there could also, in theory, be a large number of forward linkages from hydropower within the area of its production. It would appear that power could be used in both extractive and manufacturing industries to produce value-added exports instead of simply being itself exported from the region as a raw material. While powering of another extractive industry such as mining, in the same remote area, is a common use of hydroelectricity internationally, it appears to take more than the availability of electricity to spark industrialization. Foley (1990:94) argues that rather than electrification causing development, it may be that development creates the conditions under which rural electrification programs can be successfully implemented. Though electricity becomes necessary to move beyond even a very basic level of industrialization, without access to markets and raw materials and without resources for investment, clearly electricity alone is not sufficient to spark industrial growth.

Rural electrification is thus most likely to result in growth in those areas where there is already sizable economic activity and investment capability and which have access to markets and raw materials. It is unlikely to elicit major spontaneous activities in poor, less-developed areas, precisely those where large-scale hydro development are likely to occur. One exception in Nepal may be tourism which has good potential for development in certain very remote areas in the high Himalaya and along the trekking routes that lead to these destinations. But even here it takes an already well developed industry with lodges, hotels and other infrastructure substantially in place to be able to take full advantage of electricity. The successful rural electrification experiences in Ghandruk,

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17 Examples of smaller hydro projects being planned in the country for construction in the next 20 years which can be expected to involve Nepali companies and expertise are Bhote Koshi (36 MW), Puwa (6.2 MW), Chilime (17 MW), Modi (14 MW), and Middle Marsyangdi (42 MW). Examples of projects which will bypass the national hydro industry are Kali Gandaki A (144 MW), Arun III (402 MW), Upper Arun (335 MW), Upper Karnali (240 MW), and of course the mega projects such as Karnali and Pancheswor.

Salleri-Chialsa, and Thame compared to the difficulties in the Upper Mustang area support this argument.

However, rural electrification is a much desired goal for rural populations whether it leads to industrialization or not. Lack of electric lights and television have come to symbolize for rural communities that which distinguishes them from the more fortunate urban dwellers. Even in the most remote districts of the country, electricity commands a surprisingly high priority, probably both because a result of the expense, inconvenience, and unavailability of kerosene lighting (Pandey et al. 1994) and because of its symbolic value.

Hydropower is sometimes installed specifically to power an extractive industry in a remote area where there is no other industrial activity. This may prove to be a promising area in the future in certain areas of Nepal, though to date, it is only the zinc and lead mine in Ganesh Himal that has built a small hydro unit of a few hundred kilowatts specifically to power the compressors used in excavating the ore.

Another possible linkage into the local economy from hydropower development is the indirect consumption linkage. The increased income of local residents from construction and service sector jobs allows them to import consumption goods from the outside. This may then, in theory, stimulate entrepreneurs to manufacture some of these goods locally, thereby establishing investment linkages (called consumption linkages by Hirschman (1977)) into the local economy.

However, the access road built to construct a hydropower plant is likely to stimulate consumption linkages which are at least initially negative. Locally produced and consumed rope and bamboo products are replaced by plastic products. Handwoven textiles cannot compete with factory made cloth from the city. Even though the amount of money that comes into the local economy during construction can be substantial (see Arun III example below) and generate large amounts of consumption, the short construction period for hydropower projects lasting on the order of five years is unlikely to stimulate local manufacturing industries. Instead, the negative consumption linkages are likely to be sustained even once the construction is complete and there is no longer income coming into the community, as locally produced goods will no longer be able to compete with mass produced imports. Thus what initially appears to be an investment (or consumption) linkage, ends up creating new consumptive pattern that can be sustained only through migratory wage labour, arguably contributing to further *underdevelopment* of the region's own productive capacities.

Hirschman (1977:73) defines fiscal linkages as the taxes levied by the state on the incomes of extractive industries and channeled into productive investments. He argues that fiscal linkages make a strong showing in industries that have the earmarks of an "enclave". These are industries where forward and backward linkages into the rest of the local economy are likely to be weak. Hirschman's reasoning is that industrial enclaves are likely to be owned by investors from outside the region, often foreigners who are likely to be less able to lobby to reduce taxes. A large hydropower plant in a remote rural area being certainly behaves like an enclave and as such will be an obvious and comparatively easy target for the fiscal authorities.

In practice, however, the issue of fiscal linkages in Nepal has remained moot as long as it was the government-owned NEA that was developing the hydropower schemes. The prospects for direct fiscal linkages will no doubt improve with the increase in investment into the sector by private investors. The Hydropower Development Policy (1992) of the Ministry of Water Resources demands both royalty and income tax payments from private producers of hydropower for sizes bigger than 1 MW.[18] However, neither the Water Resources Act (1992) nor the Hydropower Development Policy (1992) make any mention of any of the royalty or taxes being transferred to the region where the development takes place.[19] The Memorandum of Understanding between the Snowy Mountains Engineering Corporation Ltd. of Australia and the Ministry of Water Resources, for example, calls for at least 10% of the annual energy production from the proposed 360 MW West Seti project to be given gratis to the Government of Nepal (MOU 1994) in addition to the royalty and export tax as stipulated in the Electricity Act of 1992. But the MOU

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18 However, both payments are reduced for the first 15 years of production, with the income tax actually waived for this period.

19 Legal provisions are not in place for regions of hydropower development to get a share of the fiscal linkages from private sector investment. For such sharing to happen, it needs to be worked into the legal provisions on hydropower development mentioned here as well as into the acts that govern decentralization. In the process of working out the legal provisions, the question of demarcation of the region becomes very important. Should it be the residents of the river valley in question, one or more Village Development Committees, or one or more District Development Committees which are closest to the project that benefit from the development of hydropower in their region? Clearly those communities that are negatively impacted by the development should receive benefits. The exact rules of demarcation, however, need to be worked out by an open process of consultation between residents of mountain districts and the Ministry of Water Resources.

makes no mention of any benefits to accrue to the District of Doti or to the Seti River Valley. And despite the fiscal linkage with the national government, this particular hydroelectric station would, in another important respect, be an enclave *vis á vis* even the national economy since the power is slated to be exported across the border to India.

Providing licenses to private companies to develop hydropower in order to capture fiscal linkages may well prove attractive to the central government. The question of whether the revenue thus generated will benefit the region is an open one. The government might well justify its revenue collection as needed to pay back the loans it takes to build the access roads for hydro development, assuming private investors will not be prepared to bear this expense. The ability of the government to tax the enclave is hardly a sufficient condition for vigorous economic growth in the region (or in the country as a whole). Equally important is the ability of the state to invest productively, no easy task by any means. Michael Watts (1984) points to the trap that Nigeria fell into after the meteoric growth of oil rents in the 1970s. Public sector expenditure expanded beyond increased rents resulting in serious indebtedness of the country, agriculture was allowed to collapse, and numerous developmental white elephants were taken on by the government only to be abandoned when the price of oil collapsed. Gyawali has questioned the ability of the Nepali government to invest productively noting that the state machinery continues to display many attributes of a feudal society, which "differs from a capitalist one in that the creation of scarcity and rent-seeking is a goal rather than increased production and profit-making" (Gyawali 1989: 61).[20]

Regional and local governments might be expected to be better able to pinpoint the areas where such investments are likely to be most effectively used for economic growth rather than the central government. However, with little political clout in the centers of power, the remote regions where the hydropower schemes will be developed are likely to receive little of the money collected from the developers unless they are prepared and able to demand it as a pre-condition to allowing the hydro development to take place.

20 "The culture ... has crept into the management of public utilities run by the government, where the distinction between what is public property and what is private is elastic" (Gyawali 1989:61, n3).

Transportation

Transportation presents a particularly high cost factor in hydropower development. The best hydropower sites in Nepal, where the river gradient is the highest, can only be accessed by building roads close to the Himalayas in treacherous mountainous terrain. Not only are the one time construction costs likely to be high, the ongoing maintenance costs will also be substantial. Many of the smaller and more remote sites can be deemed infeasible because of the high cost of building the road access.

The road needed to transport materials to build the hydropower project is often the major residual benefit perceived by the local populace. Roads are expected to make accessible cheap grains from the Tarai and to provide access to markets for local products such as fruit and local crafts. Farmers expect roads to provide access to cheap chemical fertilizer and other agricultural inputs to boost local food production. Roads are also seen to provide easy access to medical care in the cities, faster travel to visit relatives and overall to herald "development" in the form of vehicles in areas where wheeled vehicles are not in use.

As discussed in the example of Arun III below, however, unless local people are able to increase production and take advantage of the economic opportunities of the market, roads can actually result in a net loss of income for residents. In addition to the negative consumption linkages created by the road, local communities not organized to protect their common forest resources run the risk of losing them to loggers and poachers who spirit them away on the back of trucks and on top of buses. While it may be possible to find markets for some of the local products finding the right ones often needs external support[21].

Every time a motorable road goes through a new area, it unbalances existing social and economic organization in the areas it passes through and disadvantages the economies of whatever regions it does not go through. Road construction itself has a boom and bust cycle much like the construction of hydropower. While there is a flurry of employment during construction, once the road is built and the Indian-made trucks and buses start to ply the routes, many of the poor and landless people who derive income as porters for part of the year lose a source of employment permanently. While linkages are opened for those who have land to

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21 Through the help of NGOs and UNICEF, *allo* cloth made from the fibers of the Tibetan nettle and rice paper made from the bark of the *lokto* plant, both products of high mountain areas, have found markets in the tourist centres of Kathmandu and in export. Coordinating such projects with hydro schemes would be one way to increase the likelihood of effective forward linkages.

produce for the newly accessible market and those who can invest in the trucks and buses, the situation of the poor deteriorates unless they are able to acquire new skills to interact with the market economy. Thus the major perceived residual benefit of a hydro project does not turn out to be an unmitigated good.

Viewed from the perspective of the hydropower industry, roads present another kind of problem. The high cost of road construction will be a major barrier to the entry of the private sector in hydro development: especially for the construction of the more remote sites. However, the government may be willing to pay for the roads to be built with expectations to recover its investment from the royalty and taxation it hopes to collect from the power project. In the one private sector scheme under construction at present, the 60 MW Khimti project in Ramechhap District, HMG/N made compensation payments for houses which had to be moved, negotiated and paid for purchases of land acquired to build the access road from Nayapul to Kirne, and paid for the actual construction costs of the road (BPC Hydroconsult 1993).

Local people will want the hydropower access road to serve their needs as well as that of the power plant. After all, once the construction of the power plant is complete, the road will mainly be used by them. As the one tangible residual benefit left to them, local people will be well advised to inform themselves at an early stage on the planned alignment of the road to make sure that the government expense is also used to meet their needs adequately. The example of Arun III points to how road alignment can be a major point of contention between local people and project developers.

Unlike other extractive industries such as mining, the method of transporting electricity from a power plant is through power lines and not through road or rail. Thus, after the end of construction, the hydropower plant itself does not need the road very often. This can lead power developers to build roads which provide the most direct access to the power plant but which may have high maintenance costs (see Arun III example below).

Arun III and Andhi Khola

Prospects for regional development through hydropower development in Nepal will be explored through two examples: Arun III and Andhi Khola. It is difficult to make a direct comparison between these two schemes because of the significant difference in scale (Arun III to be a 402 MW scheme when completed, compared to the 5.1 MW Andhi Khola), and also because while Arun III has yet to be built, Andhi Khola has been in operation since 1991. Nevertheless, the comparison will serve to make some important points, for Arun III and Andhi Khola represent two contrasting categories of hydropower project that are likely to be of great importance in the coming years in Nepal.

Arun III is representative of the type of hydropower schemes that are expected to dominate NEA's system planning in the next 20 years. These are the relatively larger projects whose topographical, hydrological and other natural factors make them attractive in spite of the high cost of building roads to access them. Upper Karnali (240 MW), planned to come on line in 2006, and Upper Arun (335 MW) scheduled for 2011, are examples of other such schemes in NEA's current power generation plans (NEA 1996:11).[22] These schemes will be built very much in the economic periphery of the country.

Andhi Khola represents a prototype of a District Hydro scheme. I use this term to describe a hydropower project which will primarily produce electricity to be used for rural electrification of the surrounding project area but with a connection to the grid to feed the surplus power to other locations. Though it is unlikely that many sites will be found to build district hydro schemes in already existent centers of economic activity, a large number of suitable sites are available for their construction in areas already accessible by a road and where there is modest small-scale industrial activity before the power project (PPL, SHPD 1992 and WECS 1991).

Before the project was canceled in August 1995, the 201 MW Arun III (Phase I) also known as Baby Arun, was to be the single largest development project in Nepal.[23] NEA, the project developer, found the project to be attractive because of its particular geological, topographic and hydrological features.[24] It was selected for development in 1987 on the basis that it was thought to provide the lowest cost energy addition to

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22 Phases I and II of Arun III (201 MW each) are scheduled, in this revised planning exercise, to come on line in 2009 and 2013 respectively. While the funding for Phase I of Arun III was cancelled, the project remains a high priority for HMG/N and NEA and has not been removed from their plans.

23 The Arun III project was canceled when the World Bank withdrew its support after listening to NGO concerns about the high risks to Nepal's weak economy from taking on a single ambitious project of the size and complexity of Arun III. The NGOs proposed smaller and less risky alternatives in its place.

24 In particular these were: good rock for tunneling, a large drop in elevation resulting from high river gradient and a bend in the river, and good steady flow throughout the year as a result of substantial flows from Tibet in the dry season.

Nepal's national grid (World Bank 1994:i). However, access to the intake below the village of Num in Sankhuwasabha District would first require the building of a long (122 km), expensive, and difficult road along the Arun river and deep into the Eastern Himalayas starting from the small market town of Hile in Dhankuta District (NEA 1993:12-15). Economic activity in the Arun valley is almost entirely restricted to subsistence agriculture. The Environmental Assessment for the project, carried out by the NEA[25], points out that the main sources of cash income in the Arun valley are portering, collecting medicinal herbs and other forest products, labour on daily wages, and temporary migration to work in the Tarai and India (NEA 1993:26-27).

Concessionary funds[26] provided by the World Bank, the Asian Development Bank and the governments of Germany, Japan, Sweden, France, and Finland were to pay for the project in addition to loans from the Nepali government and NEA's own investment. The access road, dam, and tunnel for Baby Arun were to be constructed for the NEA by an international contractor selected through international competitive bidding. The grants to purchase some of the equipment such as generators and transmission towers were given on the condition that they would be purchased from the country that provided the funding. Construction of the road was to start in 1995 and the project was to be completed in 2003. (World Bank 1994:20-43).

Construction of the 5.1 MW power plant at the heart of the Andhi Khola Hydel and Rural Electrification Project (AHREP) was completed by the Butwal Power Company (BPC) in July 1991. BPC is an electric utility established by the United Mission to Nepal (UMN)[27] in partnership with the government of Nepal. The hydro project was funded by a grant from NORAD, the Norwegian governmental aid agency.

AHREP has a number of unique features. As its name implies, AHREP was, from its inception, meant to do more than generate 5.1 MW of power to feed the national grid. It was also meant to play a key role, through rural electrification, in an integrated rural development project.[28]

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25 This was based on the Basinwide Impact Study carried out by the Nepali environmental NGO, King Mahendra Trust for Nature Conservation.

26 Consisting of low interest loans over forty years and some grants.

27 UMN is a Christian organization which has been working in Nepal in health, education, engineering, industry and rural development since the early 1950s. It is essentially a very large NGO.

28 The introduction of the *AHREP Feasibility and Preliminary Design Report* states "The AHREP hydel plant is part of an integrated rural development project. Although

An accompanying UMN project known as the Andhi Khola Project (AKP) became involved in irrigation, resource conservation, drinking water and sanitation, adult literacy, and non-formal education in the electrification command area (Inversin 1994:2). A second important objective of BPC was to build up indigenous capability in hydropower technology within Nepal. BPC essentially used the construction of Andhi Khola to build up the capabilities of two Nepali companies. Himal Hydro and General Construction Limited (HH), a contractor specializing in tunneling and in civil construction was awarded the contract to build the dam, the tunnel, and all the civil works. Nepal Hydro and Electric Company Private Limited (NHE), a manufacturing and service industry based in Butwal, received the contract to manufacture the steel penstock pipe and the transmission towers. NHE also had the job of refurbishing used turbine and generator equipment from a power plant in Norway and installing them. We will see in the following sections whether these objectives, namely, to achieve integrated development in the region and to build up Nepali technical capacity while carrying out a hydro project, were met or not.

Forward Linkages

The power from Baby Arun was to be transmitted via high tension power lines directly to the town of Duhabi and from there to the country's two biggest cities, Biratnagar and Kathmandu. The power would be used almost entirely to meet the increasing needs of the national grid. High tension transmission lines would also be extended to connect with the town of Purnea in India for export of power as part of Phase II of Arun III. Though there were high expectations, the project had initially no provision for rural electrification. Constructing a substation next to the power plant to step down the voltage for local distribution was considered to be too expensive.[29] NEA proposed instead that the generation capacity established to provide power for construction later be diverted to power the major growth centers in the district (NEA 1993:A11). This would have resulted in the paradoxical situation wherein the region providing the

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surplus power will be available for feeding into the national grid, the plant will primarily produce electricity to be used for rural electrification in the surrounding project area" (Development and Consulting Services (DCS) 1982:22).

29 The provision to electrify some of the larger settlements along the road alignment was later added as part of the Regional Action Plan (most likely as a result of NGO criticism of earlier plans) and is part of the World Bank's (1994) Staff Appraisal Report.

largest amount of power to the country would itself be powered with a thermal plant running on imported fuel. Micro-hydro schemes were proposed, to be developed within the Regional Action Plan, in a few of the more remote centers with smaller power demands.

Clearly, forward linkages into the economy of the Arun Valley were not going to be forthcoming from Baby Arun as it was originally planned. Foley's study of rural electrification globally suggests that even if rural electrification had been a major component of Arun III, the low levels of economic activity pre-existing in the Arun valley would make it unlikely that significant industrialization would result (Foley 1990:93).

AHREP, in contrast, has rural electrification as a central objective. The feasibility study for the project notes "It is assumed that the project will eventually supply electricity in an area covering part of the Andhi Khola valley and the lower Kali Gandaki valley, and nearby hills, with a population of somewhere around 150,000 people" (DCS 1982:22). The project has as one of its key objectives the generation of new employment opportunities in the region through industry powered by the electricity (Inversin 1994:1-2). A second difference is that Syangja and Palpa districts, especially the towns on the Pokhara-Butwal road, already had a number of industries before the advent of electricity. A survey carried out in 1988 recorded 155 industries in the 35 *Panchayats* surveyed within AHREP's potential service area. While the majority of these were diesel-powered mills to process rice, flour, and oil, there were also small-scale textile factories, knit-wear, and bakeries (RDC 1988:4).

In the areas that have been electrified within the AHREP area, a number of agro-processing mills powered by electrical motors have since been constructed, and the chilling unit at the milk collection center in Galyang is now powered by hydro. However, in spite of the clear commitment of the project to the promotion of rural industry and the relative readiness of the area to benefit from electrification, identifying and promoting other "end-uses" of electricity has met with some real obstacles. Inversin (1994:37) identifies them as the paucity of disposable income, management and technical expertise, raw materials, and transportation and other infrastructure. A survey carried out in the area in 1993 cautions "much will depend on the development of small-scale industries to use the electricity" and recommends research on application of electricity for small-scale rural industries that will benefit those in the Poor and Poorest categories" (Poppe 1993:21).

That forward linkages will be difficult to achieve because hydropower, by its nature, will mostly be situated in the more remote rural areas is a central thesis of this paper. However, the comparison above demonstrates that smaller projects, in the less remote districts, which make a commitment to rural electrification and regional development have a much higher chance of bringing about rural industrialization than the larger schemes built in very remote districts whose only objective is to feed the national grid.

Backward linkages

Local people in the Arun valley anticipated jobs they hoped to acquire as labourers working on the road. However, the highly mechanized techniques slated for construction of the access road would have limited significantly the requirement for local labour. The road labour force was expected to average around 6,700, peaking at around 9,500 during the dry season, of which 75% were expected to be from the region. The road had to be completed within 40 months in order to expedite the bringing on-line of the power project. The extra earnings from early production and sales of electricity were calculated by NEA to be sufficient to pay for using helicopter support to build the road in record time. The road construction was to start at seven different places at the same time. Helicopters would be used to provide extensive air support to advance road crews who were not yet linked to the supply chain coming up the road (NEA 1993:15). This extremely high speed and highly capital-intensive road construction would have relied on heavy machinery and would require skilled workers from outside the region to operate them. It would thus have limited the total number of local labourers employed and the total length of time they would have jobs.

Andhi Khola, in contrast, was constructed in a very labour-intensive manner. Even the tunneling was done "by hand", with wheelbarrows and carts on rail being used to bring out the debris after explosives had been used to extend the tunnel. In the eight years it took to construct the power plant, the project did positively impact the local employment situation (Poppe 1993:23).[30] However, while AKP and BPC continue to employ a few local people, with the end of construction, the major source of employment and income for most households remains India.

The boom and bust in the local economy of the Arun valley, especially arising from road construction, would have been expected to be dramatic in the case of Baby Arun. NEA's Environmental Assessment

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30 Andhi Khola had the flexibility to use labour-intensive construction techniques because the project was built with a non-interest accruing grant from NORAD.

estimated that some four to five million dollars in wages would have entered the valley's economy each year during the period of road construction (NEA 1993:35). The Assessment points out that this influx of money would have resulted in increased imports into the area, and consequent increases in incomes for porters. This temporary increase in local consumption would, ironically, have made the bust even more devastating with no jobs after the completion of the road for either the porters or for the road-building labourers. The porters, estimated by the Environmental Assessment to number in the thousands prior to the project, would have lost their jobs permanently.

Andhi Khola was not exempt from the after-construction bust either, though the impacts were relatively subtle. While Galyang Bazaar itself appears to have sustained its growth, BPC staff involved in rural electrification have reported that a number of the electrified houses in the pilot area reduced their subscriptions for electricity from a 250 W to a 50 W connection once construction jobs came to an end.[31]

Backward linkages into the national hydropower industry are a major point of difference between Andhi Khola and Arun III. Inversin notes that AHREP is an outcome of UMN's belief that developing indigenous capability to supply the engineering and industrial services, rather than relying on a stream of overseas consultants, would be the most efficient and economical way for Nepal to exploit its considerable hydropower resources and to contribute more broadly to the nation's development (Inversin 1994:2).

Towards this end, UMN established several local companies in partnership with the Government of Nepal starting in the 1970s including BPC, HH, and NHE. The success of this strategy and long-term vision is borne out by the fact that this set of companies have built on the foundation provided them by the Andhi Khola experience to complete the construction of the 12 MW Jhimruk Project in Pyuthan District in 1994 and are the local partners in the Khimti project, a 60 MW joint venture scheduled to come on line in the year 2000. Backward linkages from hydropower development, as pointed out earlier, very much depends on the scale of projects developed . While these Nepali companies are capable of fully taking on projects as large as 20 MW and are able to play a major role in projects as large as 60 MW, they are completely bypassed by

31 A pilot area was set up to research a new tariff structure and to test innovative technologies and techniques for the promotion of rural electric cooking and to reduce the cost of rural electrification. This area was electrified in mid-1989 using power from the national grid (Inversin 1994:3-6)

projects of the size of Arun III. In addition, the process of international competitive bidding favored by international donors disqualifies local companies such as BPC, Himal Hydro, and NHE from even pre-qualifying as they have no international construction experience.

Baby Arun, by virtue of its size, complexity, and funding conditionalities allowed no role for the burgeoning domestic hydropower industry. In fact the decision of the project consultants to combine the contracts for the construction of the road with the construction of the dam and tunnel made the single contract so large that not even companies from India or China were pre-qualified.[32] If hydropower development is to have as its aim not only the immediate production of energy, but also broader development objectives, then these in-built barriers to Nepali participation must be eradicated.

External Benefits from Hydro Development

The access road was perceived by residents of the Arun Valley to be the major residual benefit from the construction of Baby Arun. The detailed feasibility study carried out for the Department of Roads in 1987 to access the project (then the full 402 MW Arun III) had recommended the "Hill Route". The terms of reference for this study had emphasized the objective of maximizing economic and social benefits to the region, as well as providing access to the project. In addition it was also stipulated that the road provide access to the towns of Khandbari and Chainpur. The planned Hill Route ran from the roadhead at Basantpur through Mamling to Chainpur, Kharang and Tumlingtar, rising through Khandbari to the Chhyangkuti ridge before descending through Num to the intake site at Phyaksinda. The total length of the road would have been 197 km.

In 1992, as part of an attempt to reduce initial expenditure, in addition to reducing the size of the project to the 201 MW Phase I, the criteria for the road design were modified. The road, henceforth, was defined as being solely for the purpose of providing access to the power site as quickly as possible. In spite of the fact that compensation payments had already been made for much of the Hill Route, the decision was made to go with an alternative Valley Route. NEA's Environmental Assessment states that though the construction costs of the shorter Valley Route (122 km) would be similar to those of the Hill Route, there would be a time saving of one

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32 The consultants reasoned that this would avoid the situation where the contractor for the dam and tunnel might have been held up by delays on completion of the road. (Public hearing in Kathmandu, Feb. 12th, 1993).

year (NEA 1993:52). The Valley Route runs from Hile, descends rapidly past Pakhribas to the Arun River and then follows the valley throughout.

The decision to have the road run along the river rather than along the mountain ridge sparked controversy in the Arun Valley. Residents of the historic town of Chainpur (an important centre for brassware in Nepal) on the ridge filed a case in 1994 in the Supreme Court to have the old alignment reinstated so that the road would go through their community. NEA argued that the Valley Route would mean early completion of the project and extra earnings from early sale of electricity. In addition, NEA argued that the Valley Route would improve access to the District of Bhojpur and would form a better long-term regional growth axis. Chainpur residents argued that the Hill Route would require much lower maintenance and would have much higher benefits for the Arun Valley. I can offer no definitive analysis of the pros and cons of different road alignment routes in this particular case. The issue has nevertheless been discussed in detail to highlight how the project developer will make the decision about the alignment of the hydropower access road solely on the basis of cost-effective access to the power site unless local people are prepared to make their voices heard early in the decision process.

In the case of Andhi Khola, one of the objectives of the project, namely, "to contribute towards self-sufficiency in food", was to be met through the construction of an ambitious irrigation project to the south of Galyang Bazaar. Poppe's socio-economic survey notes that "for those who have so far benefited, this has been a major success and a means of increasing the productivity of their land (usually at least 100%) and their self-sufficiency" (Poppe 1993:21). In terms of increasing local production, in the land-scarce hills of Nepal, irrigation is a major residual benefit if it can be attached to a hydropower project. The irrigation project in Andhi Khola is, however, behind schedule, and is yet to be completed. In addition, because irrigation water is diverted before it passes through the turbines, water use priority has become a source of conflict between the electricity and irrigation programs. Poppe notes that even in 1993, with only one fifth of the command area served, irrigation water was cut off by BPC in February just as the winter crop of mustard and wheat was ripening, because there was insufficient water for electricity generation (Poppe 1993:22). The conflict will only be exacerbated once the irrigation project is completed, especially if the shortage of electric power on the national grid continues.

While local people can demand additional benefits, such as irrigation, when a power plant is built in their locality, they need to be clear about the full benefits they are entitled to if there is not to be a conflict with project developers in the future. This example also shows how genuinely incompatible demands on a limited resource can complicate effective realization of "integrated development".

Fiscal linkages

It was suggested earlier in the paper that local people might demand some of the resource rents accruing to the central government through royalty and taxes resulting from hydropower development in their region. As Arun III was to be built with aid money and Andhi Khola was built with aid money and neither were to be developed or was developed by a private company for profit, no rents were to be paid to the government for the use of the water resources. The question of fiscal linkages was thus moot here though it may well be an important issue in the future in privately-owned hydropower projects, especially because the legal provisions set up in 1992 to allow such projects do allow HMG/N to collect royalties from them.

Regional Action Plan and the Andhi Khola Project

Instead of the anticipated benefits, the actual impact of water resources development in a remote area can well be a decrease in real incomes (on account of the road). This conclusion was arrived at by the Management of Basinwide Environmental Impacts Study (MBEIS) for the Arun Valley carried out by the environmental NGO, King Mahendra Trust for Nature Conservation in 1989. The 18-month study funded by the UNDP concluded that real incomes in the Arun Valley after completion of the Arun III access road could be expected to become worse than the baseline scenario (their simulation model predicted a decrease in real income of around 15-18%) unless direct impacts were mitigated and effective complementary investment programs were implemented (NEA 1993:A9).

The MBEIS study recommended a range of action programs to enhance economic opportunities for local people and to minimize project-derived hardship and marginalization. A Regional Action (RAP) Plan was proposed which would assist local people in organizing community forestry management, off-farm income generation, agricultural extension and training, infrastructure and energy development and environmental monitoring. Incomes were to be increased in the long run through improving access to irrigation and supply of agricultural inputs, developing markets for local agricultural production, and supporting tourism-related income generation. In the short term, RAP would assist with importing food grains into the region during construction and supporting vegetable production to meet increased demand.

While the execution of the MBEIS study and the planning of RAP were exemplary, there were a number of hitches in the execution. For one thing, the $14.6 million required over 10 years to fund the Plan was not to come from the project costs but from separate funds (NEA 1993:A 9). Though it was rumoured that donors had been found to fund the RAP, this was never officially verified even by the time Baby Arun was finally canceled. Secondly, the execution plans of RAP did not proceed very smoothly. In particular, a number of activities that the MBEIS study had pointed out as priorities for pre-emptive implementation ahead of road construction were not carried out.[33]

Interestingly, the UMN Andhi Khola Project which ran alongside AHREP has a list of activities similar to those of the RAP in the areas of health, resource management, irrigation, and off-farm income generation. AHREP and AKP were designed to be components of an integrated rural development project. In contrast to the RAP, however, the AKP program was begun in 1981, well before the construction activities actually began.

The Regional Action Plan based on the MBEIS study provides an important precedent for hydropower development in very remote areas. Local people in these areas should be prepared to demand a RAP based on a careful study such as the MBEIS in future projects. Clearly it would be unfair to subject a remote area to erosion of income in the course of developing the water resources there. The equivalent of a RAP should be considered by HMG/N for all road construction in the country for the same reason.

District Hydro

District Hydro has been defined above as a hydropower project which will primarily produce electricity to be used for rural electrification of the surrounding project area but with a connection to the grid to feed the

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33 These pre-emptive activities were in the areas of strengthening local forest management, helping communities to service wood and other construction-related demands, strengthening government institutions to cope with impacts, training and education for local human resource development, and environmental monitoring. One of the reasons for the delay in carrying out these crucial activities was probably lack of funds within HMG/N for the $2.6 million that were required for these core activities. The second was that there was little capability within HMG/N, or NEA to execute this novel and sophisticated Plan.

surplus power to other locations.[34] A District Hydro is a small hydro project (often understood in Nepal to be smaller than 15 MW) adequate to electrify roughly one mountain district although, it can also cover more than one district. To keep project costs low, and to achieve successful rural electrification, district hydro schemes are best suited to districts which already have road access and which are close (within about 50 kilometres) to the national grid. Andhi Khola provides a very good example.

District Hydro can provide a very effective path to speed up rural electrification of the country. While extension of the national grid is the most practical way to electrify the Tarai and micro-hydro schemes[35] may be the most appropriate solution for remote isolated communities in the high Himalayas, small hydro schemes are very well suited to electrification of the not-so-remote middle hills. Districts which are rich in water resources, close to the national grid, and tired of waiting for the grid to be extended into their districts will find District Hydro very attractive. In such districts, District Hydro can be used to attack the cycle of a low level of industry and resultant low power demand that make it uneconomical to supply power from the national grid, and thus results in a perpetuation of a low level of industry.

A major benefit to the national grid is that this method of electrification actually adds power to the grid, a feature very attractive to NEA which is forever coping with power shortages. Moreover, District Hydro provides an export commodity for mountain districts to the economic centre, thus helping to redress their balance of payment deficit at a time when the mountains have increasingly fewer things to sell. From the perspective of linkages, being smaller and more labour intensive, District Hydro schemes can be expected to have much stronger backward linkages both into the local economy and into the national economy where they would provide work for the hydropower industry. Small hydro schemes can be almost entirely installed by the capability

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34 The ability to sell power is very important as it generates income for the project which can then be used to fund the extension of the rural electrification network. Even after the network is complete and the bulk of the power produced is consumed in the area, it is beneficial for the project to be able to feed surplus power to the grid during the rainy season or during times of the day when local demand is low. Conversely, a connection allows the rural area to purchase power from the grid when its own supply is inadequate.

35 A micro hydro scheme produces up to 100 kW. A scheme without a connection to the grid is said to be isolated.

that exists within the country. Their forward linkages would be particularly strong as their very mandate would be to provide power to the district.

The best international example of the applicability of District Hydro to provide rural electrification and power for rural enterprise is found in China where a third of the 2300 counties and 40% of the rural townships rely on small hydro schemes (defined there as up to 25 MW) for the bulk of their electricity (Xuemin 1994:iv). Most of these schemes are either connected to the national grid or to regional mini-grids.

The funding for the development of District Hydro will need to come from a variety of sources. ITECO is seeking funds from the Swiss government to fund a proposal (ITECO 1993) to develop a mini-grid to electrify the districts of Solu Khumbu, Khotang, and Okhaldhunga in east Nepal. Two new schemes on the Rawa Khola and the Dudh Kosi would connect to two existing mini hydro schemes[36] in Salleri-Chialsa and Okhaldhunga to produce a total of 12 MW. This mini-grid would connect to the national grid at Gaighat. The Lamjung Electricity Development Co. is a public limited company formed with investment shares from a number of Village Development Committees (VDCs), the District Development Committee (DDC), and individuals in Lamjung District. They are seeking funding from GTZ and other donors at present to develop the 5 MW Nyagdi scheme to provide power for rural electrification of Lamjung as well as for feeding the grid through the 33 kV line being built by NEA to supply the district headquarters at Besi Sahar.

One funding mechanism which has not been tried yet but which might be suitable to a large number of districts is for HMG/N to provide low interest loans for the construction of District Hydros. Part of the revenue from electricity sales to the national grid would, in this arrangement, first go towards repaying the loan, while the remainder would go towards extending the rural electrification network. This model is similar to what is used in China. There the county builds the schemes with a loan from government banks. As an enterprise under the responsibility of the district government, District Hydro too can suffer from the rent-seeking behavior of elected representatives. But one advantage it does have is that account keeping for sales of electricity, especially to the national grid, is relatively simple and can be kept transparent.

36 A mini hydro scheme produces from 100kW to 1MW (or 1000 kW).

Conclusions: Generating Local Benefits from Hydro Development

* Hydropower development for feeding the grid, located in remote mountain districts in Nepal, displays the characteristics of an extractive industry. It is unlikely to result in industrial development of those districts through either sectoral or spatial spread of investment.
* While the access road may be a potential residual benefit to the region, the alignment of the road must meet the requirements for regional development and not just the needs of the hydroelectric project if it is to yield full benefits to local inhabitants. In addition, a Regional Action Plan must be executed in tandem with the road construction, if local people are to achieve a net economic gain from the road.
* The development of an irrigation component along with the hydropower project can provide tangible benefits for the region. Link roads and rural electrification tied to hydropower development are other infrastructural investments which can benefit the region.
* District Hydro can provide a way for mountain districts to achieve rural electrification and acquire power for rural industries. Districts can also earn income from exporting energy to the national grid. Effective funding mechanisms for District Hydro need to be explored. The Chinese example is worthy of serious study regarding its applicability to Nepal.
* Mountain districts need to negotiate with HMG/N if they want to receive resource rents for the use of their water resources. HMG/N might be convinced to share a portion of the royalty and taxes which it is entitled to collect from private sector investors in hydropower. These rents will have to be invested wisely in sectors which promise economic growth for the district. Since wise use of resource rents can be difficult and the willingness of the central government to hand over funds is uncertain, districts may prefer to negotiate with the project developer for investment in important local infrastructure as compensation for the use of their water resources.

References

Bayley, P. B. and Li, H. W. 1992. Riverine Fishes. *In The Rivers Handbook: Hydrological and Ecological Principles, vol. 1.* Peter Calow and Geoffrey E. Petts, eds., pp. 251-281. Oxford: Blackwell Scientific Publications.

Bunker, Stephen G. 1989. Staples, Links, and Poles in the Construction of Regional Development Theories. *Sociological Forum* 4(4): 589-610.

BPC Hydroconsult. 1993. *Khimti Hydropower Project Summary Environmental Impact Assessment*. Kathmandu: BPC.

Development and Consulting Services. 1982. *AHREP Feasibility and Preliminary Design Report*. Butwal: DCS.

Dhaul, Harry. 1994. To Be or Not to Be—That is the Question. *India Power* 1(3): 1.

Foley, Gerald. 1990. *Electricity for Rural People*. London: Panos.

Gilmour, Don A. and Robert J. Fisher. 1991. *Villagers, Forests and Foresters*. Kathmandu: Sahayogi Press.

Gyawali, Dipak. 1989. *Water in Nepal*. Hawaii: East West Center.

HMG/N, Ministry of Water Resources. 1993. *Nepalese Legal Provisions on Hydro-power Development*. Kathmandu: Ministry of Water Resources, HMG/N.

Hirschman, Albert O. 1977. A Generalized Linkage Approach to Development, with Special Reference to Staples. *Economic Development and Cultural Change* 25(Vol. Suppl.): 67-98.

Hirschman, Albert O. 1958. *The Strategy of Economic Development*. New Haven: Yale University Press.

Inversin, Allen. 1994. *New Designs for Rural Electrification: Private-sector Experiences in Nepal*. Washington DC: National Rural Electric Cooperative Association.

ITECO. 1993. *The Golden Triangle Vision of Rural Electrification (Based on Mini-Grid Structures)*. Kathmandu: ITECO.

Ives, Jack D. and Bruno Messerli. 1989. *The Himalayan Dilemma: Reconciling Development and Conservation*. New York: Routledge.

Memorandum of Understanding (MOU). 1994. *Memorandum of Understanding between His Majesty's Government of Nepal Ministry of Water Resources Electricity Development Center and Snowy Mountains Engineering Corporation Ltd. for the Development of West Seti Hydroelectric Project.* Kathmandu.

Nepal Electricity Authority (NEA). 1996. *A Report on System Planning Studies and Investment Program*. Kathmandu.

Nepal Electricity Authority (NEA). 1993. *Arun III Hydroelectric Project: Environmental Assessment and Management Executive Summary.* Kathmandu.

North, Douglas C. 1961. *Economic Growth of the United States, 1790-1860*. Engleweed Cliffs, NJ: Prentice Hall.

Pandey, Bikash. 1995. Because It Is There: Foreign Money, Foreign Advice and Arun III. *Himal* 8(4): 29-35.

Pandey, Bikash, Girish Kharel, Urmila Simkhada, and Devendra Adhikari. 1994. *Micro Hydropower in Humla with Special Reference to the Yangar Project*. Kathmandu: Intermediate Technology Development Group.

Perroux, F. 1955. Note sûr la Notion de Pole de Croissance. *Économie Appliqué.* (Jan.-June).

Poppe, Joy. 1993. *Andhi Khola Project (UMN): Socio-economic Survey.* Kathmandu: UMN.

PPL, SHPD. 1992. *Small Hydro Master Plan Nepal Eastern Development Region*. Kathmandu: Nepal Electricity Authority.

Rural Development Center. 1988. *AHREP "Markets for Rural Electrification" Survey Results.* Pokhara: RDC.

Shrestha, Hari M. 1995. *Energy Perspective Plan*: *Technical Reference Hydropower Sector*. Unpublished ms.

Tendler, Judith D. 1965. Technology and Economic Development: The Case of Hydro vs. Thermal Power. *Political Science Quarterly* 80(2): 236-253.

Verghese, B.G. 1990. *Waters of Hope.* Delhi: Oxford & IBH Publishing Co.

Watkins, Melville H. 1963. A Staple Theory of Economic Growth. *Canadian Journal of Economics and Political Science* 29: 141-158.

Watts, Michael. 1984. State, Oil and Accumulation: from Boom to Crisis. *Society and Space* 2: 403-428.

WECS. 1991. *Task Force on Identification of 1 MW to 50 MW Range Hydroelectric Projects for Private Investment*. Kathmandu: Ministry of Water Resources, HMG/N.

World Bank. 1989. *Financing the Energy Sector in Developing Countries.* Energy Series Paper 14. Washington DC: World Bank.

World Bank. 1994. *Staff Appraisal Report, Nepal, Arun III Hydroelectric Project.* Washington DC: World Bank.

Xuemin, Cheng. 1994. Recent Trends in Small Hydro Power in China**.** *International Water Power and Dam Construction* (Small Hydro Supplement) September: iv-ix.