THE IMPACT OF ENERGY INFRASTRUCTURE PROJECTS ON POVERTY

A SUSTAINABLE LIVELIHOODS ANALYSIS

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This document is an output from a project funded by the UK Department for International Development (DFID) for the benefit of developing countries. The views expressed are not necessarily those of the DFID

EXECUTIVE SUMMARY

This paper is an analytical review of two case studies of energy infrastructures projects: micro-hydro installations in Nepal and Kenya. Both case studies and the review were carried out within an overall project managed by Intermediate Technology Consultants (ITC). The principal aim is to increase knowledge of how the Sustainable Livelihoods (SL) Approach and Framework can be applied to infrastructure projects, specifically energy supply interventions, in the context of poverty alleviation. The SL Approach and Framework were developed by the Department for International Development (DfID), with the core aim of eliminating poverty. Those interested in the results of this review are expected to be primarily policy-makers and energy specialists - including planners, managers, engineers, economists and social scientists - working in national and international institutional settings.

The SL Approach has been applied very successfully in natural resource-based projects. Here its relevance to energy projects is investigated, along with the practicalities of applying it. Clearly, energy infrastructure interventions can be expected to have significant impacts on people's livelihoods. The nature and magnitude of these were the question the case studies sought to address. This review attempts to transpose those observations into lessons that can lead to the improved application of the SL Approach, including suggestions for adapting the Approach itself.

What emerges in the first instance is that the provision of energy infrastructure and energy services will not automatically lead to the enterprise creation and income generation that project plans might predict. In the language of the SL Approach, an increase in physical assets may not increase financial assets, at least not in the expected way. While the micro-hydro power schemes do appear to lead to increased financial assets, the findings of the case studies suggest that this may be through diverse impacts - building on traditional production, for example, rather than guaranteeing successful new enterprise. Meanwhile, the impact of energy services, specifically electric lighting, on community human and social assets appears beneficial and might be predicted with some certainty. The enhancement of natural assets, however, does not follow directly and demands complimentary programmes. Furthermore, the assumption sometimes made that providing communities with electricity will reduce the use of fuelwood does not hold true.

Findings have a number of implications for projects that seek to employ the SL Approach. Importantly, if financial assets are to be increased by the provision of energy services, significant attention needs to be paid to markets. The need to identify and access new markets is highlighted, while questions concerning alternatives to markets are raised. Furthermore, energy infrastructure interventions have long technical lifetimes and planners need to be aware of likely long-term changes in the technological and institutional context. The implications of findings for the SL Approach itself include suggestions for simplification and for providing worked examples for the instruction of practitioners. An observation is also made about the possible preferred sequence of asset accumulation. Overall, the SL Framework and Approach is judged to be very relevant for both the implementation and assessment of energy infrastructure and energy service projects.

Summary of main lessons:

- Multi-disciplinary project formulation and evaluation is highly desirable

- Feasibility studies should include evaluation of social, economic and environmental costs
- The changing nature of the technological and institutional context must be considered
- Innovation, spin-off and subsidiary effects should be taken into account
- Enterprise development must be market-driven
- Building on strengths is likely to prove a viable approach to enterprise development
- Markets and alternatives to markets need very careful consideration
- Physical capital does not lead directly to increasing other assets
- One form of energy is not necessarily substitutable for another
- Sequencing of asset building is worthy of consideration
- SL Approach and language might be beneficially clarified
- More SL case study examples are required

1 INTRODUCTION: QUESTIONS OF POWER AND EMPOWERMENT

What effect do infrastructure projects have on poverty? More particularly, what impact do local energy infrastructure projects have on the communities and in the environment in which they are installed? When, for example, a village has access to electrical or mechanical power does poverty vanish in a puff of productive smoke? Fairly obviously, it does not. Equally obviously, however, access to energy will – or should – have significant impacts on people's lives. But *how* does energy contribute to economic development at village level? Who are the beneficiaries likely to be - who is empowered by energy supply? And exactly what benefits does energy bring? Moreover, how can benefits, and indeed potential negative outcomes, be assessed?

When traditional sources of energy have been augmented by modern energy systems, the assumption often seems to have been that economic development would follow - almost automatically - to the benefit of all. There is now ample evidence that this is not the case. The key question is, then, rather complex. How can a local energy infrastructure intervention be planned and enacted so that it has the maximum impact, alleviating poverty for the widest possible cross-section of the population and stimulating sustainable economic development? What are the pre-conditions for it to be able to do so?

In reviewing and analysing two case studies of energy infrastructure it is not expected to definitively answer the questions that have been raised. In fact, it is likely that for every question addressed a number of equally challenging questions will emerge. Consequently, a core aim is to increase information on the relationship between energy and poverty. This information is directed to energy professionals working internationally on development projects. When referring to energy professionals, the firm intention is to include planners and managers approaching the issues from a variety of backgrounds on many levels: policy and decision-makers, engineers, economists and other social scientists – all those involved in project design, administration and implementation.

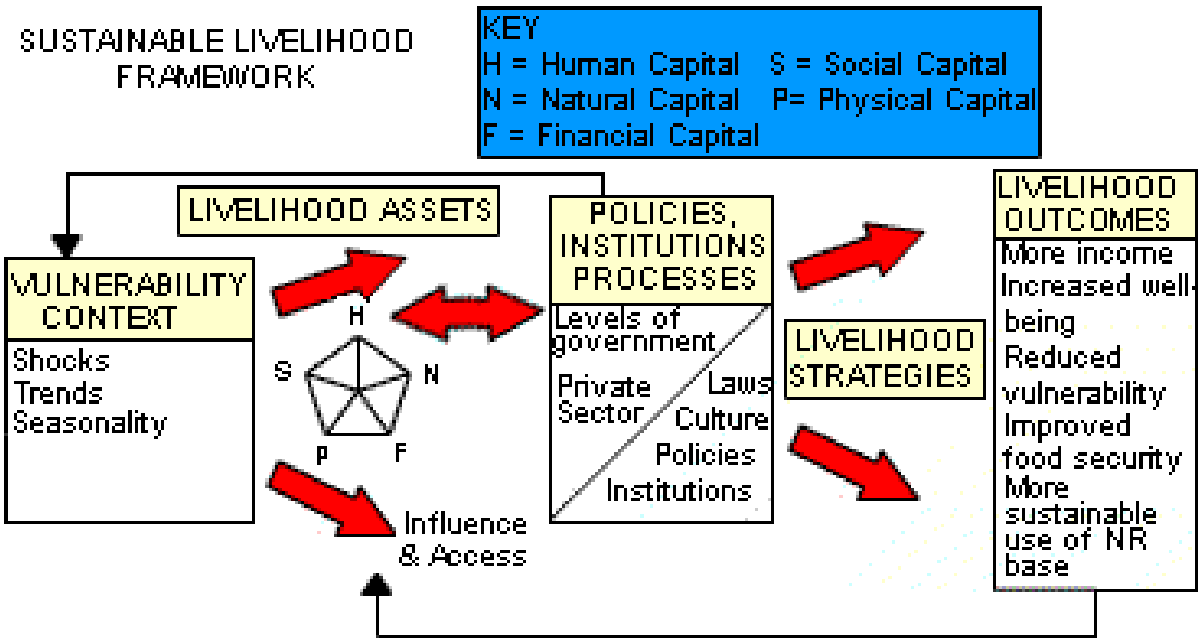
2 THE SUSTAINABLE LIVELIHOODS FRAMEWORK AND APPROACH

A second core aim is to introduce the Sustainable Livelihoods (SL) Framework and Approach adopted and developed by the UK Government's Department for International Development (DfID). Can the SL Approach be applied to energy infrastructure interventions? Can it reveal insights and help in conceptualisation? The SL Approach has been used to good effect - primarily in agriculture and rural livelihoods projects - but its relevance to energy infrastructure projects has not been assessed. If energy services *can* make a significant contribution to poverty reduction, however, then the SL Approach *should* serve to focus that contribution to maximise positive impacts. That, essentially, is the underlying hypothesis this review sets out to begin to test.

DfID's SL Framework and Approach are clearly and comprehensively explained in a series of guidance sheets. For those new to that content, a brief review of the concepts and language of SL will hopefully suffice to make what follows easier to interpret and of more value.

The SL Framework, which is centred on people and their lives, is illustrated in the schematic. The Framework does not represent a model of 'linear reality'. Arrows do not denote a direction of causality, but rather indicate the dynamic connectedness of the different types of relationships.

Thus, the Vulnerability Context is not the starting point for all analysis and Livelihood Outcomes are not where it is bound, or designed, to lead. Livelihoods are shaped by a multitude of different forces and complex interactions; no static or linear representation is possible. The purpose of the framework is to provide a checklist of critical livelihood issues and draw attention to how these are linked - the influences and processes at work.



Derived from a more comprehensive definition (Chambers, 1992), a livelihood here is understood to mean the capabilities, assets and activities required for a means of living. Essentially, a livelihood can be regarded as sustainable when people can cope with and recover from adversity without dependence on external support or their assets being critically diminished.

The SL Approach supposes that people need a range of assets. Being rich in one form of capital while having inadequate access to others will be unlikely to lead to sustainable Livelihood Outcomes. In terms of energy infrastructures, a micro-hydropower installation – physical capital – is no guarantee of increasing financial, natural, human or social assets. Neither is energy infrastructure alone likely to be sufficient physical capital to ensure development. Of interest is whether communities that do escape poverty tend to start with a particular combination of assets: is there a preferred *sequence* of asset accumulation?

The Vulnerability Context affects people's access to assets and is largely beyond their control. Shocks caused by any scale of disaster, from an earthquake to illness in the family, have an adverse affect on livelihoods. Though seasonality and trends tend to be more predictable – rains generally occur at certain times, changes in government policy might be anticipated – the majority of poor people do not have the assets, including access to information, which might cushion them from impacts. What poor people generally do in the face of the adverse effects of shocks, seasonality and trends is develop Livelihood Strategies that can be defined as 'coping strategies'. Typically, these range from the resourceful to the desperate, from migrating to urban centres in search of work to defying legislation to plunder fuelwood - to the detriment of the communal stock.

Apart from being people-centred, the SL Approach is holistic, dynamic and participatory. It analyses livelihoods on both the micro and macro levels, aiming to build on the strengths found

within communities. It is complementary to other development approaches, seeking to contribute towards poverty alleviation rather than achieve some meaningless methodological supremacy. Thus, sectoral approaches are appropriate in certain contexts and could beneficially incorporate SL analysis. Integrated Rural Development (IRD), though it has many similarities with the SL Approach, has a very different starting point and problem analysis. The essential difference is possibly that the SL Approach targets core issues rather than trying to address all the factors contributing to poverty simultaneously.

Concluding this scant review of an extensive body of work, it should be emphasised that the SL Framework and Approach are not merely analytical tools. They should be regarded as establishing the basis for effective action. Considering Livelihood Outcomes concentrates attention on achievements and indicators of progress in the process of alleviating poverty. The Livelihood Outcomes that people desire are not, as is often assumed, always centred on maximising income. Their priorities can be otherwise – good health or empowerment, for instance, building human or social capital. The SL Approach promotes choice, opportunity and diversity, allowing people to adopt Livelihood Strategies via which they can achieve their preferred Livelihood Outcomes.

3 BACKGROUND TO THE OVERALL PROJECT

The project draws on two case studies of micro-hydropower installations in Nepal and Kenya. As outlined, the objectives of the project were to show the role that energy projects play in poverty alleviation and consider whether using an SL approach with energy projects will lead to better projects in terms of poverty alleviation. The inaugural project meeting took place in Kathmandu in December 2000. Fieldwork for the case studies was carried out by Staff of the Intermediate Technology Development Group in Kenya and Nepal in their respective countries. Project management and training for staff in the SL Approach was provided by Intermediate Technology Consultants (ITC) with support from Birmingham University, drawing particularly on experience in Participatory Rural Appraisal (PRA). Dissemination of results is via publication of the case study reports in combination with this analytical review. The other aim of the project was to disseminate the use of the SL approach and framework in energy projects to people working in the field of development, so workshops and seminars were held in Kenya (August 2001), Nepal (November 2001) and the UK (March 2002).

Both teams were new to the SL Framework and Approach. Over and above the training provided, this ‘learning by doing’ dimension was recognised by ITC as a vital part of the process. By its own definition, the SL Approach is dynamic and flexible. With the proviso that it ‘will not be effective unless operationalised in a participatory manner’, there is no advocacy of a rigid methodology. Hence, many questions about the ‘nuts and bolts’ of putting it into practice had to be answered by the whole project team. The conceptual and practical problems encountered by field staff – energy professionals - using the SL Approach for the first time are analysed in this review.

3.1 Case Study methodologies

The first question was how to select sites for the case studies. In neither Kenya nor Nepal had energy infrastructure interventions been made using the SL Approach. As the SL Approach not having been applied to such interventions underpinned the project aim, this was to be expected. Hence, the decision was made to review two similar technological interventions – both village micro hydropower projects (MHPs) on the same scale – that employed different approaches and were at different stages of development. Again in an ideal world, case studies would assess

livelihoods before and after an energy intervention. As time was a limiting factor for the project this was not possible. The choice of two well-documented interventions at different stages, however, makes some before-and-after cross-referencing observations possible.

Taking into account these limitations and opportunities, the Kenyan project, Tungu-Kabiri, was in its early stages. Though significant preparatory work had taken place with the community, the turbine had not been installed. There has been little development of village-level micro-hydro in Kenya and so an established scheme was not an option.. In Nepal, implementation of the Pinthali project began in 1997 and the turbine had been running for some time. Pinthali was selected from a number of working schemes, village-level micro-hydro being a tried and tested technology in Nepal. Criteria for selection included access to project data, data quality, the extent of community interaction with policies, institutions and processes (PIPs), and - overall - the potential outcome in terms of valuable lessons.

With respect to development approaches, the decision to implement Tungu-Kabiri MHP was originally based on the potential impact of renewable energy on the local environment and thence global climate change. The goal is enterprise creation for income generation via electrification of a commercial centre. The Pinthali project approach is more holistic and akin to the SL Approach, having its roots in UNDP's own sustainable livelihoods thinking. Overall, the two case studies were thought to present a good balance of similarities and differences, allowing both comparative and contrasting observations to be made. Case study teams were united in their essential project questions: What is the relationship between energy infrastructure, the provision of energy services and poverty reduction? And how can the SL Approach be applied not just in analysis but also in project design?

3.2 Gathering data

Both studies took their unit of reference as the household. The Kenyan study considered a household as 'a person or group of persons, generally bound by kinship ties, who live together under a single roof, are answerable to the same household head and share a common source of food.' A household is defined as poor if it cannot meet the basic needs of its members. Thus clear in their aims and boundaries, the Kenyan team performed a 'detailed socio-economic survey', employing a range of formal and informal research methods:

- Interviews with local opinion leaders, key informants and other stakeholders;
- A questionnaire survey of selected households;
- Participant observation;
- Focus group discussions;
- A wealth ranking exercise.

The Nepali team, in turn, also used qualitative and quantitative research methods. The Pinthali intervention having a longer history, the team began with a review of project documentation. Subsequently the fieldwork used the following research methods:

- A structured questionnaire to conduct a household survey.
- Two focus group discussions: the first about the MHP and livelihoods; the second - with only women - on gender issues and the MHP.
- Key informant interviews.
- Observation and photographs.

Applying 'stratified sampling procedures', one-third of households in Pinthali were selected for the household survey. Food sufficiency based on landholding was used as the basis for stratification. The questionnaire was designed to ascertain information on socio-economic indicators, particularly those related to energy consumption, food sufficiency, income and income generating activities.

3.3 Project, people and Places

Tungu-Kabiri project is located in Mbuiru village in the Eastern province of Kenya, around 200 km from Nairobi. Mbuiru occupies an area of approximately three square kilometers. Marianai sub–location, of which the village is a part, covers over forty square kilometers and includes more than 900 households - an estimated 5,400 people. The Meru people, one of Kenya's minor tribes, constitute most of the population. People from other tribes have moved into in the area, however, resulting in an ethnic mix. Residents have coexisted for a long time and form an integrated, cohesive society. The vast majority of people, around 90%, are under forty years of age.

The project area lies on the leeward side of Mount Kenya and this influences its climate. With an average annual rainfall of between 600 and 900mm, the area is hot for most of the year, experiencing temperatures up to 33^0C. It is hilly and soils exhibit poor water retention. The vegetation consists of low bushes and scattered trees that have survived cutting for firewood or making charcoal.

Pinthali lies 27 km from the town of Dhulikhel, the headquarters of Kapvrepalanchok district. To reach Pinthali from Kathmandu is a two-hour drive east followed by thirty minutes steep uphill walk. Before the recent construction of the Banepa-Bardibas highway, which runs through the foothills of Pinthali, it took a whole day to reach the village from Kathmandu. Residents of Pinthali all belong to the Tamang ethnic group.

Table 1 compares some essential features of the two communities. For Pinthali, it is based, as far as possible, on data for the time before the energy intervention. Data for Mbuiru is assumed to be largely unaffected by the intervention to date.

Feature	Mbuiru	Pinthali
Local economy	Subsistence agriculture	Subsistence agriculture
Crops/staple foods	Maize, beans, vegetables	Potatoes, maize, rice, black gram
Livestock	Cattle, goats, sheep, pigs, chickens. Typically 2 large beasts/household	Buffalo (only 2.4% of households sell milk)
Cash-crops	Tobacco	Garlic, dairy produce: milk & ghee
Constraints on agriculture	Irrigation, especially for tobacco & cotton growing. Soil erosion	Irrigation, inhibiting increased cash-crop garlic production. Soil erosion
Off-farm activities & income	Important: A range of activities & forms of employment contribute 72% of annual household income.	Marginal: 'Thanka' painting & labour on the highway supplement farming income by up to 20%
Population	1,800	709
Typical educational attained	Primary level, basic literacy 90%	Primary level, basic literacy 73%
Household composition	Typically, husband, wife, 4 children	Average 6 people per household
Houses	300, 'improved' traditional – no thatch roofs	118, partially improved traditional, 36% thatched roofs
Drinking water quality	River water. Poor quality, seasonal disease risk	River water. Poor quality, seasonal disease risk
Direct road access	Poorly maintained roads impassable in rainy season	None (highway 30 minutes walk away)
Produce market	Kaanwa Market, 2km away: food, tobacco, household goods	Traders come to village to buy garlic. Dairy produce sold at side of highway
Health care provision	2 health centres very poorly equipped within 2km. Hospital with maternity facility 12 km	No village clinic
Administrative centre	Local administration at Kaanwa Market (2km)	District HQ in Dhulikhel, 27 km away
Fuel use	100% of households use fuelwood for cooking. Kerosene lamps for light. (An estimated 90% of energy needs are purchased)	Firewood & agricultural residues as domestic fuel. Wood scarce, long collection times. Kerosene lamps for light
Electricity grid connection	None.	None. Not expected within 50 yrs.

Table 1: Comparison of communities before micro-hydro intervention

Evidently, the two communities have much in common, essentially due to their economic foundation in subsistence agriculture. Pinthali is the smaller and the more isolated from infrastructures - roads, health facilities, markets and administrative centres. Many health problems are a result of poor quality drinking water and health facilities are inadequate in both cases. A lack of irrigation restricts agricultural production. With regard to energy, there is a patent similarity. Both villages are dependent on a combination of biomass for cooking and kerosene for lighting, a pattern they share with many – if not the majority - of rural and peri-urban communities in developing countries.

4 ANALYSIS OF CASE STUDIES

Pursuing the commonality, the MHPs - installed in Pinthali, proposed for Mbuiru - have electrical outputs of 12 and 14 kW respectively. Thus, choosing Livelihood Outcomes as a starting point, it is perhaps not surprising that the two communities prioritised similar aspirations in the case studies, as shown in Table 2.

Mbuiru	Pinthali
Higher income through opportunities to engage in enterprise	Increased economic activities and income, principally via irrigation for production of more cash-crop garlic
Increased well-being via better access to water for domestic & farming uses	Increased well-being from the provision of electricity for households
Enhanced food security via increased production & more affordable (grain) milling	Increased food security (undisputed top priority) via irrigation scheme
More sustainable natural resources via using electricity for productive activities.	Decreased drudgery through spending less time sourcing kerosene and fuelwood, husking rice, milling and expelling oil.
Increased social participation – people have already seen the advantage of organising & working together.	Better infrastructure, particularly road connection to markets, telecommunications & a village health centre.

Table 2: Desired Livelihood Outcomes

4.1 Mbuiru Tungu-Kabiri Project

The impact of the energy intervention in Mbuiru to date has obviously been limited. Results so far indicate that the main benefit is an increase in social capital. In the language of the SL Framework, social capital is composed of, networks and connectedness, membership of more formalised groups, relationships of trust, reciprocity and exchanges. The formation of a Project Management Committee, which has been effective in dealing with government structures and other organisations, has boosted community confidence, promoted mobilisation and increased solidarity of purpose. Through the Committee, finance has been raised from residents of Mbuiru to pay for necessary Government permits to allow installation of the MHP. Women are, for the first time, taking a role in formal decision-making processes. Local government structures, meanwhile, are aware of the project and are responding with increased cooperation and support.

Social capital may be the first asset in the sequence that leads to sustainable livelihoods. In SL terms, social capital can be built by strengthening local institutions – 'the way things are done'. This can be achieved through capacity building, training and creating a democratic environment. In Mbuiru, project partners, ITDG Kenya and the Ministry of Energy's Department of Renewable Energy, appear to have helped enable the creation of a more democratic environment and effective capacity building.

In SL thinking, there is a special relationship between social capital and policies, institutions and processes (PIPs). Social capital can foster institutions and processes within the community that are able to deal with external institutions. Again, to define terms in the language of SL, structures are organisations – public and private – that make and enact policies and legislation and perform a multitude of other functions that affect livelihoods. Processes include the policies and institutions of such organisations, representing both the incentives and constraints that influence choices of Livelihood Strategy. Hence, the relationship between social capital and PIPs may also be viewed such that pro-poor PIPs can produce social capital.

In Mbuiru, in the immediate term at least, the Project Management Committee cannot plan household connections for electricity from the MHP. This is because, under current Kenyan utility law, they are not allowed to sell electricity to a number of households. Ingeniously, the Committee and project partners circumvented this law by obtaining a dispensation to supply their commercial centre as one large 'house'. Though this is not ideal in terms of technical efficiency – people will charge batteries and carry them home to provide lighting – it represents a significant 'institutional victory' for the project. That victory is given much wider significance and import as it is hoped that, as a result of lobbying on behalf of the project and the commitment of the Ministry of Energy, Kenyan law will be changed. This is an example of 'Transforming Policies, Institutions and Policies' to support the diversification of livelihood strategies, an aspiration at the heart of DfID's SL thinking.

4.2 The Pinthali Project

The project in Pinthali has a significantly longer history and is thus more difficult to summarise. Hence, only the major impacts on sustainable livelihoods are presented. The reader is referred to the case study for the full picture. Overall, the acquisition of physical capital, the MHP, has had a positive impact on livelihoods in Pinthali. It was not, however, the use of electrical or motive power that had the greatest effect. Additional irrigation water, a by-product of canal infrastructure to supply the turbine, promoted a significant increase in agricultural production. This boosted financial assets via increased sales of cash-crop garlic. From 649 kgs per annum, community garlic sales have risen to 864 kgs. The proportion of houses selling garlic has grown from 81 to over 90%

Provision of electric light has also had an unforeseen positive impact on financial assets. It has permitted people to spend more time tending livestock. Reportedly as a direct consequence, sales of buffalo milk have risen from 800 to 1,037 litres per household per annum. As with garlic production, the number of households able to produce a surplus for sale has grown from 2.4 to around 12%. A knock-on effect is that people increasingly use money rather than barter as their preferred form of trade. Combined with the availability of electric light, this has allowed village shops to develop, opening for longer hours and stocking a wider range of goods.

Electric lighting has also contributed to building human and social capital. Community and group meetings, as well as cultural events, can take place in the evenings. Hence they are better attended and more effective. Both children and adults, meanwhile, are reported to be benefiting educationally from the opportunity to study and hold evening classes under electric light. Via the formation of a number of 'function groups', including an MHP Group and a Forest Users Group,

community social assets have been further developed. In 2001, the MHP Group registered as a cooperative company in which households are shareholders. The process of building – or rebuilding - natural assets, meanwhile, has commenced with the establishment of a tree nursery and a replanting programme managed by the Forest Users Group.

Overall then, the community's well-being has increased and its vulnerability decreased as a result of using the MHP to develop other physical capital – the irrigation scheme – as well as, to different extents, financial, social, human and natural capital. With respect to 'sequencing', Pinthali manifested significant social capital prior to the installation of the MHP. People had worked for many years, exhibiting remarkable commitment, to bring the MHP about. They engaged in a long struggle for finance and support, learning to deal effectively with the structures and processes of government, NGOs and other organisations. Notably, the community persisted with the Agricultural Development Bank of Nepal, which after years of asking eventually conducted a project feasibility study way back in 1980. Of note also, however, is that the project did not become a reality until a partner development organisation, the Rural Energy Development Program (REDP), began working in Pinthali in 1996.

The area where the project has proved least effective is in identifying productive end-uses for power from the MHP. It was expected that the most significant impact of the intervention would be an increase in community financial assets via the establishment of commercial enterprises. According to the case study, however, the community only utilises around 50% of the available power, mainly for lighting. The principal problem has been in identifying and accessing markets that would encourage productive activities to flourish. The local 'internal' market within the community remains relatively cash poor. Abiding by a tradition of subsistence, people are more inclined to make rather than purchase goods they need. Urban markets, meanwhile, are distant and difficult to access. Moreover, they are served with goods from other sources at prices that are hard to compete with. The single post-hydro entrepreneurial venture in Pinthali, a sawmill making furniture, was unable to sell its produce even at the cost of production. It failed.

Hence, though people have trained in a variety of skills and income generating activities in the course of the project, market opportunities have not been identified. The human capital developed is not tradable: people's newfound skills are inappropriate and unused. REDP and other project partners may have been preoccupied with the technological possibilities of electrical and motive power rather than focussing on markets or building enterprise capability. The need to identify viable productive end-uses for power produced from energy interventions, and thence to provide appropriate training and support, is a critical observation from the Pinthali project.

5 WHAT LESSONS CAN BE LEARNED?

Though the discussion has focused on energy infrastructure interventions, some of the lessons that might be learned have relevance not only for other infrastructure projects, but also for development work generally. The discussion in this final section is divided into three parts, all having an SL focus. The first compares Mbuiru and Pinthali directly, focusing on experience and knowledge that can be shared. Lessons from Pinthali are expected to be able to contribute significantly to project continuation in Mbuiru. The second part looks more generally at what can be gleaned from the case studies regarding the relationship between energy infrastructure and supply and livelihoods. Finally, there is a discussion about the other aspect of the project, the SL Approach and Framework. What was the experience of professionals applying it? What were the benefits revealed and the problems encountered? To restate a note of caution, observations are based on the evidence of just two cases studies. Generalisations must be viewed in this light.

5.1 Pinthali and Mbuiru: diversifying Livelihood Strategies

One lesson from the Pinthali experience may have immediate significance to project development in Mbuiru. It does not necessarily have a link with energy infrastructure, physical capital, but is certainly linked to building human capital and acquiring financial capital. In brief, enterprise development appears unlikely to lead to positive Livelihood Outcomes if it is either technology or 'wish-list' led. Production must be market driven: there needs to be a proven – hopefully predictable and sustaining - demand. Furthermore, business 'sense' is difficult to define and teach. And, given the nature of their internal institutions, development organisations may not be the best structures to provide such support. Enterprise *is* risky and the successful entrepreneur will need good business instincts. Good instincts, however, are based on a thorough understanding of the market. Thus, project partners in Mbuiru may wish to revise the long list of potential enterprises - to be developed from the MHP scheme – presented in the case study. To give an example of some of the questions that should be asked:

- Which of these enterprises has the real potential to increase assets?
- What is the extent and nature of the market for the various products?
- Who are the competitors and who are the potential co-operators?
- What are the PIPs constraints on producing and selling proposed outputs?

A thorough understanding of technical and non-technical issues is required, implying close cooperation between professionals from a range of disciplines. There is a limit to the power available and thus to the number and nature of enterprises. Development will be further limited by market considerations. In brief, using power for pumping drinking water, milling grain and oil expelling do appear to be potentially viable 'enterprises'. Charging batteries, meanwhile, may be an ideal use for surplus energy – while curing tobacco may not. Caution is needed when considering activities such as welding and woodwork shops. They will be likely to require a large proportion of the available power while demand and competition could be more difficult to predict. Other proposed activities also require further scrutiny. What, for example, are the implications of providing power to health centres that cannot afford essential drugs or the fridges to store them in?

Moving on, Pinthali benefited more from the physical capital of the irrigation scheme than from the energy intervention. As it appears in the case study, the irrigation scheme – though planned – was considered almost incidental to the MHP. Energy supply projects can have innovation and 'spin-off effects that have more impact than the core intervention. In Nepal the proliferation of village-level micro-hydro schemes has contributed to the development of a manufacturing industry to the extent that the Pinthali case study states 'virtually all turbines' are now made nationally. When policy and decision-makers consider energy interventions on any scale, therefore, the potential innovation effects should be taken into account.

Mbuiru is planning to install irrigation and water supply schemes, and the community is in the process of seeking funds to develop them. A comparative analysis of the best use of water – a limited natural resource – will be worthwhile, however. Micro-hydropower, irrigation and drinking water supply can be assessed and compared in terms of their potential contribution to building community assets. In this way, proportioning water use could be optimised, diversifying possible Livelihood Strategies. It may be, for example, that building human capital via a reduction of illnesses due to water-borne diseases would have a more beneficial effect in achieving Livelihood Outcomes than having a surplus of unusable electrical power – as is unfortunately the case in Pinthali. In other words, a scheme to provide safe drinking water may have a more positive impact than supplying power. An analysis of 'competing' benefits may serve to redetermine the uses the Tungu-Kabiri hydro plant is put to.

5.2 Energy Infrastructure and Livelihoods: taking nothing for granted

The observation made in the opening section of this review seems to hold true. Though it seems to have a positive impact, significant economic development does not automatically follow from the introduction of energy infrastructure and the provision of energy services. In the language of SL, acquiring physical capital, though it helps, does not necessarily lead to building human, social or other physical capital. In particular, it certainly does not lead directly to building financial capital. Put another way, physical capital does not directly yield viable livelihood strategies. Overall, therefore, there is no guaranteed meaningful impact on the vulnerability context due to increasing physical capital. As the Mbuiru case study picks up, the hydropower plant could, however, be considered as collateral. The study suggests this might be used 'when seeking to access funds for future development projects'.

5.2.1 The nature of energy infrastructure projects

The majority of energy supply infrastructure projects will, almost by definition, be designed for a long operating lifetime. Hence, they will have on-going effects on livelihoods. Furthermore, those effects are likely to vary over time. 'In projects with a technical life of 20-40 years, the technical and institutional conditions around the project will change very much during its lifetime' (Hvelplund & Lund, 1998). Thence, the picture of the energy interventions obtained from the case studies is very much a snapshot. DfID's Guidance notes judge it 'imperative to incorporate a time dimension into any analysis of assets'. The micro-hydro schemes in Pinthali and Mbuiru will have an impact on livelihoods that changes over time and is difficult to predict. The impact on, for example, building financial assets presented in the case studies is unlikely to remain static. The fact that the Pinthali scheme is currently unable to fully utilise energy to generate income does not mean that will always be the case.

It is suggested that business or technical feasibility studies alone are not sufficient when considering long-term energy investments. Such feasibility studies must include both the design of technically feasible interventions *and* an evaluation of the social, economic and environmental costs and benefits. An SL Approach should, therefore, be ideal for performing such studies. Returning to the hypothesis put forward earlier, this indicates that the SL Approach is very relevant to energy infrastructure projects.

The feasibility study for the Pinthali project noted that 'the possibility of the national electricity grid providing electricity within the next 50 years is practically nil.' The study failed to predict the advent of the Banepa-Bardibas highway, however, and the effect this would have on livelihoods. Villagers found work labouring on the highway, sold dairy produce to travellers, and set up kiosks to sell hot food. The highway has had a positive effect on livelihoods, increasing financial assets, but the opposite could have been the case had the unforeseen event been different. Thus, feasibility studies should not only focus on the relationship of local energy infrastructures to the national energy systems of which they are a part, they must also attempt to be cognisant of all long-term developments that are likely to have an impact on the economy of the project area.

5.2.2 Employing energy services

One form of energy is not necessarily substitutable with another. Electricity provided to a rural community – from any source - is unlikely to prove a replacement for fuelwood used in cooking. Even if the power available were virtually unlimited, as with grid connection, generally only better

off households would be able to invest in electric cookers and afford utility charges. With micro-hydro and other local renewable energy schemes, power is usually quite limited. In most situations, therefore, using conventional hotplate cookers to replace fuelwood in all households in a community will be impossible. In Mbuiru, for example, the MHP would have to provide at least 140 kW, ten times the power of the present scheme and surely exceeding the supply capability of the river. These observations notwithstanding, the assumption is too often made in feasibility studies that electrical energy services will reduce the use of fuelwood and hence conserve a natural resource that is typically scarce.

DfID Guidance notes make the point that, 'Just as school buildings do nothing for human capital if they are not brought to life with learning, so new technologies and ideas are redundant if they do not reach people.' In Pinthali a new technology has reached people but the question of how to bring it more to life in order to provide increased livelihood benefits remains unanswered. People have power but the strategies they evolved to make use of it have failed. This is potentially a problem for many such schemes. The core SL concept of building on strengths may provide a solution. If a community's strength is agricultural production, how can they increase the assets they gain from farming when they have surplus power? Could they add value to their produce by using power to process it? Could they use power to provide cold storage that would extend the 'sell by date', effectively extending the season and giving them more control over the selling price?

5.3 The Sustainable Livelihoods Experience

The premise for this section is a quote from DfID's Guidance Notes: 'If putting the ideas it represents into practice calls for adaptation or revision to make the framework more useful, all the better, it becomes a living tool. The following observations from the case studies are intended to contribute to the process of making the framework more useful, particularly – but not exclusively – as it applies to energy infrastructure projects.

5.3.1 Complexity and communication

To quote from the Notes again, 'The livelihoods framework enters an already crowded conceptual and operational landscape for development.' It does indeed. So much so that development professionals themselves are vulnerable to stress from shifting trends in thinking. No sooner, it seems, have they mastered one approach then they are obliged to get their heads round another. Although all professionals must expect developments in their fields, with which they are obliged to keep pace, the point about trends is a serious one. If the SL Approach has something valuable to offer, which as a well developed socio-economic analysis it evidently does, and if it is to survive, it should be as accessible as possible: complexity should be minimised.

Pursuing this point by highlighting specifics, the holistic approach tends to generate a mass of data. The advantage is the potential to develop a full picture of livelihoods, with all their interconnectedness, variation and dynamism. A veritable mountain of data, on the other hand, means that if such a picture is to be derived, a major, time consuming effort is needed to process and analyse it. The Pinthali and Mbuiru case studies, though reasonably focussed, presented a lot of raw data. Though all of it *could* be relevant, the daunting task of analysing it to effect proved a stumbling block in both instances. Difficulties were undoubtedly compounded by the newness of both teams to the approach. Ultimately, insightful analysis of the relationships between energy infrastructure, poverty reduction and the SL Approach is somewhat limited.

One inevitable limit to the Approach is presenting a meaningful picture of livelihoods in a static and linear format - while SL thinking regards the livelihoods context as both dynamic and non-linear.

Considering the elements of complexity, there is an evident need for well structured and presented examples of the use of the SL Framework and Approach to be made available to development professionals, possibly along with some guidance on how to analyse and interpret data. The intention behind this suggestion is not only to encourage and facilitate development professionals to adopt the SL Approach, but also to strive for outputs that are as comparable as possible, the aim being to increase the understanding of livelihoods and ultimately eliminate poverty.

Another element of complexity concerns language. and the need for development professionals working in the field with communities and other organisational partners to be able to communicate their purposes comprehensibly. As has been eloquently pointed out with respect to scientists and engineers, 'anybody who tries to introduce a technology into a society has to start off by getting the language right… There is no point using words like dioxin or ozone in the newspapers if it does not mean anything to the reader (Wolf, 1994). Similarly, without patronising people and partners or diminishing the SL Approach, it may be possible to simplify the language so that concepts can be more readily shared.

5.3.2 Market and alternatives

A lack of market opportunities is patently a stumbling block to building assets in both Pinthali and Mbuiru, exposing what can be assumed to be a common problem for poor communities, particularly isolated rural communities. Three points stand out from the case studies that may serve to clarify why markets are unavailable or inaccessible, and what action might be taken.

(a) Often projects are viewed as either assisting communities to escape static economic development or accelerate development that is moving too slowly. For geographically isolated rural communities, further isolated from the modern commercial world by their subsistence agricultural economies, economic development may not be either static or slow. The process is more likely to be moving 'backwards'. Although this statement is patently not the case for all rural communities in developing countries, it is valid when considering many situations even beyond that context, including in some cases national development. Hence, the starting point may be reversing a trend of decline. One element of this decline for rural communities is that markets have migrated further and further away – not just in terms of distance but also in the nature of the demand. Generally, there is a surplus of what rural communities are able to produce when and where they are able to produce it. Agricultural produce enters seasonal markets when there is a glut and demand is low. Meanwhile, those in need of food are typically those with the least ability to pay. Traditional craft production, similarly, tends to be what too many people turn to as a first option for earning off-farm income – the market is saturated.

(b) Very much related to the previous point, the politics of markets has an undeniable impact on people's livelihoods. DfID's Guidance Notes list as an objective 'equitable access to competitive markets.' They also state that 'A serious commitment to poverty elimination should extend to addressing the underlying political and economic factors that perpetuate it.' Without getting bogged down in a discussion of the merits or otherwise of globalisation or what does or does not constitute free trade, it is difficult to see what – at project level and in the short to medium term – communities and their development partners can do about the dearth of opportunities that result from macro-level political and economic constraints on markets. The road from building physical capital to building financial capital is largely blocked. Transforming PIPS through advocacy is inevitably a long haul. So the immediate imperative is for communities to diversify their livelihood strategies. In this regard, examples of feasible alternatives to markets are required, along with development models that demonstrate the possibility of building on combinations of other assets to achieve Livelihood Outcomes.

(c) A third observation on markets, though again related, applies specifically to the project context. When, as part of a participatory process, people identify the Livelihood Outcomes they aspire to, there is often a mismatch with the resources they have access to, including – if they can be termed a resource – markets. In the case of Mbuiru, as an example, 'higher income through opportunities to engage in enterprise' may not be a realisable Livelihood Outcome. Alternatively, there may be other outcomes that could be more readily achieved and which would have a greater positive impact on livelihoods - using the MHP to pump potable water, improving health and hence human capital, rather than to power woodwork shops in the pursuit of financial capital. The point is that development professionals need to be able to guide communities in matching their assets with viable Livelihood Outcomes that have the maximum positive effect on the Vulnerability Context. To do this, professionals need to be informed about the constraints on people's aspirations, particularly perhaps constraints on markets and building financial capital.

5.3.3 Summary of main lessons:

- Multi-disciplinary project formulation and evaluation is highly desirable
- Feasibility studies should include evaluation of social, economic and environmental costs
- The changing nature of the technological and institutional context must be considered
- Innovation, spin-off and subsidiary effects should be taken into account
- Enterprise development must be market-driven
- Building on strengths is likely to prove a viable approach to enterprise development
- Markets and alternatives to markets need very careful consideration
- Physical capital does not lead directly to increasing other assets
- One form of energy is not necessarily substitutable for another
- Sequencing of asset building is worthy of consideration
- SL Approach and language might be beneficially clarified
- More SL case study examples are required

6 END NOTE

The SL Framework and Approach explicitly acknowledges the constraints discussed. Furthermore, there is recognition that building financial assets cannot be assumed to be people's overriding livelihood priority. This holds true for Pinthali, where food security is the community's priority. Economic sustainability, SL Guidelines state, is achieved when a given level of expenditure can be maintained over time. A suggestion arising from this review is that, recognising these issues, the SL Guidelines could pay more attention to markets and particularly informing development professionals about alternatives to markets.

As an element of self-sufficiency, the core SL concept of 'building on strengths' could be developed to enhance the institution of barter, which persists in most if not all societies but particularly traditional rural communities. This might be achieved by promoting systems of barter credits and the use of what have been called 'trade dollars'. Participatory economics, where well-being is valued above wealth and markets are rejected in favour of communitarian planning (Albert & Hahnel, 1991), is another possibility. Processing produce has been mentioned and project partners may be able to help communities find fair trade organisations who will buy their products in a particular form.

Though ideologically unfashionable, planning, barter and organisations are not incompatible with markets and money; co-existence is, in fact, the norm. Extending the local applicability of such alternatives could, however, have the potential to contribute to achieving sustainable livelihoods for communities - like Pinthali and Mbuiru - afflicted by poverty and with limited access to markets or opportunities to build financial capital. The SL Approach might, then, pay more attention to alternatives alongside, of course, strategies for exploring diverse markets and effective means of advocacy for influencing restrictive structures and processes.

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