

**Pro gradu – Master’s Thesis**

**IMPACT OF MICRO HYDROPOWER (MHP) BASED  
ELECTRIFICATION ON RURAL LIVELIHOODS:  
CASE STUDY NAM MONG IN LUANG PRABANG  
PROVINCE, LAO PDR**

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## TIIVISTELMÄ

YK:n arvioiden mukaan 1,4 miljardia ihmistä elää äärimmäisessä köyhyydessä. Lisäksi noin 2,4 miljardia ihmistä on riippuvaisia perinteisestä biomassasta ruuanlaitto- ja lämmitystarkoituksiin, ja noin 1,6 miljardilla ihmisellä ei ole sähköä. Nykyaikaisia, turvallisia ja edullisia energialähteitä ja -palveluita pidetään yhtenä ratkaisevana tekijänä köyhyyden vähentämisessä. Lisäksi energiapalveluiden välitön ja välillinen vaikutus suurimpaan osaan muista YK:n vuosituhattavoitteista on yleisesti tunnistettu. Näiden palveluiden saatavuus on kuitenkin heikko. Kehitysmaiden hallitukset, kehitysyhteistyön toteuttajat sekä yksityiset yritykset ovat yhä enemmän kiinnostuneita uusiutuvan energian hankkeista. Kuitenkaan suurelta osin nämä hankkeet eivät ole edistäneet kestäväää kehitystä tai parantaneet paikallista elinkeinoa kehitysmaissa. Laosin tämänhetkinen energiasektori on suurien muutosten kohteena. Toistaiseksi Laosin suuresta vesivoimapotentiaalista vain murto-osa on valjastettu vesivoimaksi, mutta maa on sitoutunut tuottamaan sähköä 90 prosentille kansalaisistaan vuoteen 2020 mennessä. Lisäksi Laos on lupautunut tuottamaan sähköä vientiin, lähinnä vastaamaan sen naapurimaiden kuten Thaimaan ja Vietnamin kasvavaan sähköntarpeeseen. Suurelta osin vesivoimasektorin kehitys ei ole vielä käynyt toteen, mutta merkittävä määrä lähinnä suuren mittakaavan vesivoimahankkeita on jo suunnittelu- ja toteutusvaiheessa. Eri puolilta maailmaa saadut negatiiviset kokemukset erityisesti suurista patohankkeista ovat hidastaneet niiden toteuttamista. Mikrovesivoima voidaan muiden uusiutuvan energian lähteiden ohella nähdä kestävämmien energialähteiden kuten suuren mittakaavan vesivoiman vaihtoehtona Laosin paikallisissa energiaratkaisuissa. Tässä Pro Gradu työssä Nam Mongin mikrovesivoimahanketta on käytetty esimerkkitapauksena vaikutuksista paikallisväestön elinkeinoon. Vaikutuksia on arvioitu lähinnä sosiaalisten ja ympäristötekijöiden osalta. Erityisen arvioinnin kohteena olleet sosiaaliset vaikutukset paljastavat monia muutoksia kyläyhteisöjen toiminnassa ja jokapäiväisessä elämässä; elämästä on tullut helpompaa, työtaakat ovat vähentyneet ja sähköistys on tukenut tuloja lisäävää elinkeinon harjoittamista. Lisäksi tiedonsaanti ja -kulku ovat parantuneet sekä kulttuurien tuntemus rikastunut. Toisaalta tulojen lisäys on tapahtunut suurelta osin jo ennestään paremmin toimeentulevilla ryhmillä, ja paikallinen kulttuuri ja tavat ovat alkaneet hävitä ulkopuolisen tiedon lisääntyessä. Ympäristöön kohdistuvat vaikutukset sekä projektien onnistumiseen tai epäonnistumiseen vaikuttavat seikat tuodaan myös esille tulosten tarkastelussa.

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## **ABSTRACT**

According to United Nations 1.6 billion people live in extreme poverty. Around 2.4 billion people rely on traditional biomass for cooking and heating purposes and roughly a quarter of the world's population with 1.6 billion people does not have access to electricity. Access to modern, safe and affordable energy and energy services is considered as one of the attributes having a great potential to reduce poverty. In addition energy is one of the factors that can have an effect on majority if not all of the Millennium Development Goals (MDGs). However this access still remains low. Developing country governments, development community and business experts alike are increasingly moving into renewable energy sector. Although some renewable energy interventions have been able to support the local livelihoods, many have failed to reach sustainable results in the same quest. Laos is currently experiencing many changes especially in its energy sector. The country possesses a huge hydropower potential of which only a small fraction is developed so far. The government of Lao PDR is strongly committed to provide electricity for 90 percent of its citizens by 2020 and to cater also for the growing electricity needs of its neighboring countries, mainly Thailand and Vietnam. Even though majority of the hydropower development has not taken place yet, a remarkable number of mainly large scale hydropower projects are on their way. Worldwide experiences from large scale hydropower developments have shown many possible adverse impacts to the environment and people. The case of Nam Mong is used to examine the local views on mainly the social impacts occurred from the introduction of micro hydropower plant. Many agree that micro hydropower can provide an alternative in electrifying rural areas of Laos, and furthermore through its support to livelihoods of local people, it can have an effect in reducing poverty. The study assesses the environmental and social impacts of the project. The results obtained from the study indicate that many changes have taken place; life has become easier, workloads have decreased and there are more livelihood activities providing income. In addition, access to information and knowledge has improved and cultural life enhanced. However the income increase has mainly taken place in the already better-off groups and cultural traditions and ways have started to disappear. Finally environmental and access changes as well as project success and failure factors were examined.

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## ACRONYMS

ADB	Asian development bank
AIT	Asian institute of technology
DAC	Development assistance committee
DOE	Department of electricity
EdL	Electricité du Laos
EIA	Environmental impact assessment
GEF	Global environment facility
IR	International Rivers
Lao PDR	The Lao People's Democratic Republic
LDC	Least developed countries
MDGs	Millennium development goals
MEM	Ministry of energy and mines
MRC	Mekong river commission
NEF	New energy foundation
NGO	Nongovernmental organization
NGPES	National Growth and Poverty Eradication Strategy
ODA	Official development assistance
SIA	Social impact assessment
SLA	Sustainable livelihoods approach
STEA	Science, Technology and Environment Agency, Government of Lao PDR
SWAp	Sector wide approach
UN	United Nations
UNDP	United Nations Development Programme

## **1 INTRODUCTION**

There are currently around 1.4 billion people living in extreme poverty. Furthermore it is counted that altogether around 3 billion people are either undernourished or live in constant hunger. The United Nations' have set a target to end this extreme poverty by 2015 in their Millennium Development Goals (MDGs). The MDGs consist of 8 thematic areas: poverty reduction, improving access to universal education, gender equity, improving maternal and child health, combating HIV/AIDS, achieving environmental sustainability and forming global partnerships. Access to modern, safe and affordable energy and energy services is one of the attributes having a great potential to reduce poverty. In addition energy is one of the factors that can have an effect on majority if not all of the MDGs (UN 2009).

There has been a growing concern in international, regional, national and local forums on the possible effects of climate change and global warming. A clear message is that greenhouse gas emissions are increasing the average temperatures on the globe and this will have various effects to communities all around the world. Renewable energy has been seen as an alternative to combating energy derived greenhouse gas emissions and hence providing an alternative or even replacing fossil fuels in the (near) future.

Sustainable renewable energy solutions are very much discussed topic both in the developed and developing countries. Development assistance hot topic seems to be now providing electricity to rural poor and hence give these people access to poverty reduction means.

Laos is one of the Least Developed Countries (LDC) in South East Asia aiming to graduate from its status by 2020 with the help of its huge underdeveloped water resources. Laos is currently planning to harness its water resources into hydro electricity production mainly by large scale facilities. The country is also committed to electrify 90 percent of its households by 2020 mainly through national grid extension and decentralized options for remote areas. However there are many social, environmental and economic impacts involved (MEM 2009).

This Master's thesis is looking into the recent developments in Laos and studies the Nam Mong micro hydropower site as a case to examine whether decentralized small scale electrification has succeeded in providing improved and diversified livelihoods for seven villages in the vicinity of Nam Mong River.

## **2 BACKGROUND**

### **2.1 International development assistance**

#### **2.1.1 Overview**

International development assistance (also referred to development cooperation or aid) is a process where many actors are involved, each with their own interests, motives, goals and strategies. Throughout the history of modern era of aid (since the end of the Second World War until to date) its structure has changed and evolved due to competing schools and opinions on most prominent development theories at the prevailing conditions in certain times. Undoubtedly development assistance has become a permanent part of international interaction and its importance to many countries in the third world is still remarkable.

Although development assistance has been recently more inclined towards budget support, sector wide approaches (SWAp) and debt relief the traditional project funding has still retained its place as one of the important channels in delivering development assistance (Martinussen 1999, Degnbol-Martinussen & Engberg-Pedersen 2003, Kingsbury et al. 2005, Koponen et al. 2007).

Development goals for aid are mainly economic, political, environmental or social goals and very often the following are considered essential: inclusive and good governance, sense of ownership, participation and representation of all people, transparency and accountability, gender equality, human rights and freedom, democratization and representative and participative political processes, strengthening of civil society and institutional capacities, human development, growth, independence and structural change, social justice etc.. Millennium development goals set by the United Nations (UN) highlight the battle against extreme poverty, which has become the very center of development aid agenda for donors and actors (Sen 1999, Martinussen 1999, Degnbol-Martinussen & Engberg-Pedersen 2003, Hall & Midgley 2004, Kingsbury et al. 2005).

### **2.1.2 On the way to poverty reduction and strengthened livelihoods: sustainability and aid effectiveness**

It has been suggested by many that much of the development process to date has been inadequate. Whereas the development trends have changed, the lives of many poor have remained much the same. This view is supported by many other scholars and experts in the development field. This carries a notion that not all development has failed but in terms of poverty reduction, emphasized by many at the very centre of development aid, much more could have been done. Only in a few cases the projects have delivered and transferred the skills and knowledge with appropriate technology suitable for the local conditions (Degnbol-Martinussen & Engberg-Pedersen 2003, Kingsbury et al. 2005, Koponen et al. 2007).

Many scholars agree poverty reduction as the core of development aid. For instance Kingsbury et al. (2005) define development's role to eradicate poverty and creation of means to keep it away, thereby achieving better and strengthened livelihoods for all. Furthermore emphasis on development should be towards "what people want it to be" instead of an expert's idea on development. However development often is about power and the poor have usually little or no power in setting their own goals and mobilizing necessary resources to achieve them. Many donors also, besides the humanitarian reasons, enhance their own economic and political interests through own exports and services or try to influence the economic or political development in the recipient countries favorable for their (donors) own activities (Degnbol-Martinussen & Engberg-Pedersen 2003, Hall & Midgley 2004, Kingsbury et al. 2005).

Project Aid has been criticized by many for its limitations in time and space, especially in achieving results and creating sustainability. It has been noted on many occasions that achievements made in development projects have mainly contributed to short term results and effectiveness and not on long term sustainable changes and impacts. Aid policies have also frequently targeted spending of aid money in the donor country on goods and services that usually have short lifespan in the developing country and are unable to be sustained once the donor has left (Degnbol-Martinussen & Engberg-Pedersen 2003, Kingsbury et al. 2005, Koponen et al. 2007).

The role of the recipient country governments and governance has had its share of criticism in the failure of development aid to reach its real recipients. On various occasions low



recipient government capacity and high corruption has led to aid money aimed at development ending up in “wrong pockets”. Often teamed up with donors’ lack of understanding of the recipient country conditions or aid planned to address on donor’s needs and priorities instead of the recipients, the projects have turned out as failures, the “white elephants” (Degnbol-Martinussen & Engberg-Pedersen 2003, Kingsbury et al. 2005).

The inability of individual Nongovernmental organizations (NGOs) has been documented by many e.g. Degnbol-Martinussen & Engberg-Pedersen (2003) doubt NGOs achievements to generate any notable influence on either socio-economic processes or on the political system’s and state’s general policy, because of the smallness and scattered nature of actions. One of the weaknesses of international agencies has also been “off-the-shelf” format with one size or policy program suggested to fit all (Kingsbury et al. 2005).

Long term sustainable impact is desired by many donors and actors in the field. According to Degnbol-Martinussen & Engberg-Pedersen (2003) however there are very little well researched studies on impact of development assistance, especially concerning impacts at local level.

At the Paris Declaration organized by the Development Assistance Committee (DAC), endorsed on 2 March 2005, over one hundred aid giving countries and agencies agreed upon improving the quality of aid and its impact on development with 56 partnership commitments organized around five key principles that are presented in Table 1: “ownership, alignment, harmonization, managing for results, and mutual accountability”. The principles highlight how the developing countries themselves should determine their own development strategies in which the donor countries align and coordinate their actions and together the donor and the developing countries would mutually take responsibility in reaching goals and being accountable of these results. However the monitoring report (DAC 2008) shows that whereas some countries and areas have witnessed progress and change, many remain at levels of little or no improvement at all (OECD 2005, OECD 2008).

Table 1. The principles of Paris declaration (direct quote from DAC, OECD 2005)

Ownership	Developing countries set their own development strategies, improve their institutions and tackle corruption
Alignment	Donor countries bring their support in line with these objectives and use local systems
Harmonization	Donor countries coordinate their action, simplify procedures and share information to avoid duplication
Managing for results	Developing countries and donors focus on producing and measuring results
Mutual accountability	Donors and developing country partners are accountable for development results

According to Carley & Christie (2000) much technology transfer from the high-to-low income countries in the form of aid and technical assistance (TA) has been largely inappropriate up to date. Furthermore considering the above mentioned in factors in Table 1 e.g. mega-projects like dams and highways favored by donors, financial agencies and elites of many low income countries have used up the resources that could have been placed on more productive and sustainable development schemes (Carley & Christie 2000).

Grenier (1998) and Carley & Christie (2000) have examined projects at the local level and identified some essential characteristics that generally increase long term sustainability of development interventions. As Table 2 demonstrates suitability to local circumstances and meeting efficiently the needs of people affected by sustainable ways is essential. Furthermore when these are coupled with an easily operable, locally suitable and affordable solution that generates income, mitigates risks and reduces labor the sustainability of certain intervention increases (Carley & Christie 2000).

Table 2. Common features increasing project sustainability at the local level (Grenier 1998, Carley & Christie 2000)

<ul style="list-style-type: none"> <li>• Suitability to local physical environment and conditions in an environmentally sound fashion</li> <li>• Reducing risk</li> <li>• Productive use of resources(local)</li> <li>• Providing acceptable economic returns</li> <li>• Utilizing local skills, tools, and materials (spare parts, fuels, or ingredients)</li> <li>• Efficiency</li> <li>• Assessments of technology and impacts</li> <li>• Producing visible results within a sensible timescale</li> <li>• Fitting into, minimizing disturbance to, or modifying (rather than replacing) existing practices</li> <li>• Affecting all different groups equitably</li> <li>• Cultural appropriateness that does not challenge or contradict with existing fundamental cultural beliefs and takes into consideration local preferences</li> </ul>	<ul style="list-style-type: none"> <li>• Addressing the identified problems and constraints</li> <li>• Meeting multiple needs</li> <li>• Generating income, sustainable wealth creation</li> <li>• Affordability</li> <li>• Saving labor</li> <li>• Easily understandable</li> <li>• involvement of local people in problem analysis and problem devising</li> <li>• Maintainable by local people or organizations involved</li> <li>• Fitting existing systems of ownership, obligation, and authority</li> <li>• Support by trusted sources</li> </ul>
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## 2.2 Assessing impacts: Social Impact Assessment (SIA) as a part of Environmental Impact Assessment (EIA) or as a separate entity

To introduce the idea of social impact assessments it is necessary to define what it entails. An international definition by the International Association of Impact assessment on SIA principles is the following:

*“ Social Impact Assessment includes the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions. Its primary purpose is to bring about a more sustainable and equitable biophysical and human environment.”* (Vanclay 2003).

According to Barrow (2000) from 1950s onwards it was increasingly seen that assisting developing countries had lead to failure in many cases; often the interventions had created “unexpected” impacts on the communities at stake and the adverse effects had made the conditions even worse than prior to intervention (e.g. numerous large scale dam projects). Many also did not see its importance in poverty assessments and linkages to e.g. health, life expectancy. However despite the history many involved in the developing field today

have realized the important function SIA has in “reducing development failures and of improving the benefits and sustainability of successes” (Barrow 2000, Becker et al. 2003).

Social impact assessments had their origin as an additional socio-economic component to the environmental impact assessment, but have been evolved ever since considerably both in the developed and the developing countries. Although there is a clear distinction between the two, practitioners see them often as overlapping procedures and completing each other in the quest for achieving sustainable development interventions (Barrow 2000, Becker et al. 2003, Benson & Twigg 2004).

Integration of SIAs to EIAs (Environmental Impact Assessments), HIAs (Health Impact Assessments) and other impact assessments is increasingly becoming more common. SIAs can be executed throughout many different policy and project cycle stages from the planning to post implementation evaluations. SIA theory acknowledges that socio-economic and biophysical impacts are interlinked and therefore a change in one can lead to changes in others, thereby direct impacts of one may cause indirect (or direct) impacts in another (Barrow 2000, Becker et al. 2003, Benson & Twigg 2004, Vanclay 2005).

The assessment itself is a method, largely dependent on the person using it. SIA is used in finding out probable impacts of certain change to the community concerned on ex-ante (advance predictions) or ex-post (after evaluation) basis. It is not a single method but can consist of a pool of different qualitative and quantitative approaches or tools from surveys, interviews, oral histories, group exercises to national statistics, maps, existing documentations, census data and other possible sources. Ex-post evaluations have been found especially essential in finding out experiences and reasons why certain impacts do take place in the community and for gathering knowledge from past interventions on what needs to be done in the following interventions to achieve sustainable results. SIAs should focus on the most important social impacts with clearly set out research objectives and make the knowledge readable for both policy makers and citizens alike (Barrow 2000, Becker et al. 2003, Benson & Twigg 2004).

## **2.3 Millennium Development Goals (MDGs) and energy**

### **2.3.1 Overview**

Energy is widely recognized as vital part of development leading to improved social and economic well-being, and is prerequisite for industrial and commercial wealth generation. However many areas in the world have no reliable energy services in place: worldwide around 2.4 billion people rely on traditional biomass for cooking and heating purposes and roughly a quarter of the world’s population with 1.6 billion people does not have access to electricity in their homes. Some estimates indicate that energy use will double in developing countries in the next 20 years and additionally for the MDG poverty-reduction target to be met, modern energy services need to be provided to an additional 700 million people by 2015 (IEA 2003, UNDP 2004b). According to UN-Energy the existing energy divide “entrenches poverty, constrains the delivery of social services, limits opportunities for women, and erodes environmental sustainability at the local, national, and global levels”. Therefore it is essential to provide adequate and reliable energy services at an affordable cost, in a secure and environmentally benign manner and in conformity with social and economic development needs (Vera 2005).

In 2000 a list of human development objectives, the Millennium Development Goals (MDGs), were adopted at an international level to be achieved by 2015. Although energy is not explicitly mentioned in the 8 specific goals presented it is widely recognized that

access to clean and affordable energy is a precondition to achieving sustainable development, poverty reduction, raising living standards and improving human welfare (UNDP 2004b). Energy as such is not an end itself but energy and energy services can support in the provision of basic needs and creating productive activities that may have direct and indirect impacts to e.g. income generation, health, education and gender equity (Cabraal et al 2005).

Conventional energy systems are often out of reach for people in remote areas, and sometimes too expensive for the poorest to afford. According to UNDP there are currently 1.3 billion people worldwide living on less than \$1 per day. Out of this amount around 800 million reside in rural areas. This means roughly that four out of five of these rural poor in the developing world live without electricity (UNDP 2004b).

Most poor countries have abundant renewable resources and lately increasing number of developing country governments has seen the importance of renewable energy technologies in achieving MDGs. However, so far only a few developing countries have adopted policies needed to advance development of renewable energy technologies. Many international donor assisted renewable energy projects in developing countries have though demonstrated that renewable energy only when implemented in a sound manner can contribute to poverty alleviation and securing independent energy supply systems (UNDP 2004b, 2005).

The most important factors in providing energy to fight poverty are: physical access to modern energy services; affordability of such services; and the chance to select the most cost-effective and environmentally sustainable resource and technological solution to a specific energy need (UNDP 2005).

Renewable energy if implemented successfully can bring benefits in economic, social, health and environmental terms. From Table 3 it can be seen that renewable energy can e.g. expand work opportunities and working time, create income, reduce labor, promote education, improve health conditions and preserve available natural resources etc.

Table 3. Renewable energy benefits in economic, social, health and environmental terms (GEF 2001)

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<b>Economic</b>	longer working hours for income-generating activities. expanded work opportunities through productive uses of energy water pumping, cooling, mills, sewing machines, ice-making equipment etc., savings from other fuels
<b>Social</b>	Lighting allowing children to study in the evening, lessening time consumed to fuel collection(e.g. firewood) especially for women and children, more time for household chores, better communication systems, reduced isolation of rural villages and villagers, enhanced community social life(TV, Radio, Karaoke set etc.) and safety.
<b>Health.</b>	Improved health by reduced physical stress from fuel collection, diminished indoor and outdoor pollution, refrigeration for medicines and food etc.
<b>Environmental.</b>	discouraging destruction of natural areas for fuel wood, reduced local air and water and soil pollution due to fuel switching

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### 2.3.2 Reasons for renewable energy project failure

The role of energy in poverty reduction has become increasingly important for the developing countries. Access to adequate, affordable, reliable, good quality, safe and environmentally benign energy services is fundamental to human activities, development, and economic growth. This access, however, still remains low.

Today many actors such as development community, developing country governments and business experts alike are with increasing interest moving into renewable energy projects (GEF 2001, UNDP 2000, 2004a, b). According to UNDP (2004a, b) energy portfolios have grown at a remarkable rate in the recent years.

According to The Global Network on Energy for Sustainable Development (GNESD) many developing countries possess a huge potential of untapped resources for the development of Renewable Energy Technologies (RETs). Moreover some countries are already experienced with RETs. However until now the outcomes of the implemented projects have been largely unsuccessful (GNESD 2006). Many have criticized that renewable energy projects and programs have often failed to create long-term impacts such as better livelihoods and increased well being or sustainable energy services, thus it could be speculated whether energy has had any major impacts so far in reducing poverty (World Bank & Winrock International 2003, UNDP 2004a, b, GNESD 2006, 2007, Urmee et al. 2008, 2009). Literature review on the reasons for failure presents various vital findings.

Urmee et al. (2009) argues that program limiting factors are lack of adequate government policy and funding support, lack of involvement of local communities in program design, lack of in-house technical know-how and lack of availability of components and spare parts available proximate to users. In addition simultaneous gains have not been achieved due to 1) nature of projects been fragmented research and development efforts executed in isolation from other development challenges such as health, poverty, education or regional development and 2) without the guidance of integrated program and policies (GNESD 2006). The lack of coherent policies has led to a lack of coordination between stakeholders and has not been beneficial to efficient development efforts.

Most projects have been heavily subsidized or donor sponsored largely ad hoc type interventions performing well as long as the financial support lasts. In addition, many of the projects have had initial costs far beyond the ability of the poor individuals and communities to purchase and maintain them (GNESD 2006). Urmee et al. (2008) suggest also that there is a need for better national level coordination between institutions engaged in the development and implementation of these programs.

Program objectives have been generally defined in very broad and administrative terms rather than descriptive on outcomes to the system users. This tendency has weakened the ability to make meaningful assessments on socio-economic impacts in qualitative terms rather than measuring strictly quantifiable output in determining process success. Therefore on many occasions there has been a mismatch between what is provided and what is actually required. In other words these shallow assessments have failed to measure impacts from energy services and include the needs and desires of the actual end users to the implemented projects and programs (World Bank & Winrock International 2003, GNESD 2006, 2007, Urmee et al. 2008, 2009).

Whereas “one size fits all” energy strategies should be avoided, guidelines and best practices should be used when available. However a study conducted by Urmee & Harris in 2009 reports that best practice program guidelines are frequently ignored by implementers even when being aware of the existence of such. In the same study implementers saw adequate funding support and appropriate financing mechanisms as most critical success factors, whereas maintenance and monitoring were seen important. Yet it was also discovered that training for both the technicians and system users was a common procedure in a minority of cases studied (UNDP 2004a, b, Urmee & Harris 2009). Finally the study implies the majority of the programs are failing to result in increased employment or household income.

Urmee & Harris, 2009 state that program success could be enhanced in many cases by following best practice guidelines, defining specified program objectives in terms of outcomes to users, ensuring availability of adequate funding and policy support and by guaranteeing that program implementers have adequate training in program management (Urmee & Harris 2009).

According to various studies development has to be appropriate to local conditions and needs quickly to begin to increase income thus empowering users to take charge of their own development. What is desired is an enabling environment with a clear focus on the development of appropriate technologies “as part of a holistic approach to development” (GNESD 2006).

## **2.4 Lao PDR/ Laos**

### **2.4.1 General Information**

The Lao People’s Democratic Republic (Lao PDR), also referred to Laos, is located in at the centre of Indochina Peninsula in Southeast Asia. It is a small landlocked country bordering China in the north, Myanmar in the north-west, Vietnam in the east, Thailand in the west and Cambodia in the south. It has a total area of 236,800 km<sup>2</sup> and a population estimated at 6.7 million people in 2008 (CIA) with a growth rate of 2.3 percent annually. It is one of the few remaining one party (Lao People's Revolutionary Party [LPRP]) Communist states, and the majority (80 percent) of the population relies on agriculture for livelihood contributing to nearly 40 percent of GDP by sector (Stuart-Fox 2001, Maunsell 2004).

Laos is divided into 16 provinces, and two specific areas (Vientiane Prefecture and Saysomboun Special Zone), 141 districts and more than eleven thousand villages (UNDP 2001). The country is characterized by a rich cultural and ethnic diversity with more than 230 ethnic groups from four ethno-linguistic families: Tai-Kadai, Mon-Khmer, Hmong-Mien, and Tibeto-Burmese. These, in turn, all have branches and sub-groups equaling to nearly 70 percent of the total population (UNDP, 2001). Another commonly used categorization is done into three main ethnic groups: the Lao Loum/Lum (lowland), 68 %, the Lao Theung/Thoeng (low mountains), 22 % (Khamu 11 %), and Lao Sung (high mountains), 10% (Stuart-Fox 2001, Maunsell 2004).



Figure 1. Country map of the Lao PDR (ADB 2006b)

The majority of the Lao population lives in rural areas. Nearly 40 percent of the rural population equating around 2 million in 2000 (UNDP 2001) have been estimated to live in poverty. This accounts to about 300,000 households in 6,300 villages, with a vast majority of ethnic minorities, depending on subsistence level agriculture and livestock raising. Furthermore, many citizens depend on barter trade to generate income: collecting and

selling various non-timber products and wildlife from the forests, selling livestock products, hiring out family labor to nearby richer farms, selling vegetables, handicrafts and other goods. Rural villages are usually small in size (between 50 and 200 inhabitants), scattered and often difficult to reach leading times to cultural and geographical isolation (UNDP 2001).

Majority of the rural population lacks access to safe drinking water, adequate sanitation and hygiene, and medical services. Despite recent improvements in e.g. road construction and maintenance, construction of schools, free health clinics and small water reservoirs, maintenance and development of small scale irrigation systems, electricity supply, etc., many of the rural areas still remain poor in terms of productive agriculture and developed infrastructure (UNDP 2001).

The population density is 23 people per square kilometer and around 80 percent of the population live in rural areas. The adult literacy rate in 2007 was 73 % and life expectancy at birth on average 64 years (World Bank 2009).

The major cities are Vientiane, the capital, Savannakhet, Pakse and Luang Prabang. Buddhism is the dominant religion with vast majority of the population as believers and the official language is Lao (Stuart-Fox 2001).

#### **2.4.2 Natural resources and climate**

Laos is densely forested with a total forest area of 11.17Mha (million hectares) equaling to 47 percent of total land area in 2006. Forest resources are important in terms of foreign exchange as well as income generation, providing construction material, fuel wood, and other non-timber products for the people of Lao PDR. Over the past two decades forest areas have been decreasing due to shifting cultivation practices (traditional "slash and burn"), poorly planned logging activities, and forest fires leading to soil erosion and environmental degradation (ADB 2006 a, b). The country is rich of mineral resources such as gold, copper, ferrum, limestone, gypsum, lead and tin, which have been largely unexploited due to a lack of resources for development and limited infrastructure to access the resources. Lao PDR is also known for its abundant water resources due to large river network; Mekong and its tributaries flow from north to south producing an annual runoff discharge into the sea of around 240,000 million cubic meters. The tributaries of Mekong in Laos contribute to 35 per cent of the total inflow to Mekong (ADB 2006 a, b, MEM 2009). More than two-thirds of the country is mountainous rugged terrain in the north, south and east reaching up to a maximum elevation of 2820 meters above sea level at Phou Bia (Bia Mountain) in Xiengkhouang province. The lowest elevation points locate in the central plains and plateaus along the Mekong river. The mountainous terrain, combined with the existing river network, provides a large hydroelectric power generation potential, of which only a fraction is developed. Development of these resources can contribute positively to livelihoods by supplying electricity to households, offices, hospitals and schools in the mountainous areas (ADB 2006a, b, Vongsiry et al. 2002). The most important rivers in terms of government's development objectives are Nam Tha, Nam Beng, Nam Ou, Nam Souang, Nam Khane, Nam Houng, Nam Nam Ngum, Nam Ngiep, Nam San, Nam Theun, Nam Hinboun, Se Bang Fai, Se Bang Hieng, Se Bang Nouane, Sedone and Sekong (ADB 2006b).

A tropical monsoon climate with rainy season from May to November and dry season from December to April form the average annual rainfall at 1651mm (in the year 2000) of which 75 to 90% occurs during the wet season. The average temperature is 26° Celsius (e.g. Vongsiry et al. 2002, ADB 2006a, b, CIA 2009).



### **2.4.3 Socio-economic development**

According to UNDP's Human Development Index (2008) Laos is one of the Least Developed Countries (LDC) with a rank 133 out of the total 177 and one of the poorest nations in Southeast Asia. Gross domestic product (GDP) per capita is around 500 USD (MEM 2009) or 606 USD (ADB 2007), and national poverty rate in 2003 was 33 percent of the total population. Agriculture is still the main sector in Lao national economy followed by industry and services (ADB 2006b). Lao PDR is a recipient of about US\$ 200 million annually in international grant support, targeted largely at social and environmental projects designed to alleviate poverty in the country. There is though a commitment to lessen the dependency on official development assistance (ODA) gradually mainly by creating a base for countrywide growth and also through foreign investments yielding to budget revenues (MEM 2009).

From the mid 1970's to 2000 the socio-economic development of Laos improved remarkably, partly due to government's economic policy on shifting away from the centrally planned to liberalized market oriented economic system referred as the New Economic Mechanism (NEM) in 1986 (Stuart-Fox 2001).

In the recent decades economic performance of Lao PDR has continued to improve, mainly due to foreign investment inflows in mining and hydropower, growing mineral exports as well as the sustained growth of agriculture, manufacturing and services sector (ADB 2006b, World Bank 2007).

Lao economy has been projected to grow annually at 6-7 percent rate, however without the income from foreign investment flows the real growth has been around 4-5 percent. Since Asian financial crisis the Gross domestic product has been growing at 4 to 7 percent annually, and it is estimated that this rate remains likely similar for the coming years (World Bank 2007).

According to ADB economic and social prospects of Lao PDR are good due to significant potential of hydropower development, mining, tourism, commercial agriculture, transit trade, regional employment and small and medium-sized enterprise (SME) development. Furthermore the national goal of graduating from the least developed country status by 2020 is seen possible if economic growth is managed in a sustainable and inclusive manner (ADB 2006a, UNDP 2001).

### **2.4.4 Energy overview**

Energy situation in Lao PDR is best described by very low conventional energy consumption. The energy usage within the country is still heavily dependent on the use of fuel wood, accounting to around 90 percent of the total energy requirements, whereas charcoal and hydropower generated electricity account mainly for the remaining consumption. In addition, Lao PDR imports refined petroleum products from the neighboring countries. Despite the current situation, the country does have a potential of utilizing several renewable energy resources such as solar, biomass, hydro and wind power. Harnessing these resources is likely to become of importance in improving the quality of life of the Lao people, especially in rural villages, that are unlikely to have access to a conventional electricity supply in the near future (STEAM & AIT 2002).

Lao PDR has significant energy potential especially in terms of hydropower and biomass resources. The location of the country in the interception of monsoons from two directions: from the Gulf of Thailand and from the Gulf of Tonkin, witnesses considerably high precipitation and due to its terrain is favorable for hydropower development. This

opportunity would not only cater the domestic electrification needs but also enables exportation of electricity to the rapidly growing economies in the region, such as Thailand, where the demand has been steadily increasing (MEM 2009).

The estimated theoretical hydropower potential excluding mainstream Mekong hydropower development is 26,500 MW with 18,000 MW actually being technically achievable. Usable hydropower capacity including a share (8000MW) of mainstream Mekong hydropower development has been estimated to 23,000 MW in previous estimates (in 1970s, mid 1980s). In 2007 the Lao Government committed to supply 7,000MW to Thailand, 5,000MW to Vietnam and 1,500MW to Cambodia by 2015. In 2008 the Government of Lao PDR (GoL) expressed their interest in having an installed capacity of up to 30,000 MW including mainstream Mekong hydropower development by 2020. This ambitious goal is coupled by a goal of Government of Lao PDR to electrify 90 percent of the country by the year 2020 with an intermediate goal of 70 percent by the year 2010 and 80 percent by the year 2015. Plans have been made so far from over 70 hydropower (existing, under construction and planned) developments presented in Figures 2 and 3, and together with the large and medium scale developments there is also an emphasis on small scale solutions for rural electrification. The Government plans to expand electrification in the country through two methods: expansion of the grid to easily accessible areas and provision of off-grid supplies to remote areas due to environmental or cost reasons (EdL 2004, GoL 2004, Vientiane Times 2008, MEM 2009).

According to National Growth and Poverty Eradication Strategy (NGPES) Lao PDR has one of the lowest electrification rates in Asia with around 60 percent (2008 GoL) of the population having access to electricity. Out of the enormous hydropower potential only a small fraction has been developed so far with around 670 MW originating from 11 large and 40 medium-sized hydropower plants. This equals to less than 2 percent of the exploitable potential and nearly 90 percent of the generation is exported to neighboring countries, mainly to Thailand (STEА & AIT 2002, UNDP 2006a,b, MEM 2009). At present Hydropower contributes to 99.87% of total electricity production (MEM 2009).

The development of the country's Hydropower potential has been seen to play an important role in achieving sustainable social and economic development objectives of the country. Hydropower without doubt offers extensive benefits for the country; it is already a major contributor to economic output, government revenues, and export earnings. Furthermore the role of hydropower is highlighted in the national poverty reduction efforts and it is said that increased accessibility to electricity in rural areas will improve living standards and help reduce poverty, and thus is integral to the national development framework (E.g. STEА & AIT 2002, EdL 2004, GoL 2004, MEM 2009).

#### **2.4.5 Becoming the battery of Asia**

In October 2007 the Government of Lao PDR announced its efforts of becoming the battery of Southeast Asia by supplying electricity not only to Thailand, but also to China, Cambodia and Vietnam (Vientiane Times 2007). According to International Rivers (IR) at least six under construction and nearly 15 planned large dam developments are underway currently mainly for electricity export purposes (IR 2008). The current and exponential future hydropower developments are shown in the Figures 2 & 3. The dotted areas with black represent the already existing dams, while the green and red dots correspond to under construction and planned dam developments, respectively.

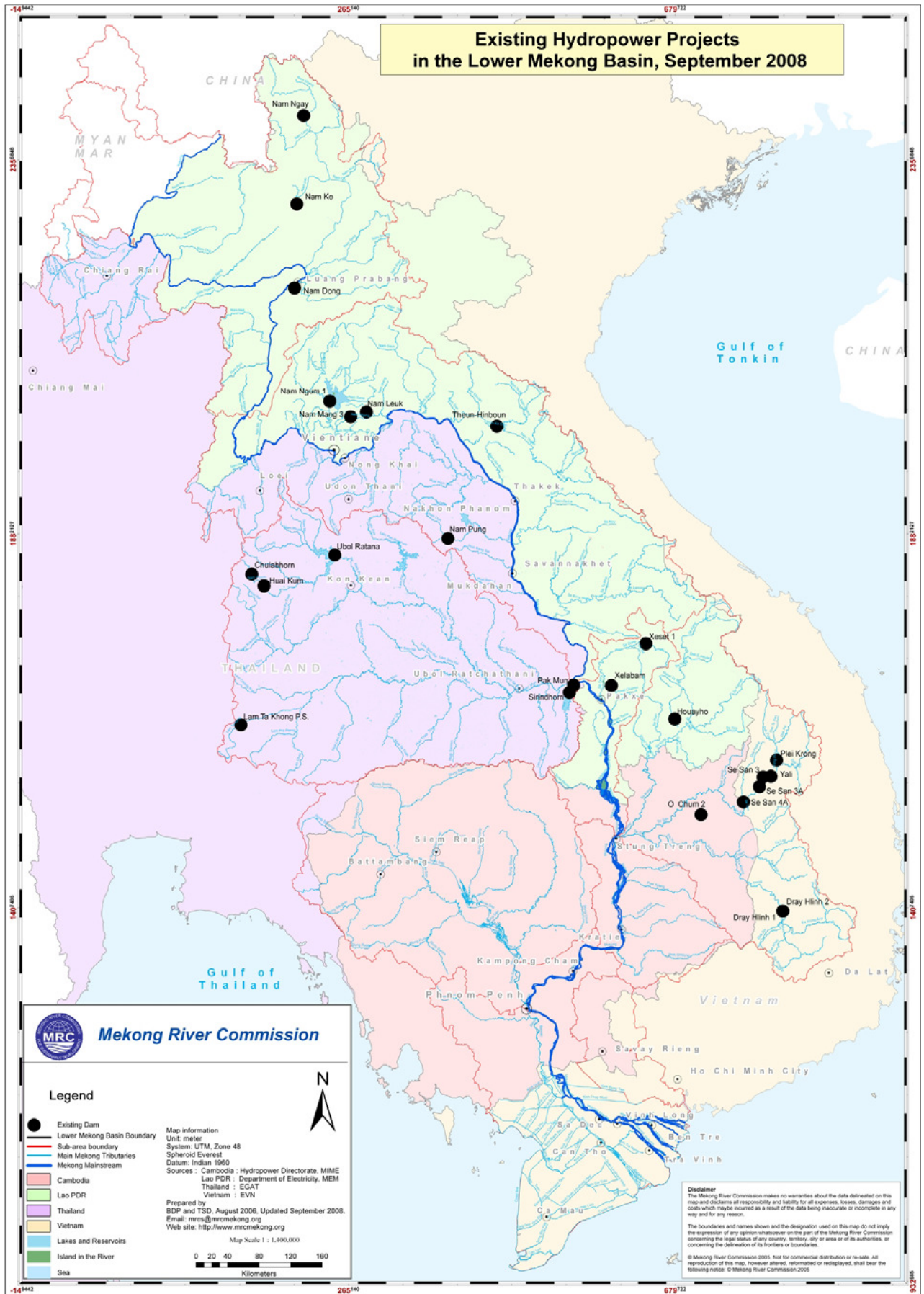


Figure 2. The existing large hydropower projects in the Lower Mekong Basin (MRC 2008)

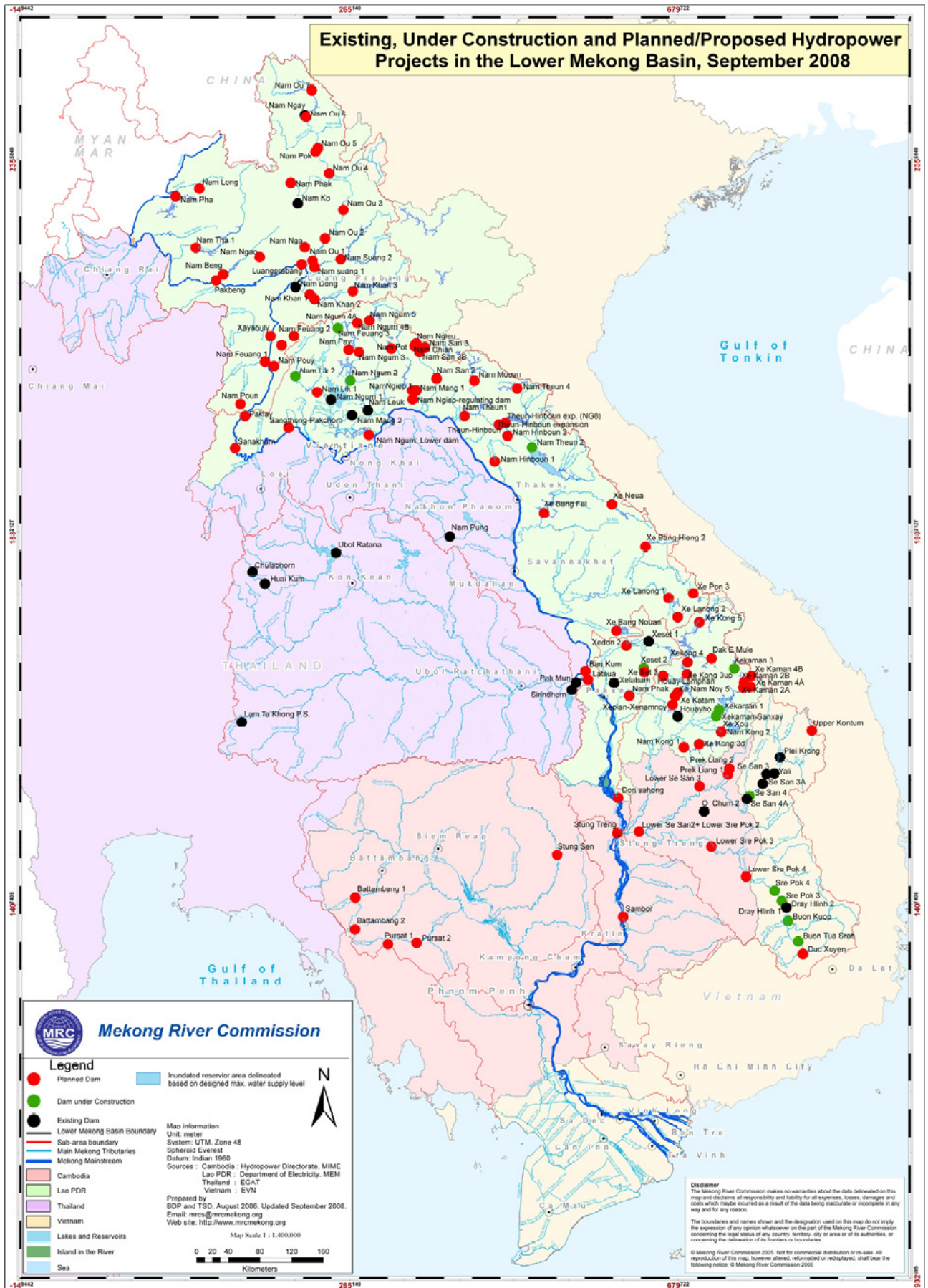


Figure 3 Existing, under construction and planned (large) hydropower projects in Lower Mekong Basin (MRC 2009)

Hydropower developments are mainly justified by economic revenues involved with the electricity export and the social impact it can have to the society and people through increased incomes and poverty reduction. Government of Lao PDR sees this hydropower development very important to the country's development and poverty reduction efforts (GoL 2004). The recent boom in the development of mainly medium to large scale hydropower plants has been backed by the multilateral development banks primarily Asian Development Bank (ADB) and the World Bank (WB) as well as in the institutional level by the intergovernmental, country-driven river basin organization Mekong River Commission (MRC). The main push however has come from private investors mainly from Thailand, China, Russia, Vietnam and Malaysia who have been driving this expansion due to increasing electricity demand from neighboring countries. In addition, the enthusiasm of the Government of Lao PDR in driving the rapid electrification goal of the country has enabled the give out of hydropower concessions to any interested developer on a "first come, first served" basis with little emphasis on the reputation of the company or actual social and environmental costs involved (IR 2008, Molle et al. 2009).

According to International Rivers (IR) in a country with "low government capacity to monitor the impacts of dam projects, where freedoms are restricted, transparency is low, and corruption is high" this exponential increase in development of high risk hydro projects is at least troublesome. It is estimated that hundreds of thousands of Lao villagers will suffer from significant impacts imposed on rural livelihoods, fisheries and land and other resources by large dam development. These include e.g. resettlements, water quality problems, changes in fish amount and fish biodiversity, sedimentation, biodiversity perturbation, human health deterioration, and other downstream impacts. Together with the inability of both developers and the Government of Lao PDR to mitigate the environmental and social impacts concerned and to compensate on the losses to the affected people, it is highly probable that food insecurity and poverty will increase (IR 2008, Molle et al. 2009).

The issue of developing the Mekong river and its tributaries is far beyond simple. The complexity of the Mekong river ecosystem combined with the fact that millions of people are directly dependent on its resources on daily basis need to be addressed before hydropower development plans can take place. At present the development enthusiasm of the region's water resources cannot be found feasible in all social, environmental and economic terms. According to Keskinen et al. (2007) and Molle et al. (2009) the most recent Cumulative Impact Assessments (CIAs) and water flow models concerning the Lower Mekong river basin indicate that upstream development of the Mekong river and its tributaries will most probably lead to disastrous impacts on the environment and the people. For example Tonle Sap Lake in Cambodia, one of the most productive freshwater ecosystems will be impacted severely from the Mekong river developments taking place in Laos or the Yunnan province in China. The extraordinary flood pulse system of the lake is already at risk affecting the availability of fish and the amount of flooded forest areas. This is directly linked to people's livelihoods in an area that already is one of the poorest in Cambodia. More examples from the riparian countries are widely present. One of the most important, the adverse impact to fish resources and water ecosystems at large can be seen as very troublesome. Fact is that fish, already a decentralized resource, is the most important source of protein for millions of poor people in the region. This combined to other adverse impacts to land ecosystems and environment most definitely has a grave effect on the people purely dependent on these resources. Thus hydropower development is a very sensitive issue and it is important to highlight not only the national but the regional and the trans-boundary context that it may indeed have the opposite impact by creating poverty and food insecurity through droughts and floods, and/or decreased amounts of fish

instead of reducing poverty. Thereby impacts related to such developments should be thoroughly examined and the effects of the upstream development of the Mekong river and its tributaries to lower Mekong Basin demonstrated (Keskinen et al. 2007, IR 2008, Molle et al. 2009).

#### **2.4.6 Justifying large hydropower developments with distorted Impact Assessments (IAs)**

In its National policy signed in 2005 on Environmental and Social sustainability of the hydropower sector in Lao PDR it is declared that all large scale (from 50 MW up) have to be assessed in terms of their impacts. This is seen as a guarantee for socially and environmentally responsible actions to the affected areas (GoL 2005). Despite the noble idea of impact assessment, it has been often used to “justify” the proposed actions. According to existing literature and articles impact assessments have been despite its three dimensional definition on being economically viable, socially equitable and environmentally sustainable used to justify economic benefits while undermining the social and environmental side. For instance in cases of various large scale dams including the latest Nam Theun 2, which was planned to become the model dam also in terms of social and environmental dimensions, the developments have partially or completely failed to consider the actual impacts on the environment or to the affected people. Furthermore it has been criticized that very often the impact assessments are carried out by consultants highlighting and even overestimating the economic benefits while understating the actual impacts to the people and environment leading to a distorted assessment. Often considering the zero option in large dam planning of not building the planned infrastructure seems not to be an option but rather disregarded due to the economic benefits involved (E.g. Ryder, 2004, 2007, Probe International, 2007, 2008a, b, IR 2008b, Lamberts 2008, Molle et al. 2009).

### **2.5 Hydropower**

#### **2.5.1 Definition of hydropower**

Renewable energy sources (including hydropower) are principally derived from the sun’s energy directly or indirectly. They are in contrast to non-renewable resources constantly replenished. Due to growing concern on the fossil fuels running out and the effect of their use to natural ecosystems and global climate, renewable energy sources have been seen increasingly as more sustainable options (Boyle 2004, Alternative Energy 2009).

Sustainability factor on the energy sources as defined by Boyle (2004) is: *“it is not substantially depleted by continued use, does not entail significant pollutant emissions or other environmental problems, and does not involve the perpetuation of substantial health hazards or social injustices.”* On these criteria nuclear energy and large scale hydropower can be excluded as being really sustainable renewable energy sources (Boyle 2004, Alternative Energy 2009).

Hydropower is generated from moving water by extracting the energy of water movement by electricity generators. Historically hydropower’s origin was in milling practices or agricultural use, but today many of the rivers have been harnessed to produce electricity through hydro generators (Boyle 2004, Alternative Energy 2009).

Hydropower is commonly divided into two scales: large and small scale hydropower. Whereas there is no actual consensus on what is meant by small hydropower generally 10 MW with regional variation has been agreed to be the upper limit. The same widely agreed

values for mini, micro and pico hydropower are < 1 MW, < 100 kW, < 1kW respectively as is the case also in Lao PDR, although some country specific variation does occur in these definitions. However the definition, small scale hydropower has been considered, despite some criticism, as one of the most environmentally benign energy generation options (Boyle 2004, Alternative Energy 2009).

Whereas large hydropower resources have been mainly explored worldwide in the major rivers and river basins, small hydropower resources have huge untapped potentials in many parts of the world. As discussed in the earlier chapters hydropower capacity of the Lao PDR is still largely underutilized both in small and large scale developments. However investors and other parties are increasingly moving into hydropower sector with revenues in mind (IR 2008, MEM 2009, Molle et al. 2009).

## 2.5.2 Installed electricity capacity and micro hydropower overview in Laos

### 2.5.2.1 Overview

The present total installed electricity capacity is around 673 MW, of which nearly all (99.66%) comes from small to large scale hydropower (over 1MW). The rest 0.34 % comes from combined diesel, solar and mini and micro hydropower resources.

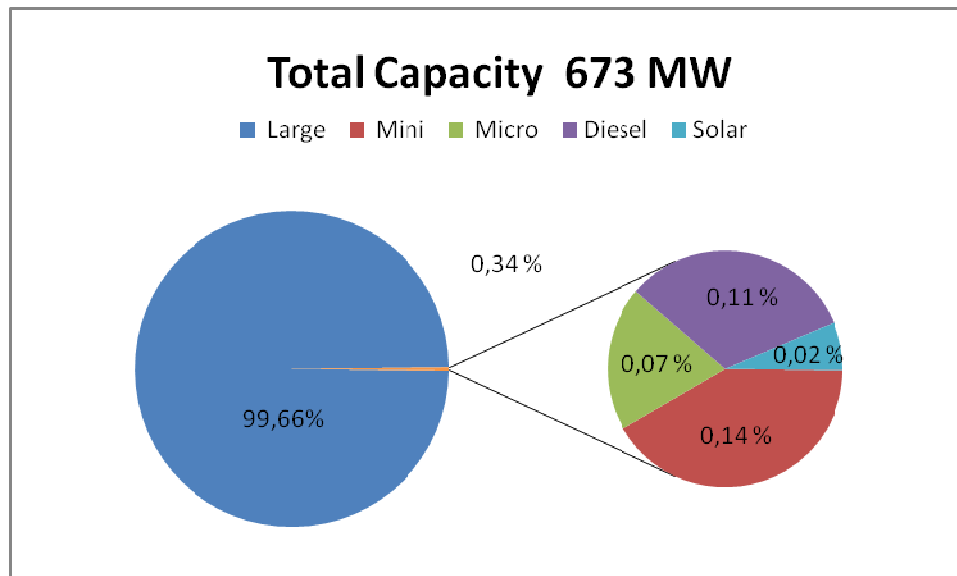


Figure 4. Share of different sources in total installed electricity capacity (MEM/DOE 2009)

Figure 4 and Table 4 show that small to large scale hydropower dominate the energy sector equalling to roughly 671 MW. This is though expected to increase with additional 1070 MW with the opening of Nam Theun 2 in December 2009 ([www.namtheun2.com](http://www.namtheun2.com)). Mini and micro hydropower contribute to 951 kW and 454 kW respectively whereas the shares for diesel and solar are 740 kW and 151 kW. Although there are no available statistics on the use of pico hydropower, it is widely used in the country. In Smits (2008) it is estimated that there are around 60,000 pico hydropower units all over Laos even in the remotest areas. The electricity amounts generated by single units could be even comparable to those of e.g. micro hydro or solar panels if statistics existed. Smits continues estimating that pico hydropower provides electricity to around 90,000 households and is indeed a very important energy source in the remote areas (Smits 2008).

Table 4. Total installed electricity capacity in Laos (MEM/DOE 2009)

<i>TYPE</i>	<i>KW</i>	<i>SUM</i>	<i>%</i>
HYDRO		672 253,4	99,87
SMALL TO LARGE >1000 KW	670 848,0		(99,79)
MINI 100 - 1000KW	951,4		(0,14)
MICRO 1- 100KW	454,0		(0,07)
PICO < 1KW	NO DATA		
DIESEL		740,0	0,11
SOLAR		150,8	0,02
TOTAL		673 144,20	100

### 2.5.2.2 Situation of micro hydropower plants in Laos

Table 5 demonstrates the hydropower situation in Laos in terms of the working and damaged facilities and capacities. Altogether there are just fewer than 40 mini and micro hydropower plants with a capacity of 4,108 kW. Out of these around 1,400 kW is still produced by the working facilities whereas the capacity of the damaged or stopped working facilities equals to around 2,700 kW. As is seen in Table 5 a remarkable share of both the number of implemented facilities and their electricity production capacities can not be utilized at present.

Many micro hydropower plants are in a poor condition, are running on a low capacity or stopped working entirely in the Lao PDR. Sundqvist & Wårlind (2006) state that in 2005, out of the installed 38 hydropower plants with a capacity ranging from 5 to 250 kW, only 14 were still operating. From the *Electricity statistics of Lao PDR 2005* by the Ministry of Energy and Mines it is seen that 70 % out of the total micro hydropower capacity (from 1 kW to 100 kW) was damaged or had stopped working. Furthermore out of the working plants, many have been stated to be in poor condition or running on low capacity (Sundqvist & Wårlind 2006, MEM 2005, Smits 2008).

Table 5. Damaged and working hydropower in Laos (MEM/DOE 2005, 2009, Smits 2008)

TYPE	SIZE	CAPACITY WORKING (kW)	TOTAL NO.	DAMAGED OR STOPPED WORKING NO. & (%)	DAMAGED OR STOPPED WORKING CAPACITY(kW) & (%)
SMALL TO LARGE HYDRO	>1000KW	670,848	10	-	-
MINI HYDRO	100KW-1000KW	951	9	3 (33%)	1,980 (68%)
MICRO HYDRO	1KW-100KW	454	30	21 (70%)	723 (61%)

### 2.5.2.3 Reasons for failure

According to case study on 8 micro hydropower sites conducted by Sundqvist & Wårlind (2006) it is found out that electricity generated is not enough to meet the villagers' energy demand. It is often sufficient for only lighting or TV and seldom there is enough supply for income generating activities. Shortages of electricity are also very common especially during dry season, when the flow is low (Sundqvist & Wårlind 2006).



The most common reason for micro hydropower plant to stop operating is damage to electromechanical equipment either by floods, overload to generator and mismanagement or lack of regular maintenance. Often there are no spare parts available and utilization of poor quality second hand equipment (mainly from China) is very common. On many occasions the second hand equipment does not fit or cannot be optimized with the sites leading to low or no operation at all (Malaykham in Sundqvist & Wårlind 2006).

Insufficient (or lack of) training on maintenance and lack of equipment and spare parts has lead to plant operators not having enough capacity to handle emerging problems. Coupled with the villagers not having enough money to pay for major reparations or new components has inevitably lead to failure of many micro hydropower schemes (Sundqvist & Wårlind 2006).

Greacen (2004) has also documented very similar experiences to those presented by Sundqvist & Wårlind (2006) from different micro hydropower developments from Thailand in his dissertation study.

Government supports the use of micro hydropower in theory since its advantages for the community, but as money is needed in many other sectors the budget for rural electrification is very limited. Thus micro hydropower sector is highly donor-dominated in practice, and sadly in many cases when the donors are finished with the project, there is hardly any budget for the ministries or the villages to sustainably operate the plant (Malaykham in Sundqvist & Wårlind 2006, FFRC 2009).

### **3 CASE STUDY NAM MONG: MICRO HYDROPOWER DEMONSTRATION SITE**

#### **3.1 Nam Mong demonstration site**

##### **3.1.1 Location**

The Project site is located at the Nam Mong River in northern part of Luang Prabang province in Nambak district about 2 hrs by car from Luang Prabang. The site can be reached easily and it has a convenient location from the point of view of construction and maintenance. Nam Mong River is a relatively small river, one of the tributaries of Nam Khan River. The project site is located in the middle part of Nam Mong River, which has a total length of 40 km with catchment area of 114km<sup>2</sup> and relatively gentle river gradient (NEF 2004).

Nam Mong demonstration project has been regarded as one of the most successful renewable energy project in Lao PDR. Also it is one of the first in terms of the connecting isolate projects into grid. One of the villages, Pak Mong, was already cut out from the micro hydro powered electricity in 2006 due to constant overload to the small grid and connected to national grid. The project was aimed to be handed out to the Government of Lao PDR in 2004, but there was no mention on how this will be done officially (from donor to government) and the case was unresolved for a period of time. New Energy Foundation (NEF) requested on 10 million yen (78, 000 Euros) transfer cost for the dam in the end of the project period, but Government of Lao PDR did not have available funds at that time (Malaykham 2007). At present the project has been transferred to Electricité du Laos and should already be connected to the national grid of Laos (EdL 2009).

### 3.1.2 Villages and their People

#### 3.1.2.1 Case study villages along Nam Mong River

Nam Mong River has been and still remains the main source of water for the villagers of Nam Mong, Houay Ang, Vang Hinh, Mok Vek, Phon Home, Pak Mong and Vang Kham. Initially the project consisted of all seven villages, but as the electricity usage of Pak Mong created overload to the grid, it was connected to the national grid. Since this the villages have not had problems of power cuts or overload. As presented in Figure 5 the current electrification rates in all the villages are over 70 percent with an average electrification rate of 83 percent of all the households. The actual village specific amounts of electrified households can be seen in the Table 6.

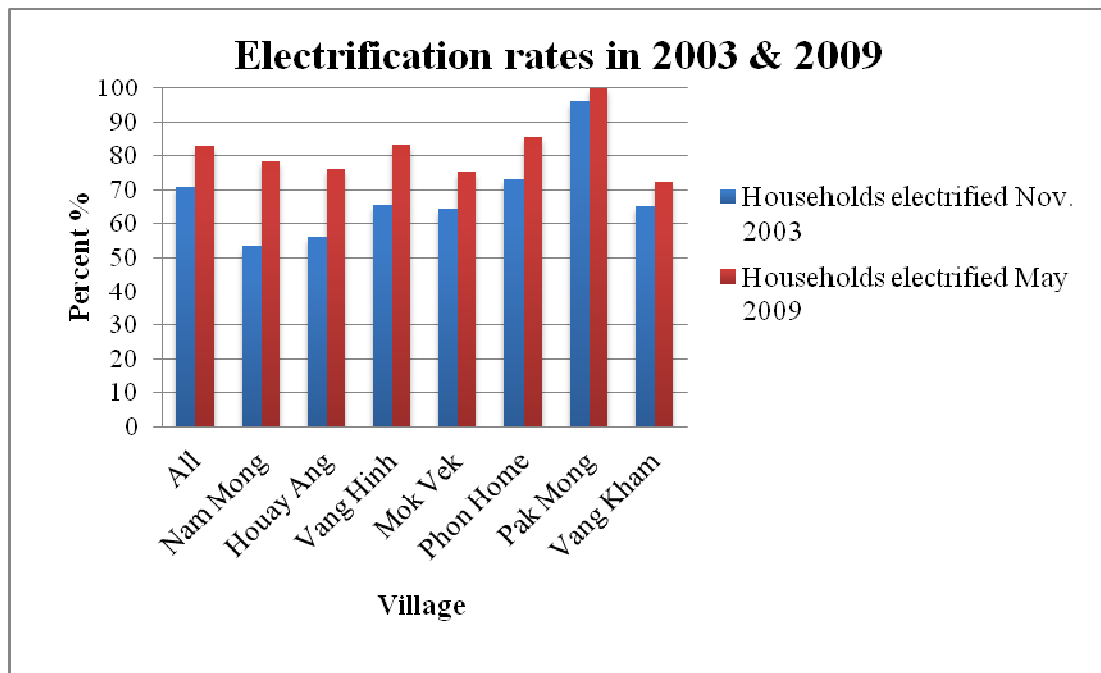


Figure 5. Household electrification in 2003 & 2009. (NEF 2004, EdL 2009)

Table 6 demonstrates villages having between 42 to 122 households each and a total population of for all villages around 3500 inhabitants. Most common housing materials are bamboo and wood on the walls with very few exceptions on concrete and brick, roofing materials were mainly bamboo or metal. Most of the houses are built on poles, especially those made of bamboo or wood.

Table 6. Villages, total population, ethnic groups, households and electrification rate in May 2009 (\*Pak Mong is counted together with Phon Home)

VILLAGE NAME	POPULATION	ETHNIC GROUP	HOUSEHOLDS MAY 2009	HOUSEHOLDS ELECTRIFIED MAY 2009
Nam Mong	391	Khmou	74	58
Houay Ang	244	Khmou	42	32
Vang Hinh	400	Khmou	72	60
Mok Vek	662	Khmou	114	86
Phon Home	1323	mixed 2/3 Khmou	117	100
Pak Mong	*	mixed 2/3 Khmou	122	122
Vang Kham	510	1/2 Khmou, 1/2 Lao Loum	87	63
Total all villages	3530		628	521

Majority of the population are Lao Theung, specifically Khmou as can be seen in the Table 6. Exactly 521 households out of the total 628 have been electrified by April 2009 (EdL 2009).

### 3.1.2.2 The Khmou, a short description of the people of northern Laos

Khmou (also spelled *Khmu*, *Kmhmu*, *Kammu*, *Khammu* and *Khamu*) people are largest group in the Lao Theung, and can be found all over the northern Laos from Phongsaly province to Paksan in Bolimxay province and adjoining areas in Thailand, Vietnam and China. Mainly though they inhabit the northern central areas and have been claimed to be the founders of the ancient capital Luang Prabang. Khmou ('person') are further divided by the people themselves into further sub-groups which are though hard to identify as a separate minority or a group. The Khmou have no written language or history of their own. Most Khmou are peasants living in permanent villages in hilly areas in the vicinity of a stream for getting water. The people are still mainly animists having shamanistic rituals and worship spirits (*phi*), but have been influenced by Buddhism, Catholicism and Protestantism. The main livelihood activities are farming (mainly rice) and plantation, animal raising, fishing, hunting and gathering of non timber forest products (NTFPs) and craft and basketwork (Lindell et al. 1982, Chazée 1999, Stuart-Fox 2001, Kislenko 2009).

### 3.1.3 NEF Project document: A modified summary

#### Objective

The Project aim was to develop a demonstration plant constructed cheaper, being simpler, easier and more economic to maintain than those existing. Through the gained project experience, the simplified micro-hydropower system was to be standardized and the system idea distributed especially in rural areas as a favorable means to rural electrification.

The Project has contributed to electrification of 7 villages in Nam Bak District, with initial expectations to improve living conditions, livelihoods, economic situation and education.

#### Financing, partners and implementers

New Energy Foundation (NEF), Japan (financing partner) and the former Ministry of Industry and Handicraft (MIH) Lao PDR (now under Ministry of Energy and Mines,

MEM) were the initial project partners. The site was constructed by DAI NIPPON CONSTRUCTION (DNC) and supervised by Kaihatsu Design Consultant Engineering Co., Ltd (KDC). Installation work of turbine and generator was carried out by KUBOTA Corporation and transmission lines and distribution by Electricité du Laos and locally trained operators (NEF 2004).

#### Description of work

Preliminary survey was carried out in 1998, Memorandum of Understanding was signed in 1999, and designing followed by construction was completed in February 2000. Operation and demonstration tests lasted for six years. Scale of installed capacity of the Plant was planned considering the number of households (469 households in total, in 1998) to be electrified and the unit electric demand per one household was assumed as 150 W/household. Therefore the installed capacity was planned as 70 kW in total (NEF 2004).

As the micro hydropower site was isolated from the grid, the drought water discharge in dry season was set as maximum discharge for generation. In the case of Nam Mong site, the drought water discharge in dry season was determined around 0.7 m<sup>3</sup>/s, equaling to catchment area (CA) of 100 km<sup>2</sup>. Maximum discharge for generation (Q<sub>max</sub>) to be on the safe side was set at 0.55 m<sup>3</sup>/s equaling CA =114 km<sup>2</sup> (NEF 2004).

#### Monitoring and outcomes

Monitoring on socio-economic situation was carried out before and after electrification by a questionnaire and interviews of the village leaders and some of the users. Sixty six households out of the 367 household were surveyed (mainly quantitative) and it was found that "life was a bit better". Also annual income and expenditure, occupation, energy for cooking and lighting, household appliances, electricity charge and ability to pay, as well as ways how electrification has contributed positively in the villages were surveyed (NEF 2004).

The project has not faced any major problems so far, excluding minor land degradation, some abrasion on turbine parts and one leaking pipe. However all of the abovementioned have been fixed. The project has been found as a success story by implementers and the ministry people (NEF 2004, Malaykham 2007). According to NEF (2004) success factors were:

- Suitable hydroelectric planning and design according to local site characteristics
- Local people accepting and understanding the system selected
- Sufficient education and reeducation to operators fulfilling the expectations of local people
- Periodic inspections for a few years including maintenance of equipment and training for the operators.
- Facilities planned to be maintained and operated easily
- Operation and maintenance organized to ensure that local operators are able to carry out these operations by themselves

### **3.2 Objectives**

#### **3.2.1 Motivation for the study**

Firstly as already presented earlier the pace of hydropower developments in Lao PDR is increasing rapidly in the near future. This development will according to Government of Lao PDR happen through mainly medium to large scale developments. Furthermore most

of the electricity is already sold to export purposes and only a fraction is used to ensure domestic need/demand. Almost all large scale hydropower developments globally have been seen to have adverse effects to the people and environment in the reach of the introduced dam development mainly through resettlements or negative environmental and social impacts. The government of Lao PDR justifies these energy developments through poverty reduction, but there is little evidence on whether this has been the case for the poor. Increasingly it is though shown that the people affected are the ones suffering the most with no benefits whatsoever for the loss of their traditional lands and livelihoods.

Second motivation factor originates simply from the natural circumstances; many of the rural villages in Lao PDR are located in terrain that is mainly mountainous or otherwise hard to reach. The expansion of national grid in these areas is, if not impossible, at least not feasible. Therefore the rural electrification options have to be mainly decentralized off grid systems utilizing the available natural resources site-specifically. Although NEF (2004) have already carried out a survey on the outputs of the Nam Mong demonstration site it was seen beneficial to deepen the already gathered information with more qualitative and detailed data. Since the project is one of the few “success stories” in Laos in the renewable energy field, it was seen to provide valuable insights for future development interventions.

### **3.2.2 Research question**

Underlying research question:

*Has the introduction of renewable energy had any long term impacts on poverty reduction?*

Question 1

*What are the possible (short/) long-term impacts of electrification on livelihoods at local level?*

Question 2

*What are the villagers’ experiences from electricity and the impacts related to electrification?*

## **3.3 Materials and Methods**

### **3.3.1 Methods of collecting and analyzing data**

The research was carried out as a case study with an emphasis on assessing the impacts (most importantly social) on livelihoods and livelihood diversification. A general definition of Impact assessment (IA) is widely agreed as the process of identifying the future consequences of a current or proposed action. It is used to ensure that projects, programs and policies are economically viable, socially equitable and environmentally sustainable. This assessment though was carried as an ex-post evaluation of the project to find out whether the pre implementation set objectives and outcomes had indeed come true.

The case study was carried out mainly by utilizing qualitative research methods. Typical to case study research many approaches were used such as: interviews, direct observations, project reports analysis as well as previous articles, books, studies and interviews etc. carried out in micro hydropower development field (Laine et al. 2007). Also case study was selected to present as richly as possible the experiences and environment of which the local people live or as Patton (2002) puts it “take the reader into the case situation and experience” the life as it is in the site.

The main data was collected from the interviews conducted in the villages. The interviews were divided into two groups: village-specific semi-structured interviews with the village leaders and semi-structured interviews with the households in the studied villages. The village leader interviews were selected from three groups according to the type of electricity connection to get an overview representing different electricity using groups inside the villages. Semi-structured interviews were selected since they are flexible and can be modified in the site depending on the situation. This is extremely helpful especially in situations where there is no previous knowledge about the study area, or when the difference in cultural background limits the researcher to see the most important factors in advance. Semi-structured interviews are directed to certain topics, but contrary to quantifiable structured surveys, can get close to deep interviews in gathering rich data of the interviewed people. However the main aim was not to collect data randomly, but to concentrate on the meaningful responses as laid out in the research plan (Tuomi et al. 2009).

Also one focus group discussion was held in Phon Home village, and the provincial Ministry of Energy and Mines (MEM) and Electricité du Laos (EdL) high level chiefs were interviewed as well as the district staff from EdL looking after the Nam Mong power plant.

These were carried out to get more data on the research topic and especially in the case of the focus group discussion to see whether certain topics emerge from the discussion, and whether “snowballing” (Tuomi 2009, Davies 2007) approach in determining sample had provided variety of informants with variety of backgrounds and views on the research topic. Snowballing has been criticized as being purposive and can be misleading, but in this case study the village leaders of the selected villages both introduced the researcher to the community as well as pointed out the people representing certain sub sample. The focus group discussion was carried out in an open way, the researcher not actually taking part in the discussion, but rather facilitating the discussion. The importance is how the discussion is dynamically “interweaved into the data collection task” (Davies 2007).

Generally the qualitative research was chosen because of the limitations in resources as well as on the mere fact that collecting a statistically representative sample was not seen as necessary. The saturation points were seen already very early in the interview process, and therefore it can be stated that increasing the sample size would not have changed the results remarkably if any. As mentioned by Tuomi et al (2009) the importance is not on the size of the sample but on durability and depth of the interpretation (Tuomi et al. 2009).

All the interviews and the focus group discussion were recorded, translated and transcribed and cross checked. Translator was present in all the interviews, translating from English to Lao, sometimes additional interpreting from Lao to Khmou [by the village leader of Pak Mong and Phon Home] and back to English. Also field notes, pictures and observations were made in situ. To prevent misinterpretation the Lao interpreter went through all the transcribed material to assure that obtained information was indeed accurate. The gathered material was informed to be provided back for inspection to the interviewed households on a request, and permission to record and use all the data (e.g. pictures, interviews and other possible material) was asked from all the informants. Even though permission to use all the gathered material, including personal details when presented, was asked, it was selected to present the views anonymously in order to respect the privacy of the respondents. Pictures however, are presented with personal details.

The question sets (Appendices 1 & 2) were prepared mainly to find out information about possible changes and impacts to the villages and villagers, with the idea of finding potential poverty reduction linkages. The questions also considered the success and failure

factors of the implemented electrification project in order to find out factors useful for future project planning, implementation and sustainability. The village leader questions covered basic village specific facts such as population and number of households, main occupations and seasonal variation in these activities. Questions covered how life was prior to electricity and whether there had been a change to situation at present and what kind of change. These included themes such as e.g. energy use, connectivity to electricity grid, who are the beneficiaries, positive and negative aspects of having electricity, electricity use to agriculture, business and income generating activities, access to communication, credit and market services, river usage and changes in it, utilization of available natural resources, benefits concerning the poorest, women and children, socio-economic, cultural and environmental changes and impacts and the successfulness of the intervention. Villager interviews followed similar themes to those with village leaders, but additional, more household specific information was on the focus such as livelihood activities, monthly income and expenditure, energy expenditure and most important energy usage types, electricity availability, grid connectivity, daily time-use, benefits and views of electricity together with other changes and impacts to daily lives were asked.

Data analysis was conducted with inductive qualitative content analysis by bearing in mind the Sustainable Livelihoods Approach (SLA). First the “raw material” was organized and carefully gone through. At second step the raw material was coded accordingly to analytical categories and the simplified expressions were listed to reduce the analyzed material. Thirdly the material was clustered and compiled to lower and upper categories and finally the data was added to the directing approach thinking SLA (Patton 2002, Flick et al. 2004, Silverman 2005, Tuomi et al 2009). Furthermore the coded data was organized with SPSS statistical tool to find proportions between different groups and to quantify the data at some extent. The results present both the qualitative descriptions and quantified data obtained from the villages.

### 3.3.2 Question framework: Sustainable Livelihoods Approach (SLA)

The question framework was specifically trying to find out impacts on livelihoods and livelihood diversification that has been increasingly seen as a means for survival both in rural and urban settings (Ellis 1999). Generally livelihood is defined as means of making a living comprising the capabilities or *assets* (both material and social resources), *activities* as means to achieve living and finally as Ellis (1999) suggests *access* to assets. Together the activities, access and the use of the assets are determined by social factors and exogenous trends and shocks\*. The presented idea is commonly called as Sustainable Livelihoods (SL) framework or approach, and it is used widely in poverty reduction, sustainability and livelihood strategies nowadays by many development actors. As Ellis (1999) puts it “*assets, activities and access jointly determine the living achieved by an individual or a household*” (Scoones 1998, Ellis 1999, Eldis 2009, Krantz 2001, Benson & Twigg 2004).

\*Exogenous trends (e.g. economic trends) and shocks (drought, disease, floods, pests), Social factors (social relations, institutions, organizations)

#### Assets

##### Human Capital

- Knowledge, education and skills, health and nutrition of household members, capacity to work and adapt, etc.

##### Physical capital

- Infrastructure (e.g. roads, water supply, energy), tools and technology (equipment, fertilizer, pesticides, etc.)

#### Social capital

- Social networks and associations to which people belong (formal/informal), etc.

#### Financial capital and its substitutes

- Savings, credit, cattle, land, etc.

#### Natural capital

- Natural resources: Water, Forests, land, wildlife, wild foods and fibers, biodiversity, environmental services, etc.

(Also Cultural capital (Bourdieu 1986), Intellectual capital, political capital, etc. which are not dealt in the study as irrelevant)

#### Activities

- Fishing, Farming, Manufacturing, Collection, Industry and Services, forestry, cattle raising etc.

#### Access

Access to assets and activities e.g.:

- Markets
- Education
- Health services
- Communication

### 3.3.3 Timetable

The research was carried out during six months from March to August 2009

MARCH	Background research and preparatory work, making contacts
APRIL	Research plan and preparatory work, Travel, guide and interpreter arrangements
MAY	Fieldwork stage: interviews, data gathering, meeting with different related organizations
Week 1:	Organizing meetings with related organization members Translating the questionnaire, making village travel plan Arranging transportation to and from villages Other arrangements such as contracting translator and guide
Week 2:	Field visits, interviews to the villages
Weeks 3&4	Field visits, interviews to the villages
JUNE	Translating, transcribing, cross checking
JULY	Organizing and analyzing the gathered data
AUGUST	Preparatory work and writing background for Final Thesis Finalizing the Final Thesis work, making corrections and disseminating the information



#### 4 RESULTS: POVERTY REDUCTION THROUGH RENEWABLE ENERGY

'Oh, sowing this field, Let sowing be fast, Let sowing be easy,  
 Moving up the mountain, Crossing the slope,  
 Finishing early, Eating by daylight!'  
 -Khmou sowing song

Altogether 28 interviews were conducted in two sets: firstly all of the village leaders (VL) were interviewed. Secondly the villagers of two selected villages namely Vang Kham and Phon Home/Pak Mong were further divided into three groups according to their electricity connection:

those with direct electricity connection, who use the electricity for livelihood activities (six households)

those with direct electricity connection mainly for entertainment purposes (nine households)

those with indirect connection from their neighbors or relatives (six households)

Out of the villager respondents six were female and 15 male, and of the village leaders all six were male. Altogether six households in each group were interviewed and three additional interviews were made with those having direct connection to electricity for mainly entertainment purposes. The share of indirectly connected households in all the villages was around ten percent of the total households of the villages.

Also an open informal focus group discussion (Appendix 3) was held in the village of Phon Home with the villagers having the chance to bring out their views on the project. However, the discussion is not used to present results but rather as providing additional insights to the themes raised from the individual interviews.

The answers of the interviews were grouped according to Sustainable Livelihood Approach (SLA) in order to find out what impacts there have been contributing to the assets, activities and the access to these two. Furthermore the impacts were grouped into mental, physical, environmental, cultural and access changes. The quotes used represent a carefully chosen sample of the observations of the people. More comprehensive list of quotes can be found in Appendix 4. However, this list tries to avoid repetition of already mentioned answers and themes, and therefore is not a complete list of all the answers given by the respondents but more of a sample as well. All of the answers have been quantified, and nearly all questions with correspondent answers are represented in tables in Appendices 5, 6 and 7.

#### 4.1 Village background: occupation, monthly income and expenditure, energy usage and expenditure and price of electricity

##### OCCUPATION

Majority of the interviewed households are dependent on slash and burn or seasonal rice farming with additional fruit or vegetable plantation and animal raising activities for making a living. About one third of the interviewed also had some business activities with farming, and three of the total 21 household respondents had only business activities. None of the respondents in Vang Kham village is involved in business activities entirely, but rely on farming whereas in Pak Mong/ Phon Home village the share of business people was as

high as for the farmers. This can be explained partly due to the fact that Pak Mong/ Phon Home is located in the crossroads of two busy roads. This has had an effect of bringing more business activities to the village to cater the needs of the people passing by (Appendix 5 & 6).

#### MONTHLY INCOME AND EXPENDITURE

Most of the respondent households have five or more people, and the majority of the people have a monthly income under 1.5 million Kip (around 140 Euro, 1 Euro= 10,500 Kip in April 2009). Over half of the households in Vang Kham had monthly income under 500,000 Kip whereas in Phon Home none of the respondents had income that low. Monthly expenditure in both villages was under 500,000 Kip for nine respondents and the rest with an exception of one household of 500,000 to 1.5 million Kip in total (Appendix 5 & 6).

#### ENERGY SITUATION OF THE VILLAGES

Before the introduction to electricity majority of people was dependent on candles, kerosene and fuel wood (also on minority of cases diesel for aggregate use) as main energy sources. After the electrification all respondents were using electricity for lighting purposes and majority of people (except those with indirect connection) had rice cookers or water boilers. However, the usage of the boilers and cookers was found very low due to lack of knowledge how to use these devices safely leading to many of the respondents still using fuel wood as a main energy source for cooking purposes. Over half of the respondents in total were able to use electricity to support livelihood activities, five households could use it only for lighting and the rest on lighting and entertainment purposes. In comparison the households in Pak Mong/ Phon Home were mainly using electricity for entertainment and lighting purposes whereas in Vang Kham majority of the interviewed households used it also for work (Appendix 5 & 6). Those who were able to use electricity also for livelihood activities had also been able to increase their incomes most.

#### PRICE OF ELECTRICITY

Majority of the people saw the price of electricity as normal and roughly a quarter as expensive. None of the respondents saw the price of electricity cheap. In Vang Kham the respondents considered the amount of electricity enough whereas in Pak Mong/ Phon Home over half would have needed more electricity to use. Majority of the respondents were spending under 40,000 Kip per month for electricity with only five exceeding that amount per month (Appendix 6). Many respondents stated that the use of electricity is much cheaper than the cost of kerosene, candles or diesel. Also electricity is all the time available for use on the household, whereas prior energy sources had to be bought from outside the village thus raising the total price of energy used. The share of electricity cost from total monthly income is around or even lower than five to ten percent and from the total monthly expenditure the share is only somewhat higher. Unfortunately the energy expenditure prior to electrification was not examined; this could have shown the quantifiable difference in energy expenditure before and after the intervention, but it was clearly seen that electricity was more economical and comfortable to use.



Figure 6. "People's lives are getting better and they want to develop"  
– Mr. Boun Xou, villager in Phon Home

## 4.2 Social impacts

### 4.2.1 Mental changes

#### IMPROVED MENTAL ASSETS

Mental assets of the villagers in all the project villages have improved according to village leaders. The quality of life has improved compared to situation before the electricity. Majority of the respondents feel better about themselves and they want to develop themselves and their surroundings. According to village leaders people are now proud to have electricity and people have become smarter. The villagers state they are now happier and have more knowledge of the outside world.

*“We have become more independent, therefore, I feel so proud of having electricity.”* – Village leader, male

*“They have learned to deal with different things such as to trade with the others, learn to do farming and learned from the outside world and the kids have become smarter...In overall the quality of life is getting better, the cleverness seems to increase among people. Before the smart or clever people were about 50 percent [of the villagers] now it is probably 80 to 90 percent, therefore the civilization has come along with them.”* - Village leader, male

#### SOCIAL STATUS

Social status after the electrification had increased in roughly half of the respondent households, whereas the other half had not seen any improvements in their household status compared to situation before the electricity. Especially in Vang Kham the respondents felt their household status is now improved. While majority of the directly connected had witnessed an improvement in their status, nearly all of the indirectly connected saw their status mainly the same as before the electrification (Appendix 5 & 7).

Social status has increased after electrification through increased access to knowledge and incomes, also owning electrical devices has been seen very desirable and increasing the family status in the community. Nearly all the respondents see that knowing about the outside world and getting the news and information through TV, radio and telephone has made their household members smarter and more aware on what is going on. Also income increase has in some cases had an effect of raising the family status as well as electrical devices such as TV, CD, fan, karaoke sets, etc.

*“Status increases because they know more about the outside world and know what is going on, not just information on the village but also on the province.”* - Village leader, male

*“They think electric devices make their status better.”* - Village leader, male

#### INCREASED KNOWLEDGE THROUGH IMPROVED ACCESS TO INFORMATION AND COMMUNICATION

In terms of the change in communication and entertainment all except one respondent felt that life is now easier and better than before the electrification. Access to communication, information and learning has improved the quality of life in the in the villages remarkably. Both village leader and villager respondents found that life is now much easier when you don't have to travel for long distances to deliver a message or to communicate with your friends and relatives. Through telephone people are now able to communicate outside their community. Furthermore TV has enabled learning through broadcasted programs that can

be useful in livelihood activities and news from all over to world. Respondents also feel their thinking has changed.

*“We were like cows or water buffalos, didn’t know anything.” - Village leader, male*

*“If comparing before and after having electricity, it is like “to die and then reborn”. Now I feel like I have more knowledge and no one can teach so much in details than TV does. I feel like I learn something new every day. I have also become calmer person. I don’t want to shout on my wife or kids anymore.” - Village leader, male*

*“The situation is like earth and sky, before when I needed to communicate with relatives, I had to send a letter and when I went to see or visit my cousin and sometimes they were not there so I had to wait for them. That is because there was no advance communication. I can also order stuff through phone for my shop.” - Female, Phon Home*

The expenditure to entertainment and communication devices was somewhat high compared to monthly incomes with the majority of people using more than 1 million Kip for such devices, one third of the respondents had spent more than 3 million Kip for entertainment and mainly those households with indirect connection had not purchased any entertainment equipment at all or used very little money for that. (Appendix 6)

*“First that a majority would purchase is TV, second CD and third fan and the other equipment. In average each household would spend around from 2-3 million kip to get entertainment equipments.” - Mr Village leader, male*

#### LACK OF INFORMATION HOW TO USE ELECTRICITY PRODUCTIVELY AND SAFELY

All the village leaders stated that there is a lack of information how to use electricity safely and productively to support livelihood and income generating activities. Many respondents were afraid of electric shocks in making the connections and using electricity e.g. due to being afraid of mixing water with electricity, majority were using rice cookers and water boilers seldom and cooking mainly with fuel wood. Especially elder women were afraid of using “new” equipment since they did not have adequate knowledge how to use them. One of the problematic issues raised by both many villagers and village leaders was the lack of knowledge on how to use electricity for livelihood activities; how to get more income from electricity through new activities and how to ease the daily occupational activities with electricity. People’s attitudes were very willing to get to know new skills to diversify their livelihoods.

*“They [villagers] would want training for activities on how to get more benefits to the village, especially how to use electricity to make money for example on business activities, water pumping to the rice fields and how to use electricity wisely. They would need to get information on how to cook and use electrical appliances with electricity and use electricity safely.” - Village leader, male*

*“I want to get trained how to turn electricity into more business opportunities.”. – Female, Phon Home*

*“There is a high risk for electric shock and I am afraid my kid might die.” – Male, Phon Home*




Figure 7. *“...we have limited technique on how to use electrical devices and we are concerned about the safety in using those electrical equipments. We are afraid that we would make fires. It would be very good if there was training for villagers on skills on how to use electricity to make money. I want this village to become more developed; especially I want the village to have alternative jobs for women such as weaving activities with skills provided”*

Mr. Khamsay Sengmong, Phon Home & Pak Mong (VL)

#### 4.2.2 Physical changes

##### BENEFITS FOR WOMEN AND CHILDREN: REDUCED WORKLOADS, MORE CHOICES AND PRODUCTIVE TIME AND IMPROVED STATUS AND SAFETY

All respondents both village leaders and villagers saw many benefits to women and children from electrification. The benefits agreed by all were that they have less workload, more productive time and choices when to work, improved status and more safety after the electrification. The reduced workloads especially from water gathering and traditional rice milling were recognized by all the women respondents. Furthermore time and energy saved from fuel wood gathering were also mentioned. Women and children now have more choices to work partly because of having light in the early morning and in the evening but also from the time saved from daily activities because of electricity. Both female and male respondents have found that now there is more security for women and children from wildlife and “bad” people. Many men informed that women can now walk safely without somebody to accompany them in the evening and they are not afraid anymore. Women can also shower at home instead of the river because there is now water pumps to get the water.

*“We had a two 200 liter water containers before electricity and we had to go to Nam Mong each day to get water for twenty four times back and forth to get the containers full. It took 10 minutes back and forth for once to go and collect the water. Now we use water [pumping] services. I feel safer, nobody can come and steal from our house, I am not afraid anymore. It (electricity) gives better status for us.”* - Female, Phon Home

*“Electricity reduces workload for women; before they had to carry the baby while they were milling rice with traditional rice mills. Now there is no need to use traditional rice milling or go to gather water anymore.”* - Male, Vang Kham

*“No more going for gathering water and no more traditional rice milling. It saves labour and time and improves life.”* – Female, Vang Kham

Children have more light to study and they can study in the evenings, they have more time to play due to reduced workloads and time used to work. Children have also become more active and smarter according to respondents.

*“...[There are] many benefits for women and kids. It [electricity] has reduced time and work load for females on traditional rice milling, also for collecting fuel wood (also for men), the children have more time to play, because they do not have to go collecting fuel wood.”* Village leader, male

*“After having electricity the kids became so active in their studying at night at home.”* - Village leader, male

##### MORE HOURS WITH LIGHTING, MORE PRODUCTIVE TIME

Majority of the respondents had livelihood activities in the evening: mainly preparing vegetables and crafts for markets. Six of the respondents had no activity in the evening, but used evenings to relax and four respondents had business related activities in the night. One interesting factor was that all female respondents had livelihood activities in the evening in preparing products to markets while over one third of the male respondents had no activity in the evening at their households (Appendix 6 & 7).

According to majority of both villager and village leader responses electricity has created choices when to work and given people more productive time especially in the evenings

and mornings. Before it was very hard to do activities in the evenings since there was no proper lighting, but now many are able to prepare products for sale at the market and even do business activities in the evenings.

*“At night I prepare products for the markets by dividing them from big bags into smaller. It went fine when I was younger but when I got older it is hard to see if there is no proper light.”* - Female, Phon Home

*“We have light in the shop and if somebody comes to buy something they just go outside and sell. We can have the shop open until 7 to 8 pm.”* - Male, Phon Home

*“Life is more convenient, now I can work at night. Before I had to use fuel wood for lighting and it was so smoky that my eyes got easily infected and sore. Now we can slice bamboo and do mats for rice drying and remove rice grain from their branches during the night, before we could not do this.”* – Male, Vang Kham

#### INCREASED INCOMES

Incomes had increased in both the villages after electrification. Only those with indirect connection to electricity grid had not been able to increase their incomes or increased their income only a little compared to situation before electricity. Altogether eight respondents were able to increase their incomes by 50 percent or more after the electrification. The most increase in incomes was found in those households that could use the electricity for business and other livelihood activities (Appendix 5, 6 & 7).

Income increase has mainly taken place through new livelihood activities and by making old livelihood activities carried out easier and quicker. Before it was difficult to have business activities but now with the electricity there are already new businesses in the villages. There was also no experience or knowledge how to do business or other income generating activities. Now there are new activities in all the villages including rice mills, water pumping, lighting for fishing ponds and animal houses. Also the old activities are now carried out quicker and easier with the help of electricity and electrical tools e.g. in house building or motor fixing.

*“Now after the electricity they have around 80 rice mills in the families, and they use electricity for the rice mills. Also building of houses has changed, cutting and smoothing of wood has changed.”* - Village leader, male

*“Now they can build houses faster.”* - Village leader, male

*“I have more income because electricity provides techniques [through TV] how to farm better”* – Male, Vang Kham

#### DECREASED WORKLOADS AND WORKING TIME FOR ALL

None of the respondents in Pak Mong/ Phon Home used electricity in agriculture, while in Vang Kham majority used electricity for rice milling or other agricultural activities. One of the reasons for not using the electricity e.g. for pumping water to rice fields was the fact that most people had their fields far from the village and it was not possible to use it for such purposes (Appendix 6).

However, workload and working time have decreased for majority of people through electricity. Especially rice milling has become easier with electricity together with fuel wood collecting and water gathering. Majority of the people use less time to carry out the daily livelihood activities.





Figure 8. *“Before it was very difficult to work at night, but now you can see things clearly and it is easier for example to change the diaper. And now I can wake up early and see clearly. Now I feel like reborn. I only wish I was younger to go around.”*  
- Mrs. Sao Kien, Vang Kham

### 4.3 Environmental impacts

#### MORE PEOPLE HAVE MOVED TO THE AREA

According to villagers the micro hydropower dam as such has not had any negative environmental impacts but the increased amount of people moving into the area after electrification has led to fewer resources available for the villagers. A remarkable portion of the respondents had observed this movement as more people started moving from the mountains to the outskirts of the villages when the area was provided with electricity.

*“Before, there were 40 households in the village now there are 80 households altogether.” - Female, Vang Kham*

Also people are still cooking mainly by utilizing wood and therefore the need for fuel wood collecting has not been changed after the electrification. There were now fewer non timber forest products (NTFPs), fuel wood, fish and the water was dirtier. One of the reasons for the water becoming dirtier was said to be the fact that people in the upstream of the river dumped their waste into the river including dead animals, motorbike oils, trash, washing detergents, etc.

#### WORSE WATER QUALITY AND LESS FISH AVAILABLE

Water quality of the dam was found worse than before in both the villages. All respondents in Vang Kham thought the water was now dirtier than before the electrification. In the case of Pak Mong/ Phon Home only one thought the water quality is better than before. Also the amount of fish was found reduced by many respondents. However, some respondents saw that there is now more fish and fish are bigger in size. Both of the observations were explained through the increased amount of people in the area using the river (Appendix 5 & 6).

*“Currently, there are less fish because more people are going fishing. Before, we used it [the river] for bathing and washing and drinking. Compared to before, water is now dirtier. Dead animals are thrown into the river that’s why it makes the river even dirtier. Now we do not even want to go there to take a shower or to get drinking water from the river.” - Male, Vang Kham*

#### LESS FOREST RESOURCES AVAILABLE

The amounts of collected fuel wood were in the case of most respondents 50 to 200 kg per month, and six respondents announced of even collecting over 200 kg of wood per month for mainly cooking and heating purposes. In Vang Kham people were generally consuming more wood than in Pak Mon/ Phon Home. Also time used for gathering fuel wood was found higher in Vang Kham with almost all respondents gathering wood more than five times a month. In comparison respondents in Pak Mong/ Phon Home were all gathering wood for less than five times a month. However in both the villages the time used and amount gathered are equal or less than before the electrification, only two respondents said they collect now more wood than before electricity. The availability of forest resources is less than before the electrification. Nearly all respondents found that it is now harder to find non timber forest products (NTFPs) and fuel wood. The main reason for this is seen to be the people who have moved to the project site when electricity came, and since there are now more people in the area, fewer resources are available. (Appendix 5 & 6)

*“There is still a lot of cutting trees, because in the village the main fuel used for cooking is wood. Even after the electricity the cutting of fuel wood is still the same.” - Male, Phon Home*

Figure 9. "Kids get diarrhoea when playing in the water and then they swallow/drink the water. Before it was also like this because people throw their waste into the river."

- Mr. Phoumy Pheng, Vang Kham(VL)



#### 4.4 Cultural impacts

##### CULTURAL LIFE ENHANCED, TRADITIONS CHANGE

Generally electrification has been seen as a good thing as is the improvement of access to communication and entertainment. People have become more aware of the outside world and it has enriched their lives and given more knowledge. Villagers are spending more time on watching TV, interaction amongst the community members has lessened and cultural ways of dressing, singing and living have changed especially amongst teenagers. According villager leaders the villagers really believe in what TV “says” and this has an adverse effect to the society. In addition to educative programs villagers are following drama and getting influenced by what they see on TV. This is especially true with teenagers who do not want to listen and dance to traditional music anymore, but imitate and adapt to what they see e.g. Thai pop music and fashion. This also has an effect to adults who are wearing less traditional clothing and watching TV instead of gathering to sing and dance as has been the tradition before. Many villagers also see TV as more favorable option to relax and spend their leisure time.

*“Negative impacts especially for the teenagers are that they are now listening to too much Thai songs and they have been influenced by the programs on TV, they imitate the actions they see on the TV. It also affects the traditional ways of life like dressing and also they are losing their culture.” - Village leader, male*

*“Before people would laugh at a woman wearing pants because they thought pants are for men only, but now it has become normal as they can see women wearing pants on TV.” - Female, Vang Kham*

*“Before we would do fishing nets and chat, and now in the evening we can watch TV.” - Male, Phon Home*

#### 4.5 Access impacts

##### ACCESS TO MARKET, HEALTH AND EDUCATION, AND BANKING SERVICES THE SAME

Electrification has not improved access to health and educational facilities, but has provided light to study at home and electricity (national grid) to the hospital to do surgeries. These mainly from the fuel switching have decreased the amounts of eye and respiratory infections in the villages to some extent. However, wood is still the main energy source for other household activities such as cooking. Roads to the markets and banking services are good according to all the respondents. Additionally there are even people coming to take products to market straight from the villages. Access to information and knowledge as well as to new activities have improved. Electrification has not improved access to markets or banking facilities, but has been helpful in preparing products for market. Although access to hygiene, sanitation services and clean water are considered very important, all of the villages lack such adequate services.

*In the past when they did not have the electricity they had to use the fuel wood for lighting for study and that was very smoky. They [now] can use fan to get away the mosquitoes too.” - Village leader, male*

*“Mostly we do not have to go to take these [agricultural] products to the markets but people from Pak Mong would come to buy the products from them, and collect everything.” - Village leader, male*

*“I hope for water supply for the whole village, especially for clean drinking water.” - Male, Vang Kham*

#### **4.6 Positive and negative factors identified on the project**

INCLUSIVE PROJECT CYCLE MANAGEMENT AND QUICK MAINTENANCE SERVICES PLANNED TO BENEFIT THE LOCAL PEOPLE

Project has been seen as a success according to all the respondents. Project was planned for the benefit of the local people, including them in the project cycle and providing quick and efficient maintenance. Villagers were happy to gain extra income from the construction work and they felt included in the project planning and constructing. People were asked on the suitable electricity prices and they were always consulted in case of problems or repair work. People were not satisfied on the local electrical authorities or the electricity billing, more electrical capacity would be needed and maintenance after the project funding ends is seen expensive to be handled by the villagers. Some of the villagers were overcharged by the electric company.

*“The project has been well taken care. When it breaks down, it is quickly fixed. They keep good maintenance and take care the equipment is fixed quickly, and it [project] also brings the benefit to local people.” - Village leader, male*

The demonstration site is now been transferred to national grid and therefore people were asked on their opinions of the change. In the case of Pak Mong/ Phon Home respondents saw the change as positive by providing more electricity, without blackouts, to people enabling them to use it to generate more income, whereas in Vang Kham majority of people could not say how this will affect their lives since they have not experienced it yet. Only three respondents expected the change be worse by stating that the price of electricity will go up and they will also have to pay for the changes of electrical equipment such as the counting meters (Appendix 6).

*“if they have to change the meters it might be that many people will not be able to afford to have new EDL meters, especially for the poor families because they have to work and save enough money to buy the meter to use the current system. Some people have just gotten electricity meters 3 months ago and now they have to change to the meter EDL uses.” - Male, Vang Kham*

#### **4.7 Analysis of the results**

SUMMARY OF RESULTS

To summarize major findings it is necessary to look to the different results emerged from the study. As can be seen from the Table 7, the project has had many impacts to the villagers of the project site. These have been grouped in different categories such as mental changes, physical changes, environmental changes, cultural changes and access changes (Appendix 4).

Under mental changes it can be seen that people now feel better about themselves and their surroundings, and access to information and learning has been seen very important by many. Generally there was no variation between the different respondent classes but all respondents had observed the same impact: people have become more active, smart and wanting to develop more. Access to communication and entertainment has made life easier and while all the respondents saw improved access to communications very important some men even saw there is a change in the thinking of their wives and children.

Social status has increased in over majority of the respondent households with exception those with indirect connection. Only one respondent of the indirectly connected households had seen a change in the household status after electrification. There was no significant variation between male and female respondents' answers.

All village leaders seemed to be aware on how to use electricity safely and productively to support income generating and other livelihood activities, but also recognized that among the villagers there is no knowledge on how to use electricity in a safe manner and to produce income. Although some villagers were aware of new technologies, nearly all of them replied that there should be such information available. Generally women were more concerned on the safety issues related to electricity together with some men who were mainly worried on the security of women and children. Majority of men were interested on the other hand on how to use electricity for agriculture and business and how it could provide more income and ease the workloads of the households.

In physical changes it is seen that women and children are now better off; they have a decreased workload (mainly from traditional rice milling, fuel wood collecting and water gathering) and more time from old activities to do something else. Their status has increased and children can now study better. Furthermore it seems to be safer, not only for women and children but for the whole village. All respondents, both the village leaders and the villagers, agreed on the benefits to women and children. Whereas men seemed to be emphasizing the reduced workload from wood collecting and traditional rice milling, women put more emphasis on the reduced need to collect water, increased choices when to work and security in the evenings.

Electricity has also had an effect on the incomes and new activities are being carried out such as water pumping, rice milling and wood cutting. Many have been able to increase their incomes through activities either old or new, excluding though those who do not have capabilities or resources to use electricity. For example in agricultural changes after electrification it was seen that none of the indirectly connected were able to use electricity to any agricultural activities while over half of the directly connected used electricity for agricultural activities. More information and training is though needed for the local people to increase their incomes. There are for example many women who are willing and able to have alternative work. People are also very keen to know how to generate income, but unfortunately there has not been adequate information, guidance or training available for such activities.

There is now more productive time for the majority of the villagers. However, here it is also seen that the benefit for those connected indirectly are lesser compared to other people. As many stated there are now more activities in the evenings and early mornings, it needs to be also stated that the same respondents are now enjoying the entertainment provided by TV during the evenings.

There is a consensus on the least benefiting people: those who are the poorest, indirectly connected, widows, subsistence farmers or others who use electricity for only lighting or entertainment. The most benefiting ones according to all respondents in contrast are the ones who know and can use electricity to make money. However it is said that all benefit from electricity in terms of having lights, now people can do activities during the evenings which was either impossible or hard before. Furthermore, it is said that there is now more productive time in the evenings and mornings and life has become easier, healthier and more enjoyable.

There have been some positive environmental impacts from slightly reduced use of fuel wood in lighting and collecting of it, but people still do use wood as the main source for cooking due to tradition or lack of knowledge how to use electricity safer/better for cooking. Many people are afraid of “mixing water and electricity” and hence rice cookers and water boilers are seldom used or are used mainly as a second and “emergency” choice for wood. Electricity has though brought also more people to the villages from nearby areas and thereby the availability of fish, water and forest resources such as wood, wild animals and plants has decreased. The dam itself according to the villagers has not caused any adverse environmental effects. Water quality problems have been mainly seen as a problem caused by the people disposing their waste to the river.

In terms of cultural impacts there has been impact on the villagers. All are affected in some way; whereas the teenagers are more prone to cultural influences outside their community (mainly Thai) impacting their dressing and local culture, even in the case of adults there are less people using the traditional dresses and gathering for singing, dancing and knowledge sharing. Many are more excited by the vast amounts of information TV provides and often spend their evenings now relaxing among their family instead of gathering together with other community members.

Electrification has not had any direct impact on access to educational or health facilities, even though it has provided lights for the hospital where it is now possible to do activities also during the nights and provided children proper light to study with. There have not been any direct improvements in banking services, but villages are now establishing village development funds and health insurance funds. Whether this is an indicator of more income in the area may be the case or at least speculated. Access to the markets has not changed due to the project intervention as roads are in good condition year round and there are people coming to the villages to buy all their products. However people are now able to produce more products to the markets by having lights in their households during the evenings. Access to different assets and activities outside the abovementioned is though clear in some cases. There is now better access to new activities and improved situation to all capitals. This can be stated in terms of majority of the villagers who have been able to increase their incomes, livelihood activities or reduce workloads by electricity. Not all though have the same chance. Access to clean water especially for drinking purposes and sanitation and hygiene services has been seen as a major need in almost all of the villages.

The study also looked into the aspects that can contribute to project successfulness. Many see the project as successful; the project has been planned for the benefit of the local people, people have been included throughout the project cycle, especially in the construction stage where a lot of local people were employed for the work. Furthermore the project staff has provided quick and efficient maintenance services. On the other hand it was criticized on the insufficiency to provide enough electricity during the peak hours, and some of the Electricité du Laos (EdL) district level staff did not provide good services such like overcharging and lack of maintenance e.g. especially when the electricity counting meters were running too quickly it was hard to get anyone to fix this problem.

#### RESULTS IN RELATION TO SUSTAINABLE LIVELIHOODS APPROACH AND RESEARCH QUESTIONS

The aim of the study, as stated in the research questions in Chapter 3.2.2, was to examine the possible (short/) long-term impacts of electrification on livelihoods at local level, what kind of experiences the villagers have from electricity and the impacts related to electrification and thirdly how these two findings relate to poverty reduction?

People's experiences have been primarily good by accepting and taking ownership as well as feeling proud of the project. There has not been much negative views on the intervention, the only being quarrels on the overcharging or similar. Despite the fact that not all the villagers have been benefitting equally of the project, hardly any negative view came out from the discussions. Even those with indirect access to electricity had mainly nothing but good to say about the project.

Results obtained from both village leader and villager interviews are combined in Table 7. The impacts have been collected under social, cultural, environmental and access impacts. Furthermore the social impacts are divided to mental and physical changes to better distinguish the different capitals introduced by Sustainable Livelihood Approach (SLA) in Chapter 3.3.2. These observed impacts are examined through the Sustainable Livelihood Approach (SLA) to see whether there can be seen any improvements in assets through different capitals, activities are examined to find whether there have been such improvements present that can contribute to better livelihoods, and finally it is examined whether the access to assets and activities has improved.

The results present that the changes occurred in the communities have had a positive impact to the local livelihoods. Especially it is seen that there has been a positive impact to human, physical and social capitals and therefore it can be stated that the villagers have been able to improve their assets compared to situation before the project. In addition, there have been many positive changes in the daily activities of the villagers and thus also activities can be seen as improved. Also access to e.g. new activities, income generation and information and knowledge has improved significantly compared to time before electricity. Access to assets such as roads, markets and health services already existed before the project.

This indicates that all of the factors having an influence to sustainable livelihoods have improved. According to SLA practitioners when assets, activities and the access improve, it can improve livelihoods and support livelihood diversification. This is seen to create a more sustainable (long term) impact to the livelihoods of the affected beneficiaries. Furthermore improved and diversified livelihoods have been seen crucial by development actors in interventions aimed to poverty reduction. Poverty reduction has been seen as the aim for development assistance today.

Finally the answers to the research questions are:

- There have been many impacts to the lives of the people after the electrification. These impacts have been seen generally as positive by improving living conditions and making lives more convenient.
- Activities, assets and access have improved after electrification thereby improving the 'making of living'. In other words livelihoods have improved and people are more able to diversify their livelihood sources/activities.
- Through the improved situation in livelihoods it is seen that the electrification has had a long term impact on poverty reduction among the villagers. The exact magnitude of the poverty reduction impact is hard to determine, but it seems that lives are now many times richer (not only income-wise) for majority of the villagers.



Table 7. Results and their short and long term impacts

RESULTS	SHORT TERM IMPACT	LONG TERM IMPACT
<b>SOCIAL IMPACTS</b>		
Mental changes		
People feel better and want to develop themselves and their surroundings		
Social status has increased with the introduction of electricity and electrical devices		
Electricity has enabled access to information and learning and made communication easier within and outside the community		
There is a lack of information on how to use electricity safely and productively to support livelihood and income generation		
Physical changes		
Women and children have less workload, more productive time and choices when to work, improved status and more safety after the electrification.		
Children have more choices when to study, studying is easier and they have become smarter and more active		
Electricity has created choices when to work and given people more productive time especially in the evenings and mornings		
Electricity has enabled increase in income through new livelihood activities and by making old livelihood activities carried out easier and quicker		
Workload and working time have decreased for all		
Life has become more convenient, healthy and safe		
All benefit from electricity, The ones who use more, benefit more, especially in income generating activities.		
<b>CULTURAL IMPACTS</b>		
People are spending more time on watching TV, interaction amongst the community members has lessened and cultural ways of dressing, singing and living have changed especially amongst teenagers. Community life though has benefited from electrical devices such as Karaoke sets, TVs, CDs etc.		
<b>ENVIRONMENTAL IMPACTS</b>		
The micro hydropower dam has not have any negative impacts, but the introduction of electricity has encouraged more people to move into the village, thereby causing less forest resources (animals and plants) and fish available and reduction in water quality		
<b>ACCESS IMPACTS</b>		
Electrification has not improved access to health and educational facilities		
Electrification has not improved access to markets or banking facilities, but has been helpful in preparing products for market		
No access to hygiene, sanitation services and clean water		
Access to information and knowledge improved		
Access to new activities and income generation improved		

## 5 DISCUSSION

In order to open up the discussion for the results obtained, let us look into the factors that create the basis and motivation for the study.

Firstly, development assistance effectiveness and its long-term impacts have been largely debated issue in the recent development interventions. Development assistance projects and programs have been found by many as being not as efficient as they could have been. On the agenda now is finding out ways to improve both efficiency and long term aid impact as was discussed in Chapter 2.1. Practitioners have highlighted common pitfalls and failures of development assistance and hence numerous guidelines on how development assistance should be delivered in an effective way have been developed such as those from e.g. Grenier (1998) and Carley & Christie (2000) or the internationally agreed Paris declaration from OECD discussed in Chapter 2.1, among others.

Secondly, the access to energy and energy services have been agreed as a vital part in poverty reduction and thus providing energy to the poor have been increasingly set in the agenda for international development actors. Renewable energy technologies (RETs) have been emphasized as providers of sustainable long term energy options to the communities at hand. However, evidence from these actions suggest so far many of the renewable energy projects and programs have failed to create long-term impacts such as better livelihoods and increased well being or sustainable energy services. Therefore it could be speculated whether renewable energy interventions have had any significant impact so far in reducing poverty. The reasons for failures are many as already presented in Chapter 2.3.2 varying from technological to policy level problems (World Bank & Winrock International 2003, UNDP 2004a,b, GNESD 2006, 2007, Urmee et al. 2008, 2009) (see Chapter 2.3).

Thirdly, Sustainable Livelihoods Approach (SLA) raises the critical issue in finding ways how to support the livelihoods of the peoples' in a sustainable manner to reduce poverty and also 'keeping it away'. SLA has been one of the approaches used by various development actors e.g. UN, DFID, bilateral donors such as Finland etc. and it is becoming more agreed upon in the international development agenda (Krantz 2001) (see Chapter 3.3.2).

Finally we have Laos' ambitious idea in harnessing its so far largely untapped hydropower resources to become the 'battery of Asia' with its potentially vast pool of adverse impacts on the people and environment versus the decentralized 'Small is beautiful'- options that have mainly also in the case of Laos had so far only marginal success stories and few or any long term impacts on livelihoods that can actually contribute to poverty reduction (see Chapters 2.4.5, 2.5.2.2 and 2.5.2.3).

The case study Nam Mong undoubtedly is a successful project. Many of the results presented in the previous chapter are evidence of that mere fact. The people's lives have become easier to all, and there are clear linkages on how the intervention has positively impacted on the livelihoods and accounted to more income for many in the area.

The benefits are many as can be seen from the previous chapter. These positive impacts include improvements e.g. in women's status, reduced workloads, opportunities for children and adults to study and learn, improved safety, reduced adverse health impacts, increased incomes, etc. as can be seen in the results chapter. The economic, social, health and environmental benefits of renewable energy presented in Table 3 in Chapter 2.3.1 by Global Environment Facility 2001 show great resemblance to the results obtained from the study and therefore are not repeated here. However, this notion can be seen as highlighting

the project success at least in many areas (mainly socio-economic and health) rather than bringing out many adverse effects to the community.

One of the most commonly stated factors in rural energy projects are connected to education of the children and minimizing the respiratory effects to women while cooking with traditional methods and fuels (E.g. Boyle et al. 2003). This project on the other hand shows that even though children do benefit from the lighting in the evenings the benefits to educational facilities otherwise are not significant; in the case study villages schools had not benefitted from electrification at all. In the relation of cooking to respiratory and eye infections there can be seen an improvement now when wood, candles or kerosene are not used for lighting, but on the other hand the main energy source for cooking is still wood due to lack of knowledge by the users.

One concern though raised by the respondents on the livelihood support and especially in its diversification factor was that there is no sufficient knowledge how to generate income from the electricity. The direct linkage of energy services to income generation has been seen as beneficial for the project sustainability. Mapako & Mbewe (2004) emphasize through sub-Saharan examples the importance of modern energy being linked into income generating activities for it to have greater impact. Furthermore they state that energy utilization merely in household/domestic use have lesser impact in promoting modern energy for rural areas. Training is therefore needed not only for the maintenance and operation of the facility but also for different opportunities and available activities.

Khennas & Barnett (2000) suggest that finding profitable end use for micro hydropower based energy is one of the most important factors to be considered in such interventions. In their study they found out that to achieve project sustainability that eventually leads to improvements in the lives of beneficiaries and creates conditions for poverty reduction or gender equity, the end use factor is crucial.

The villagers had observed that they have now more time available for other activities due to decreased workloads. Expanding productive time and productive uses of energy has been seen important by many development practitioners. By many definitions it is mentioned that “a productive use of energy is one that involves the application of energy to create goods and/or services either directly or indirectly for the production of income or value”. It is often said that productive use of energy can contribute positively to poverty reduction by increasing possibilities to earn more income. The expansion of productive time on the other hand increases the possibilities to have more activities in the evening time. However, in many studies carried out post electrification it is seen that evenings are used rather on entertainment and relaxation than for additional work. Although many respondents informed of carrying out additional activities in the evenings, many saw evenings as a time to relax and watch TV. According to many development practitioners this cannot be counted as productive use of energy, but rather as a wasted possibility to use energy productively (Cabraal et al. 2005).

Cabraal et al. (2005) have responded to such criticism through Sen’s “development as freedom” thinking. They suggest that energy’s productive use role can be expanded to entail more functions than the commonly agreed income-generation function. Recent studies have shown that watching TV has actually contributed positively to many factors such as gender equity and improved knowledge and education. This can be seen also in the case study villages. Additionally to increased income generating activities, electricity has provided much information and knowledge to the communities. This has contributed in various ways the life of the villagers as presented before e.g. women wearing pants is now normal, learning to do trade or farming etc. Productive uses of energy and productive time

that is available through provision of modern energy services to rural poor are essential with any energy projects. However, productive use of energy is much more than activities related to only income generation. The broadening of the term productive use is therefore necessary in expanding freedoms to the people through energy interventions and linking development firmly with energy services (Sen 1999, Cabraal et al. 2005).

Sustainability of and long term impacts of micro hydropower projects in Laos according to statistics are somewhat sad. As already mentioned e.g. in Chapter 2.5.2.3, most facilities are not running anymore due to different reasons. The situation in Nam Mong is different. The plant has been operating almost flawlessly since its opening and provided a secure energy source for the villagers. However, it can be speculated whether the actual placing of a decentralized energy option to an area that will in the near future be connected to national grid is feasible in the first place. One of the main criteria of choosing the site was the easy access by road to the area, and it can be speculated whether the connection to national grid was already known in the planning phase. In such case the intervention has been largely ineffective considering the long term impact. In his dissertation in 2004, Graecen has found out that the vast majority of micro hydropower sites in Thailand have been abandoned due to many reasons. Some of these reasons are e.g. technical or economic as is seen also in other cases e.g. Sundqvist & Wårlind (2006), but Graecen also introduces one of the reasons to be connection to national grid. In some cases the local micro hydro solutions have even been considered better than the connection to national grid, yet the change has been mainly inevitable. Nam Mong site is now one of the first decentralized projects connected to national grid in Laos and it will be interesting to see how the situation evolves. The Government of Lao PDR is still heavily dependent on donor driven decentralized rural energy projects and it is a fact that these projects normally end up in an area that is easily accessible (along the main roads) and will be connected to national grid sooner or later. According to consultation with Rural Electrification division's off-grid project management unit of the Ministry of Energy and Mines there is a clear tendency of project implementers to focus on easy access areas. Furthermore it was said that nobody wants to go to remote areas for the mere fact that it is more difficult (FFRC 2009). For example World Bank's Southern Provinces Rural Electrification Project and Village Off-Grid Promotion & Support (VOPS) – project show how the energy projects are located along the main roads and furthermore close to the planned national grid transmission lines. The portfolio for renewable energy projects implemented in developing countries seems to be increasing currently at a remarkable rate as already mentioned in Chapter 2, and therefore it needs to be asked if it really is feasible to implement projects in a temporary nature.

The project factors contributing to failure or success of the sustainability have been brought out by e.g. Grenier (1998) and Carley & Christie (2000) previously and can be seen in the Table 2. New Energy Foundation (NEF) 2004 recommendations for project sustainability are seen in Chapter 3.1.3. These results have been combined into Table 8. The identified success factors from the case study site were:

- planned for the benefit of the local people,
- people have been included throughout the project cycle, especially in construction stage providing income for the local people
- project staff has provided quick and efficient maintenance services

Table 8. Combined success factors for project implementation

<ul style="list-style-type: none"> <li>• Suitability to local physical environment and conditions in an environmentally sound fashion</li> <li>• Reducing risk</li> <li>• Productive use of resources(local)</li> </ul>	<ul style="list-style-type: none"> <li>• Addressing the identified problems and constraints</li> </ul>
<ul style="list-style-type: none"> <li>• Providing acceptable economic returns</li> <li>• Utilizing local skills, tools, and materials (spare parts, fuels, or ingredients)</li> <li>• Efficiency</li> <li>• Assessments of technology and impacts</li> </ul>	<ul style="list-style-type: none"> <li>• Meeting multiple needs</li> <li>• Generating income, sustainable wealth creation</li> <li>• Affordability</li> <li>• Saving labor</li> </ul>
<ul style="list-style-type: none"> <li>• Producing visible results within a sensible timescale</li> <li>• Fitting into, minimizing disturbance to, or modifying (rather than replacing) existing practices</li> <li>• Affecting all different groups equitably</li> <li>• Cultural appropriateness that does not challenge or contradict with existing fundamental cultural beliefs and takes into consideration local preferences</li> <li>• Local people accepting and understanding the system selected</li> </ul>	<ul style="list-style-type: none"> <li>• Easily understandable</li> <li>• involvement of local people in problem analysis and problem devising</li> <li>• Maintainable by local people or organizations involved</li> <li>• Fitting existing systems of ownership, obligation, and authority</li> </ul>
<ul style="list-style-type: none"> <li>• There should be periodic inspections for a few years including maintenance of equipment and training for the operators.</li> </ul>	<ul style="list-style-type: none"> <li>• Support by trusted sources</li> <li>• Operation and maintenance should be organized to ensure that local operators are able to carry out these operations by themselves</li> <li>• Sufficient education and reeducation to operators fulfilling the expectations of local people</li> <li>• Facilities should be planned to be maintained and operated easily</li> </ul>

The main identified success factors by the villagers are similar to those from Table 8. Furthermore there were findings in the results presented on other points such as that electricity benefits all, there are no negative environmental impacts by the facility, it generates income, etc. that all correspond to the factors identified by Grenier (1998) and Carley & Christie (2000)

Sundqvist & Wårlind (2006) bring out the main reasons for especially micro hydropower failures in Chapter 2.5.2.3, and Chapter 2.3.1 deals with the renewable energy failures in a broader concept. The main failure factors are combined into Table 9. The emerging negative factors from Nam Mong were mainly to do with staff and electricity pricing. However factors such as not having the knowledge on how to do different income generating activities and the lack of training on such post-implementation factors is something that inevitably needs to be addressed to avoid partial failure. The main idea to support income generating activities does not necessarily come true if there is no additional training on how to do business.

Table 9. Combined failure factors in project implementation

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<ul style="list-style-type: none"> <li>• Lack of adequate government policy and funding support</li> <li>• Lack of national level coordination between institutions engaged in the development and implementation of these programs.</li> <li>• Inadequate maintenance and monitoring and training for both the technicians and system users</li> <li>• Heavily subsidized or donor sponsored ad hoc type interventions performing well as long as the financial support lasts</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of involvement of local communities in program design</li> <li>• Fragmented research and development efforts executed in isolation from other development challenges such as health, poverty, education</li> <li>• Lack of coherent policies has led to a lack of coordination between stakeholders</li> <li>• Initial project costs far beyond the ability of the poor individuals and communities to purchase and maintain them.</li> <li>• Program objectives defined in very broad and administrative terms not on descriptive outcomes to the system users.</li> <li>• Mismatch between what is provided and what is actually required</li> </ul>
<ul style="list-style-type: none"> <li>• Fail to measure impacts from energy services and include the needs and desires of the actual end users</li> <li>• Strictly quantifiable output in determining process success instead of assessments on socio-economic impacts in qualitative terms</li> <li>• Electricity is not enough to supply income generating activities</li> <li>• Best practice program guidelines are frequently ignored by implementers</li> <li>• Failing to result in increased employment or household income</li> <li>• Lack of in-house technical know-how and lack of availability of components and spare parts</li> <li>• Spare parts not available and utilization of poor quality second hand equipment</li> </ul>	<ul style="list-style-type: none"> <li>• “One size fits all” energy strategies</li> <li>• Inadequate funding support and appropriate financing mechanisms</li> <li>• Electricity generated is not enough for villagers’ energy demand.</li> <li>• Damage to electromechanical equipment either by floods, overload to generator and mismanagement or lack of regular maintenance.</li> <li>• Communities not having enough money to pay for major reparations nor new components</li> </ul>

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## 6 CONCLUSIONS

Micro hydropower based electrification can contribute to poverty reduction if executed properly. However electrification for only lighting purposes has no significant impact in improving livelihoods or generating income as such (excluding crafts or similar), but there has to be opportunities and chances to reduce workload, lessen the time used for work, and to generate income.

Access to electricity does not necessarily mean it has an automatic contribution to better income or livelihood opportunities. The beneficiaries need to be equipped for such knowledge and skills that enable them to have benefit out of the intervention. This may consist e.g. use of agricultural equipment or other machinery, knowledge for safe usage of electricity, introduction on possible new activities from ice and ice cream making, laundry services, furniture making to even establishment of internet cafes. Also concrete education

on running a business or other activities is very much needed and therefore should be included in the development project cycle.

Often it is also stated that when people or districts are starting to get more income, there will happen a trickle down effect so that even the poorest are witnessing the increase in their incomes and living conditions. This is somewhat false according to the site studied. Even though all the people saw the intervention as a success giving benefits to all, it needs to be said that the ones getting the most increase in income were the ones who also used the most electricity. However, this proportion of increased income for some could not be seen clearly as increased incomes among the poorest households of the community. The incomes for the poorest had remained much the same as before the intervention.

Electricity benefits all but unequally, if there are no supporting mechanisms for the poor present. As discovered by the Nam Mong project, many of the people outside the small electricity grid were simply not able to afford the direct connection. Therefore, an adequate support mechanism should be available for the poorest people.

Despite the criticism the project has truly been a success. It has provided the beneficiaries much easier and better life. It has supported the livelihoods and clearly it is seen that now people are more active themselves to decrease poverty. Donor projects as the one studied can provide the means for poverty reduction and together with the determination of the people poverty can be conquered. There is a clear signal that people are willing to develop themselves and increase their household status when there are examples present from their own friends, relatives and neighbors who are not poor anymore.

Laos is most definitely living a period of great changes and the country will inevitably develop in the years to come. The task to electrify 90 percent of the country and getting rid of the Least Developed Country (LDC) status by 2020 is a hard but hopefully realistic plan. Much of the future of the country though depends on the choices it makes at present. How will the energy sector develop and what are the paths it chooses? Whether there will be large scale exploitation of the country's water resources and what will be the effects of it to its people and natural environment or what will be the role of the more sustainable alternatives and renewable energy. Have all the decisions been made already and how to have an influence on these decisions? No-one can answer these questions, but as long as the major developments of the mother of the rivers, Mekong and its tributaries has not taken place there is a chance to have an influence on the way they are implemented.

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## APPENDICES

### Appendix 1. Question set 1

#### **Part 1. Basic facts of the electrified villages: Village leader interviews (6+1 interviews)**

#### **ພາກທີ 1. ຂໍ້ມູນພື້ນຖານ ຂອງການຕິດຕັ້ງໄຟຟ້າໃນໝູ່ບ້ານ: ສຳພາດນາຍບ້ານ (ສຳພາດ 6+1)**

1. Village name, District , Province ຊື່ບ້ານ, ເມືອງ, ແຂວງ
2. How many people live in the village? ປະຊາຊົນຢູ່ໃນບ້ານນີ້ ມີທັງໝົດເທົ່າໃດ?
3. What is the total amount of Households in the village? ຢູ່ໃນບ້ານນີ້ມີທັງໝົດຈັກຫຼັງຄາເຮືອນ
4. What are the main occupations in the village? (farming, fishing, cattle raising, business, industry, etc.). ອາຊີບຫຼັກຂອງປະຊາຊົນຢູ່ໃນບ້ານແມ່ນຫຍັງ (ເຮັດນາ, ລ້ຽງປາ, ລ້ຽງງົວຄວາຍ, ທຸລະກິດ, ເຮັດວຽກຢູ່ໂຮງງານ ແລະ ອື່ນໆ)  
Is there seasonal variation in the livelihoods? What do people do in different times? ໃນການດຳລົງຊີວິດ ຂອງປະຊາຊົນ ມັນມີຄວາມແຕກຕ່າງກັນ ໃນ ແຕ່ລະດູການບໍ່? ຖ້າມີປະຊາຊົນເຮັດຫຍັງໃນເວລາທີ່ແຕກຕ່າງກັນ?
5. What has changed due to access to electricity? How life was before and how is life now? In what sense? Has electrification contributed to the livelihoods of the villagers? How? ມີຫຍັງປ່ຽນແປງບໍ່ຫຼັງຈາກໄດ້ໃຊ້ໄຟຟ້າ? ຊີວິດການເປັນຢູ່ກ່ອນ ແລະ ຫຼັງການໃຊ້ໄຟຟ້າເປັນຄື ແນວໃດ? ຖ້າປ່ຽນແປງ , ປ່ຽນແປງ ແນວໃດ? ການນຳໃຊ້ໄຟຟ້າໄດ້ມີສ່ວນເຮັດໃຫ້ຊີວິດການເປັນຢູ່ຂອງປະຊາຊົນດີຂຶ້ນບໍ່?
6. How many households have access to electricity? Who are connected to grid, who are not? What are the reasons behind not connecting to or leaving from grid? (too expensive, don't need it, not reliable, other reasons) ຢູ່ໃນໝູ່ບ້ານ, ມີຈັກຄົວເຮືອນທີ່ໄດ້ຕິດຕັ້ງໄຟຟ້າ? ມີລາຍຊື່ຂອງ ຄົວເຮືອນທີ່ໄດ້ຮັບໄຟຟ້າຈາກສາຍລິ້ງໂດຍກົງ ແລະ ລາຍຊື່ຄົວເຮືອນທີ່ບໍ່ໄດ້ຮັບຈາກສາຍລິ້ງໂດຍກົງບໍ່? ສາຍເຫດຫຍັງຈຶ່ງບໍ່ໄດ້ຕໍ່ກັບສາຍລິ້ງໂດຍກົງ? (ຍ້ອນວ່າແພງໂພດ, ໃຊ້ບໍ່ດີ ແລະ ສາຍເຫດອື່ນໆ)
7. What are the most positive/negative aspects of having electricity? What is electricity used for? ການນຳໃຊ້ໄຟຟ້າ ມີຜົນດີ ຫຼື ຜົນເສຍແນວໃດ? ໄດ້ ນຳໃຊ້ໄຟຟ້າເຮັດຫຍັງແດ່?
8. What is the most common energy source used for cooking, heating, lighting? Any/what kind of change after the electrification? (e.g. rice cookers) ຢູ່ໃນຄົວເຮືອນ, ໃຊ້ພະລັງງານປະເພດໃດເພື່ອ ແຕ່ງກິນ, ໃຫ້ຄວາມຮ້ອນ ແລະ ແສງສະຫວ່າງ? ຫຼັງຈາກໃຊ້ໄຟຟ້າແລ້ວ, ມີຫຍັງປ່ຽນແປງບໍ່? (ຕົວຢ່າງ ໝໍ້ຫຼຸງເຂົ້າ.)
9. Do people have access to education/health services? Has there been any change in the situation since electrification? Where are the nearest schools and clinics? ຊາວບ້ານໄດ້ເຂົ້າໂຮງຮຽນບໍ່ ຫຼື ມີສຸກສາລາໃຫ້ນຳໃຊ້ບໍລິການບໍ່? ຫຼັງຈາກໃຊ້ໄຟຟ້າແລ້ວ, ມີຫຍັງປ່ຽນແປງບໍ່?
10. What are/ what would be the main benefits from electricity for schools or health clinics? ໄຟຟ້າໄດ້ໃຫ້ປະໂຫຍດຫຍັງ ກັບໂຮງຮຽນ ຫຼື ສຸກສາລາ.
11. Are there any income generating businesses in the village? Existing and after electrification new economic activities/businesses? Has there been a change compared to situation before electricity? ຢູ່ໃນໝູ່ບ້ານມີລາຍຮັບທາງດ້ານທຸລະກິດໃດໜຶ່ງບໍ່? ມີກິດຈະການໃດທີ່ມີຢູ່ແລ້ວກ່ອນຕິດຕັ້ງໄຟຟ້າບໍ່? ຫຼັງຈາກຕິດຕັ້ງໄຟຟ້າແລ້ວ ມີກິດຈະການໃໝ່ເກີດຂຶ້ນບໍ່?
12. Do people have access to credit or banking services in the village? ຊາວບ້ານ ສາມາດນຳໃຊ້ບັດ ເຄຣດິດ, ຫຼື ບໍລິການຂອງທະນາຄານ ໃນບ້ານໄດ້ບໍ່?
13. Are there subsidies for households that are not able to pay? What would be needed? Are there any special supporting mechanisms to the households in need? If has, how sure what subsidies for? ມີຄ່າໃຊ້ຈ່າຍຫຍັງທີ່ກ່ຽວ

ກັບການຕິດຕັ້ງ ຫຼື ນຳໃຊ້ໄຟຟ້າທີ່ຄົວເຮືອນບໍ່ສາມາດຈ່າຍໄດ້ບໍ່? ຖ້າມີແມ່ນຄ່າໃຊ້ຈ່າຍຫຍັງທີ່ຈ່າຍບໍ່ໄດ້? ໄດ້ຮັບການຊ່ວຍເຫຼືອຈາກພາກສ່ວນໃດໜຶ່ງບໍ່? ຖ້າມີ ການຊ່ວຍເຫຼືອນັ້ນມີຄວາມແນ່ນອນຫຼາຍປານໃດ?

- 14. Has there been any change in agricultural activities after electrification? What kind of changes? (e.g. machinery, water pumping, rice mills) ທາງດ້ານວຽກງານກະສິກຳ ມີຫຍັງປ່ຽນແປງບໍ່ ຫຼັງຈາກມີການຕິດຕັ້ງໄຟຟ້າ? (ຕົວຢ່າງ: ການນຳໃຊ້ ເຄື່ອງກິນຈັກຕ່າງໆ, ເຄື່ອງດູດນ້ຳ, ໂຮງສີເຂົ້າ)
- 15. Is the river used for fishing? If not, why not? If yes why? How do the fishermen see the dam? ໄດ້ຫາປາໃນແມ່ນ້ຳມອງບໍ່? ຖ້າບໍ່, ຍ້ອນຫຍັງຈຶ່ງບໍ່ຫາ? ຖ້າຫາ, ຍ້ອນຫຍັງ? ຊາວປະມົງຄົດແນວໃດຄິດແນວໃດ ກ່ຽວກັບເຄື່ອນນ້ຳມອງ?
- 16. What kind of changes there has been with the river after the introduction of hydropower plant? ມີການປ່ຽນແປງຫຍັງແດ່ເກີດຂຶ້ນຫຼັງຈາກມີການສ້າງເງື່ອນແລ້ວ.
- 17. Are there any changes in the amounts/quality/species of fish/water resources? What kind of changes? What are the reasons behind? ມັນໄດ້ມີການປ່ຽນແປງຫຍັງບໍ່ທາງດ້ານປະລິມານ/ຄຸນນະພາບຫຼືຊະນິດຂອງປາ ຫຼື ແຫຼ່ງນ້ຳບໍ່? ແມ່ນການປ່ຽນແປງແບບໃດ? ເຫດຜົນເບື້ອງຫຼັງຂອງການປ່ຽນແປງແມ່ນຫຍັງ?
- 18. How do you see the usage of the river now and before (besides fishing, e.g- traveling, transportation)? Who uses it, for what purposes? Change from before? What are the reasons? ເຈົ້າຄິດແນວໃດກ່ຽວກັບການນຳໃຊ້ແມ່ນ້ຳກ່ອນ ແລະ ຫຼັງການສ້າງເຄື່ອນ (ນອກເໜືອຈາກ ການຫາປາ, ການສັນຈອນທາງນ້ຳ ແລະ ການຂົນສົ່ງ)? ແມ່ນໃຜເປັນຜູ້ໃຊ້ແມ່ນ້ຳ? ໃຊ້ເພື່ອຫຍັງ?
- 19. Where does the village get its water from? Change to previous situation, and the reason for the change? What kind of change? Time use for washing the clothes/fetching water? Is electricity used for water pumping and irrigation? ຢູ່ໃນໝູ່ບ້ານເອົານ້ຳແຕ່ໃສມາໃຊ້ພາຍໃນຄົວເຮືອນ? ມີຫຍັງແມ່ນແປງຈາກເມື່ອກ່ອນບໍ່, ແລະສາເຫດຂອງການປ່ຽນແປງແມ່ນຫຍັງ? ແມ່ນການປ່ຽນແປງແນວໃດ? ເວລາໃຊ້ໃນການຊັກເຄື່ອງ/ຕັກນ້ຳເດມີຫຍັງປ່ຽນແປງບໍ່? ໄດ້ນຳໃຊ້ໄຟຟ້າເຂົ້າໃນການດູດນ້ຳ ແລະ ຊົນລະປະທານບໍ່?
- 20. Can/How do people utilize the forests? What are the activities? Has there been any change after electrification? How is the condition of the forests? Any changes in this? What changes? Why? ປະຊາຊົນສາມາດນຳໃຊ້ປ່າໄດ້ບໍ່? ນຳໃຊ້ແນວໃດ? ນຳໃຊ້ສຳຫຼັບກິດຈະກຳຫຍັງແດ່? ມີຫຍັງປ່ຽນແປງບໍ່ຫຼັງຈາກມີໄຟຟ້າໃຊ້? ຖ້າມີ, ສະພາບຂອງປ່າເດ ເປັນແນວໃດມີຫຍັງປ່ຽນແປງບໍ່? ຖ້າມີ, ແມ່ນຫຍັງທີ່ປ່ຽນແປງ? ຍ້ອນສາເຫດຫຍັງ?
- 21. How are the roads to markets? Can and how do the villagers enter the markets? Distance to the market places? What is sold, to whom? (rainy/dry season) ຖະໜົນຫົນທາງໄປຕະຫຼາດເດ ເປັນແນວໃດ? ຊາວບ້ານໄປມອດມາເຖິງຕະຫຼາດຢູ່ບໍ່? ໄລຍະທາງແຕ່ໝູ່ບ້ານຫາຕະຫຼາດໂກປານໃດ? ແມ່ນຫຍັງທີ່ຊາວບ້ານນຳເອົາໄປຂາຍ? ຂາຍໃຫ້ໃຜ? (ໃນລະດູແລ້ງ/ລະດູຝົນ)
- 22. How do you see the access to communication and entertainment services (telephone, internet, TV, Radio, )? Positive and negative effects (culture, spiritual life)? What kind of impacts does it have to community? How big portion of the income is used for entertainment? What are the first purchases that use electricity (rice cookers, TV, Video, Karaoke set, etc)? ເຈົ້າຄິດແນວໃດກ່ຽວກັບການບໍລິການທາງດ້ານການຊື້ສານ ແລະ ຄວາມບັນເທີງຕ່າງໆ (ຕົວຢ່າງ ການໃຊ້ ໂທລະສັບ, ອິນເຕີເນັດ, ໂທລະພາບ, ວິທະຍຸ)? ມີການປ່ຽນແປງທາງດ້ານດີ ແລະ ດ້ານລົບ ແນວໃດ (ທາງດ້ານວັດຖະນະທຳ ແລະ ຄວາມຊື່ຖື)? ສິ່ງບັນເທີງເລົ່ານັ້ນມີຜົນກະທົບແນວໃດຕໍ່ຊຸມຊົນ? ໄດ້ໃຊ້ເງິນຫຼາຍປານໃດກັບສິ່ງໃຫ້ຄວາມບັນເທີງເລົ່ານັ້ນ? ຢູ່ໃນຊຸມຊົນ, ຊາວບ້ານຊື້ວັດຖຸອຸປະກອນຫຍັງທີ່ໃຊ້ໄຟຟ້າອັນທຳອິດ (ໝໍ້ຫຼຸງເຂົ້າ, ໂທລະພາບ, ວີດີໂອ, ຊຸດເຄື່ອງຫຼິ້ນຄາລາໂອເກ ແລະ ອື່ນໆ)
- 23. Do people see new electronic appliances desirable? Does it increase their status? ອຸປະກອນເຄື່ອງໃຊ້ໄຟຟ້າເປັນທີ່ດຶງດູດຈິດໃຈຂອງປະຊາຊົນບໍ່? ມັນໄດ້ເຮັດໃຫ້ສະຖານະພາບທາງສັງຄົມຂອງເຂົາເຈົ້າດີຂຶ້ນບໍ່?
- 24. Who do you think benefits the most from electrification? Why? ເຈົ້າຄິດວ່າໄຟຟ້າໃຫ້ຄຸນປະໂຫຍດສູງສຸດຫຍັງຕໍ່ເຈົ້າ? ຍ້ອນຫຍັງ?

25. Who benefits the least from electricity? Why? ແມ່ນໃຜທີ່ໄດ້ຮັບຜົນປະໂຫຍດໜ້ອຍຊຸດຈາກໄຟຟ້າ? ຍ້ອນຫຍັງ?
26. How about the poorest households? How do you see they have benefitted from the electrification? ສຳລັບຄົວເຮືອນທີ່ທຸກຍາກທີ່ສຸດເດ ເປັນແນວໃດ? ເຈົ້າຄິດວ່າພວກເຂົາເຈົ້າໄດ້ຮັບຜົນປະໂຫຍດຫຍັງຈາກໄຟຟ້າ?
27. Have there been any particular or special benefits for women and children, at the village or household level because of electricity? If so, please give examples (security, flexibility in scheduling household chores, better quality light for study or reading)? ໄຟຟ້າໄດ້ມີຜົນປະໂຫຍດທີ່ສະເພາະເຈາະຈົງ ຫຼື ພິເສດສຳລັບແມ່ຍິງ ແລະ ເດັກໜ້ອຍໃນໝູ່ບ້ານ ຫຼື ຄົວເຮືອນບໍ່? ຖ້າມີ ກະລຸນາຍົກຕົວຢ່າງ (ເລື່ອງຄວາມປອດໄພ ສາມາດເລືອກເວລາໃນການເຮັດວຽກເຮືອນ, ຄຸນນະພາບຂອງແສງສະຫວ່າງ ສຳລັບຮຽນໜັງສື ຫຼື ການອ່ານ ດີຂຶ້ນ)
28. Do you think the electricity project has been implemented successfully? What do you see the as the main reasons for success/failure? ເຈົ້າຄິດວ່າໂຄງການເຂື່ອນນໍ້າຕົກໄຟຟ້າໄດ້ຮັບຜົນສຳເລັດດີບໍ່? ຍ້ອນຫຍັງເຈົ້າຈຶ່ງຄິດວ່າມັນໄດ້ຮັບຜົນສຳເລັດ/ຫຼືບໍ່ໄດ້ຮັບຜົນສຳເລັດ?
29. How do you see the possible connection for the main grid in the future? (better/worse) Why? ເຈົ້າຄິດວ່າຄວາມເປັນໄປໄດ້ໃນການຕໍ່ໄປຈາກສາຍສົ່ງໂດຍກົງໃນອານາຄົດຈະດີຂຶ້ນ ຫຼື ຂີ້ຮ້າຍກ່ວາເກົ່າ?
30. Are there any hopes or wishes for the future for the village? Why and What? Any other interesting matters in the villages? (changes/opportunities/problems/concerns) ໃນອານາຄົດມີຄວາມຄາດຫວັງຫຍັງ ສຳລັບໝູ່ບ້ານບໍ່ ແລະ ຍ້ອນ ຫຍັງ? ມີຫຍັງອັນອື່ນໃນໝູ່ບ້ານທີ່ໜ້າສົນໃຈບໍ່ (ມີບັນຫາ/ໂອກາດ/ບັນຫາ/ສິ່ງທີ່ໜ້າເປັນຫ່ວງ)?



### Appendix 2. Question set 2

#### Part 2. Household interviews with the villagers (20+ interviews: Three subgroups (Those with electricity and benefit, those with electricity but no remarkable benefit, those without electricity)

#### ພາກທີ2. ການສຳພາດຄົວເຮືອນກັບຊາວບ້ານ (ສຳພາດ 2030: 3 ກຸ່ມຍ່ອຍຄື ກຸ່ມທີ່ໄດ້ຮັບຜົນປະໂຫຍດຈາກໄຟຟ້າ, ກຸ່ມທີ່ນຳໃຊ້ໄຟຟ້າແຕ່ບໍ່ໄດ້ຮັບຜົນປະໂຫຍດອັນພົ້ນເດັ່ນ ແລະ ກຸ່ມທີ່ບໍ່ໄດ້ໃຊ້ໄຟຟ້າ)

1. How many people are there in this household? (Adults, children) ຢູ່ໃນຄົວເຮືອນນີ້ ມີທັງໝົດຈັກຄົນ? (ເດັກນ້ອຍຈັກຄົນ, ຜູ້ໃຫຍ່ຈັກຄົນ)
2. Do the children go to school? Do/can you use health services (clinics)? Why? ເດັກນ້ອຍໄປໂຮງຮຽນບໍ່? ຄົວເຮືອນເຈົ້າໄດ້ໃຊ້ບໍລິການສຸກສາລາ ຫຼື ຄຣິນິກບໍ່?
3. What is your main occupation? What other activities do you do? Is there seasonal variation in the activities? What? - ອາຊີບຫຼັກຂອງເຈົ້າແມ່ນຫຍັງ? ເຈົ້າເຮັດກິດຈະກຳອື່ນໆບໍ່? ມີວຽກໃດທີ່ຕ້ອງເຮັດຕາມລະດູການບໍ່? ຖ້າມີ ແມ່ນອາຊີບຫຍັງ?
4. How much is your monthly income and expenditure? ລາຍຮັບ ແລະ ລາຍຈ່າຍຂອງຄົວເຮືອນເຈົ້າຕໍ່ເດືອນແມ່ນເທົ່າໃດ?
5. How much do you spend on energy monthly? ເຈົ້າໃຊ້ສຳລັບພະລັງງານຕໍ່ເດືອນຫຼາຍປານໃດ?
6. What are the main energy sources of energy for cooking, heating, lighting, other activities? ແຫຼ່ງພະລັງງານຕົ້ນຕໍໃນການ ແຕ່ງກິນ, ໃຫ້ຄວາມຮ້ອນ, ແສງສະຫວ່າງ ແລະ ກິດຈະກຳອື່ນແມ່ນຫຍັງ?
7. a. Is the household connected to electricity? Why? Have you been connected to electricity earlier? What are the reasons behind having electricity or not having electricity? ກ. ຄົວເຮືອນຂອງເຈົ້າໄດ້ເອົາໄຟຟ້າເຂົ້າເຮືອນບໍ່? ເຫດຜົນທີ່ເອົາໄຟຟ້າເຂົ້າແມ່ນຍ້ອນຫຍັງ? ຫຼືຍ້ອນສາເຫດຫຍັງຈຶ່ງບໍ່ເອົາໄຟຟ້າເຂົ້າ?

*7b Households with electricity ຄົວເຮືອນທີ່ມີໃຊ້ໄຟຟ້າ*

1. Do you have electricity all day long? Does the demand/supply for energy vary during the year? Why? ເຈົ້າມີໄຟຟ້າໃຊ້ຕະຫຼອດວັນບໍ່? ປະລິມານການຊົມໃຊ້ ແລະ ການຕອບສະໜອງຄວາມຕ້ອງການໄຟແຕກຕ່າງກັນບໍ່ໃນຕະຫຼອດປີ?
2. How do you see the price of electricity? What is the monthly expenditure to electricity? ເຈົ້າຄິດແນວໃດກ່ຽວກັບຄ່າໄຟຟ້າ? ຈ່າຍຄ່າໄຟຟ້າເດືອນໜຶ່ງຫຼາຍປານໃດ?
3. Is there enough electricity to meet the household demand? If not, why more? Able to pay for more? ມີກະແສໄຟຟ້າພຽງພໍສຳລັບຄວາມຕ້ອງການໃຊ້ໄຟໃນຄົວເຮືອນບໍ່?
4. What are the most important uses for electricity? (Lighting, TV/radio, water pumping, refrigerator) –ແມ່ນມີຄວາມສຳຄັນສຸດໃນການໃຊ້ໄຟຟ້າ? (ແສງສະຫວ່າງ, ໂທລະພາບ/ວິທະຍຸ, ການດູດນ້ຳ, ຕູ້ເຢັນ)
5. How was fuel and energy use prior to improved electricity services, including energy from all sources, such as candles, biomass, batteries, the electric grid, diesel generator sets, etc. What has changed? ນັ້ນມັນ ແລະ ພະລັງງານທີ່ເຄີຍໃຊ້ໃນການປັບປຸງການຊົມໃຊ້ໄຟຟ້າ ລວມໄປເຖິງທຸກໆແຫຼ່ງພະລັງງານເຊັ່ນ: ທຽນ, ຫຼວາຟິນ, ຖ່ານສາກ, ການຕໍ່ໄຟຟ້າຈາກສາຍໂດຍກົງ, ການໃຊ້ບັນໄຟກະຊວນ, ແລະ ອື່ນໆ.
6. How big portion of the income is used for entertainment? What are the first purchases that use electricity (rice cookers, TV, Video, Karaoke set, etc)? ເຈົ້າ ໄດ້ໃຊ້ເງິນຫຼາຍປານໃດກັບສິ່ງໃຫ້ຄວາມບັນເທີງ? ເຈົ້າຊື້ວັດຖຸອຸປະກອນຫຍັງທີ່ໃຊ້ໄຟຟ້າເປັນອັນທຳອິດ (ໝໍ້ຫຼຸງເຂົ້າ, ໂທລະພາບ, ວີດີໂອ, ຊຸດເຄື່ອງຫຼິ້ນຄາລາໂອເກ ແລະ ອື່ນໆ)

8. How would you describe your/your spouse's/your children's time use during the day? (activities)Any change after electrification? ຜິວ/ເມຍ ແລະ ລູກຂອງເຈົ້າໃຊ້ເວລາເຮັດຫຍັງໃນເວລາກາງເວັນ? ໄດ້ມີການປ່ຽນແປງຫຍັງບໍ່? ຫຼັງຈາກ ການຕິດຕັ້ງໄຟຟ້າ?
9. How often/ much time is used to collect fire wood? ຄອບຄົວຂອງເຈົ້າໃຊ້ເວລາຫຼາຍປານໃດ ເມື່ອໄປຊອກຫາຟັນ ແລະ ໄປເລື້ອຍປານໃດ?
10. Do you work or do other activities after dark? What? Has this changed with the introduction of electricity? ຄົວຄອບຂອງເຈົ້າເຮັດກິດຈະກຳຫຍັງໃນເວລາການຄືນບໍ່? ມີຫຍັງປ່ຽນແປງບໍ່ຫຼັງຈາກມີໄຟຟ້າໃຊ້?

11. How did your life change when the electricity came to the village? (activities, introduction to new things etc) ຊີວິດການເປັນຢູ່ຂອງຄອບຄົວເຈົ້າມີການປ່ຽນແປງແນວໃດຫຼັງຈາກມີໄຟເຂົ້າຮອດໝູ່ບ້ານຂອງເຈົ້າ? (ມີກິດຈະການໃໝ່ໆໃນໝູ່ບ້ານບໍ່)?
12. Do you think the electricity project has been implemented successfully? What do you see the as the main reasons for success/failure? ເຈົ້າຄິດວ່າໂຄງການເຂື່ອນນ້ຳຕົກໄຟຟ້າໄດ້ຮັບຜົນສຳເລັດດີບໍ່? ຍ້ອນຫຍັງເຈົ້າຈຶ່ງຄິດວ່າມັນໄດ້ຮັບຜົນສຳເລັດ/ຫຼືບໍ່ໄດ້ຮັບຜົນສຳເລັດ?
13. Have you been able to increase your income as a result of electrification? If so, how? (crafts, household industry, restaurant, other)? ລາຍຮັບຂອງຄົວຄອບເຈົ້າ ເພີ່ມຂຶ້ນບໍ່ຫຼັງຈາກເອົາໄຟຟ້າເຂົ້າເຮືອນ? ຖ້າມີ, ແມ່ນມີຄືແນວໃດ? (ເຄື່ອງຫັດຖະກຳ, ກິດຈະການຂະໜາດຄອບຄົວ, ຮ້ານອາຫານ ແລະ ອື່ນໆບໍ່)?
14. Are there any income generating businesses in the village? Existing and after electrification new economic activities/businesses? Has there been a change compared to situation before electricity? ຢູ່ໃນໝູ່ບ້ານມີລາຍຮັບທາງດ້ານທຸລະກິດໃດໜຶ່ງບໍ່? ມີກິດຈະການໃດທີ່ມີຢູ່ແລ້ວກ່ອນຕິດຕັ້ງໄຟຟ້າບໍ່? ຫຼັງຈາກຕິດຕັ້ງໄຟຟ້າແລ້ວ ມີກິດຈະການໃໝ່ໆເກີດຂຶ້ນບໍ່?
15. Do you have access to credit or banking services? Are there subsidies for households that are not able to pay? What would be needed? Are there any special supporting mechanisms to the households in need? ເຈົ້າ ສາມາດນຳໃຊ້ບັດເຄຣດິດ, ຫຼື ບໍລິການຂອງທະນາຄານ ໃນບ້ານໄດ້ບໍ່? ມີກິນໄກໄດ້ຮັບການຊ່ວຍເຫຼືອຄອບຄົວໃດໜຶ່ງທີ່ເຈົ້າຕ້ອງການບໍ່?
16. For what purposes do you/your household use the river (before and now, if different)? Fishing, irrigation(water pumping)? Where do you get your drinking water, washing water? Transportation? Has there been any change in these activities after the power plant? Have there been changes in the river amounts/quality/species of fish/water resources? What kind of changes and why? ຄອບຄົວເຈົ້າໄດ້ນຳໃຊ້ນ້ຳມອງເຮັດຫຍັງບໍ່? (ຫຼັງຈາກທີ່ມີເຄື່ອນນ້ຳມອງແລ້ວມີການປ່ຽນແປງຫຍັງບໍ່) ການຫາປາ, ເໝືອງຜາຍ, (ການໂປ້ມນ້ຳ)? ເຈົ້າເອົານ້ຳກິນ,ນ້ຳໃຊ້ມາແຕ່ໃສ? ການຄົມມະນາຄົມທາງນ້ຳເດ ເປັນແນວໃດຫຼັງຈາກມີເຂື່ອນ? ມັນໄດ້ມີການປ່ຽນແປງຫຍັງບໍ່ທາງດ້ານປະລິມານ/ຄຸນນະພາບຫຼືຊະນິດຂອງປາ ຫຼື ແຫຼ່ງນ້ຳບໍ່? ແມ່ນການປ່ຽນແປງແບບໃດ?ເຫດຜົນເບື້ອງຫຼັງຂອງການປ່ຽນແປງແມ່ນຫຍັງ?
17. Have you seen any change in agricultural activities after electrification? What kind of changes? (e.g. machinery, water pumping, rice mills)? Have you benefited from the change? ທາງດ້ານວຽກງານກະສິກຳ ມີຫຍັງປ່ຽນແປງບໍ່ ຫຼັງຈາກມີການຕິດຕັ້ງໄຟຟ້າ? (ຕົວຢ່າງ: ການນຳໃຊ້ ເຄື່ອງກົນຈັກຕ່າງໆ, ເຄື່ອງດູດນ້ຳ, ໂຮງສີເຂົ້າ)
18. Can/How do you/your household utilize the forests? What are the activities? Has there been any change after electrification? How is the condition of the forests? Any changes in this? What changes? Why? ຄອບຄົວຂອງເຈົ້າ ສາມາດນຳໃຊ້ປ່າໄດ້ບໍ່? ນຳໃຊ້ແນວໃດ? ນຳໃຊ້ສຳຫຼັບກິດຈະກຳຫຍັງແດ່? ມີຫຍັງປ່ຽນແປງບໍ່ຫຼັງຈາກມີໄຟຟ້າໃຊ້? ຖ້າມີ, ສະພາບຂອງປ່າເດ ເປັນແນວໃດມີຫຍັງປ່ຽນແປງບໍ່? ຖ້າມີ, ແມ່ນຫຍັງທີ່ປ່ຽນແປງ? ຍ້ອນສາເຫດຫຍັງ?
19. How are the roads to markets? Can and how do you/your household enter the markets? Distance to the market places? What is sold, to whom? (rainy/dry season) ຖະໜົນຫົນທາງໄປຕະຫຼາດເດ ເປັນແນວໃດ? ຄອບຄົວໄປມອດມາເຖິງຕະຫຼາດຢູ່ບໍ່? ໄລຍະທາງແຕ່ໝູ່ບ້ານຫາຕະຫຼາດໄກປານໃດ? ແມ່ນຫຍັງທີ່ຊາວບ້ານນຳເອົາໄປຂາຍ? ຂາຍໃຫ້ໃຜ? (ໃນລະດູແລ້ງ/ລະດູຝົນ)
20. How do you see the access to communication and entertainment services (telephone, internet, TV, Radio, etc)? Positive and negative effects (culture, spiritual life)? What kind of impacts does it have to the community? Do people see new electronic appliances desirable? Does it increase their status? ເຈົ້າຄິດແນວໃດກ່ຽວກັບການບໍລິການທາງດ້ານການຊື້ສານ ແລະ ຄວາມບັນເທີງຕ່າງໆ (ຕົວຢ່າງ ການໃຊ້ ໂທລະສັບ, ອິນເຕີເນັດ, ໂທລະພາບ, ວິທະຍຸ)? ມີການປ່ຽນແປງທາງດ້ານດີ ແລະ ດ້ານລົບ ແນວໃດ (ທາງດ້ານວັດຖະນະທຳ ແລະ ຄວາມຊື່ຖື)? ສິ່ງບັນເທີງເລົ່ານັ້ນມີຜົນກະທົບແນວໃດຕໍ່ຊຸມຊົນ? ໄດ້ໃຊ້ເງິນຫຼາຍປານໃດກັບສິ່ງໃຫ້ຄວາມບັນເທີງເລົ່ານັ້ນ? ຢູ່ໃນຊຸມຊົນ,ຊາວບ້ານຊື່ວັດຖຸຊະນິດກອນຫຍັງທີ່ໃຊ້ໄຟຟ້າອັນທຳອິດ (ໝັ້ນຫຼືເຂົ້າ, ໂທລະພາບ, ວີດີໂອ, ຊຸດເຄື່ອງຫຼິ້ນຄາລາໂອເກ ແລະ ອື່ນໆ)

21. What do you see as the main benefits of having electricity connection? ເຈົ້າຄິດວ່າໄຟຟ້າໃຫ້ຄຸນປະໂຫຍດສູງສຸດຫຍັງຕໍ່ເຈົ້າ? ຍ້ອນຫຍັງ?
22. Are there any disadvantages that came with electricity? ການມີໄຟຟ້າໃຊ້ມີຂໍ້ເສຍຫຍັງບໍ່? ຖ້າມີ ແມ່ນຫຍັງ?
23. Who do you think benefits the most from electrification? Why? ເຈົ້າຄິດວ່າແມ່ນໃຜໄດ້ຮັບປະໂຫຍດສູງສຸດຈາກການນຳໃຊ້ໄຟຟ້າ?
24. Who benefits the least from electricity? Why? ແມ່ນໃຜທີ່ໄດ້ຮັບຜົນປະໂຫຍດໜ້ອຍຊຸດຈາກໄຟຟ້າ? ຍ້ອນຫຍັງ?
25. Have there been any particular or special benefits for women and children, at the village or household level because of electricity? If so, please give examples (security, flexibility in scheduling household chores, better quality light for study or reading)? ໄຟຟ້າໄດ້ມີຜົນປະໂຫຍດທີ່ສະເພາະເຈາະຈົງ ຫຼື ພິເສດສຳລັບແມ່ຍິງ ແລະ ເດັກນ້ອຍໃນໝູ່ບ້ານ ຫຼື ຄົວເຮືອນບໍ່? ຖ້າມີ ກະລຸນາຍົກຕົວຢ່າງ (ເລື່ອງຄວາມປອດໄພ ສາມາດເລືອກເວລາໃນການເຮັດວຽກເຮືອນ, ຄຸນນະພາບຂອງແສງສະຫວ່າງ ສຳລັບຮຽນໜັງສື ຫຼື ການອ່ານ ດີຂຶ້ນ)
26. How do you see the possible connection for the main grid in the future?(better/worse) Why? ເຈົ້າຄິດວ່າຄວາມເປັນໄປໄດ້ໃນການຕໍ່ໄປຈາກສາຍສົ່ງແຫ່ງຊາດໃນອານາຄົດຈະດີຂຶ້ນ ຫຼື ຂີ້ຮ້າຍກ່ວາເກົ່າ?
27. Do you have any future hopes or wishes for your family? Why? Any other interesting matters ? (changes/opportunities/problems/concerns) ໃນອານາຄົດມີຄວາມຄາດຫວັງຫຍັງ ສຳລັບໝູ່ບ້ານບໍ່? ຍ້ອນຫຍັງ? ມີຫຍັງອັນອື່ນໃນຄອບຄົວຂອງເຈົ້າທີ່ໜ້າສົນໃຈບໍ່ (ມີບັນຫາ/ໂອກາດ/ບັນຫາ/ສິ່ງທີ່ໜ້າເປັນຫ່ວງ)?

### Appendix 3. Focus group discussion in Phon Home

#### Life before electricity

It was very difficult before electricity. We had to use lamps to go around the village in the dark. Women had to work during the night with the help of kerosene lamp, it was also very difficult to cook at night. Nowadays with electricity it [life] has become very much easier.

Before [electricity] we needed to use fuel wood for cooking and lighting. Before we had to mill the rice by hand, keep the rice bag on the other shoulder and mill at the same time. We also had only one TV in the village, and before that [TV] we used to gather to play the tin boxes like drums and dance. That was entertainment before.

Bamboo was used to make water containers, but we could not fit much water in these containers, and we had to go many times (4-5 day) for collecting enough water to be used. The place to get the water was also distant from the village. There was no water pumping for water. We had a lot of lung cancer and eye infections because of the smoke inside the houses. This was very bad; we were coughing all the time. Also when eating we had to keep one hand to hold on the fuel wood, and another use for eating. Often ash dropped to the food and tears were running [on the cheeks] because of smoke. When making a fire we had to blow to the fire and we often got ash into the lungs. We believed that these diseases originated from a house ghost that had come to the house, but now we know that it was because of the smoke.

We had to go very far to get fuel wood and water, mainly women and children had to go and collect fuel wood and after the electricity came the workload for women reduced a lot. It took a long time to gather the fuel wood; sometimes they had to walk 1-2 hours to get enough fuel wood up and down the mountains to find enough. During the rainy season the paths were very slippery and had a lot of leeches and snakes. All of these burdens of collecting fuel wood and water gathering were on women's shoulders because the men went for hunting and getting food. Women had to get a lot of fuel wood before.

It also took a long time to mill the rice and it was difficult because they [women] had to make this by hand, for milling 5 kilos of rice it took 2 hours. After milling they would get white rice 3 kilos out of 5 kilos non-grained rice. This amount was only enough for a big family for breakfast for 10 people. Women had to get up at 3-4 am to mill the rice and now they have a choice to mill the rice around 6 or 7 am. It was really hard to do rice milling before and now it is just one click.

For studying we had to have 3-5 people in a group, three pieces of fuel wood had to be put together to make enough light, and then read together, and it was still hard to read because of smoke from fuel wood going into our eyes. Also fan was your own hand.

The situation with smoke has improved a lot, because before the electricity the smoke was going everywhere in the house and now the smoke is only in the kitchen, because we don't have to use it for lighting. We also have now fans to take away the smoke. Now we can cook and let the fire off when ready whereas in the time before the electricity we had to have fire for light for the whole night.

#### Life after electricity

Communication has totally changed; now everything is very modern compared with before. Before we had to communicate by letters or travel to deliver a message and now we can just call. We can listen to nice music and use fans and rice cookers. During events in the village, we can use all electronic entertainment devices. Electricity has many benefits like water pumping and making living conditions of local people better in the whole village. Now we can boil water easily, have cold or hot drinks to drink, get information and news from the TV and know what is going on outside the community. Now we have TVs and CDs and life is very enjoyable. We can also observe different dances and events from other countries. TV also changes the traditions and we learn from other cultures. Before the kids were very scared of foreigners but now they are not scared anymore. It seems their brain development is faster and now they play games and know a lot about computers and mobiles. With TV everything is more convenient; we learn from trading and it improves our social connections with other people. We see life many tens of percentages better.

Now with electricity, we can teach our kids at night, and the kids can learn with their own age group. Now they start grade 1 at 6 years old and they can have breakfast before going to school. Before they were already 15 year old when they started grade 1. There are many changes because of using electricity in the households.

Before we built houses by hand and now we have electric wood cutters and smootheners so we have more beautiful houses. Apart from that, it is convenient to go around into the villages when everything is so bright! Before during the village meeting at night it was very dark everywhere. Kids also used fuel wood for lighting before and sometimes we had fires because the grass roofs burned easily

The workload of the past does not exist anymore. We have more time as we don't have to go collecting water. Also in the case of emergency they can just call and get help. There is no need to go to the river, we can shower at home.

Women have now more spare time and they can watch TV and work also during the night. They can start cooking or working immediately. Before they had a lamp for lighting but wind would blow out the flame. Now in the early morning when women get up to cook, they just can turn on the light. Before, to get the light they had to look for a lighter in the dark before they could start making fire, and if one house had fire, then the others went to get the fire from there. It [electricity] is reducing workload for women because before they used a lot of fuel wood for cooking and heating. Now there is a choice, and they don't have to do something as before, women can choose to go for collecting fuel wood or not to go collecting fuel wood. They don't need to spend much time on collecting wood anymore. They go there only when they feel missing the activity they have done before and go there for collecting wood for exercises.

There are now more activities to do and businesses; noodle factory, restaurants and guesthouses can use cooling systems and electric pots and lights. We also have more choices e.g. on how to mill, with diesel generator or electricity, pump water or carry water.

Now we have more time and people also go to other places to find more income. Before it was 12 hours per day for work, but now there is more time and no need to collect water that saves 2 hours [daily] of productive time or the time saved from rice milling. Now people have better health condition because they reduce doing heavy work and they can go to bed later so it feels like the time has extended. Houses are now cleaner and workloads are smaller.

What we would now need is to have skills and training on how to make money from different activities (e.g. weaving) for both women and men and how to achieve a better life standard.

Why are there still poor?

They have such a limited education, no experiences or skills to make income, no money to start up productive activities and for some families there is not enough labor in their households. Furthermore they don't have water pumping for their fields and most of the poor people cannot sell any rice because they have just enough to eat. They have lack of place to cultivate, and there is nobody who would teach them to use electricity or how to have gardens, use fish or collect fruit. In the future it would be good to have industry in the area to get some labor possibilities for the poor also. The poor also don't have enough money to buy books for their children and the school in the village is only up to grade 5. The poor are not able to go further, they could also use bicycle but it is a long distance and if the bike gets broken then they don't go.

The differences in time use and use of electric lighting are the main benefits for the poor; there is an increase for productive time both in the morning and night. Poor households see others using electricity and they become very eager and motivated to get their own connection when they see their neighbors using electricity.

Modified focus group discussion at Phonhome village, three women and around eight men

## Appendix 4. Quotes

### MENTAL CHANGES

#### People are feeling better about themselves and want to develop themselves and their surroundings

*“Now it is more convenient and people are happier. Before the village people were simpler.”* - Female, Phon Home

*“ It[electricity] has helped for family development, they have a chance to see news, have new experiences, use fan in the summer time and have nice food in the fridge.”* - Village leader, male

*“We have become more independent, therefore, I feel so proud of having electricity.”* - Village leader, male

*“It makes us want to wear cleaner clothes and want to keep the house clean because we see a cleaner house on TV.”* – Male, Vangkham

*“They have learned to deal with different things such as to trade with the others, learn to do farming and learned from the outside world and the kids have become smarter...In overall the quality of life is getting better, the cleverness seems to increase among people. Before the smart or clever people were about 50 percent [of the villagers] now it is probably 80 to 90 percent, therefore the civilization has come along with them.”* - Village leader, male

#### Social status has increased with the introduction of electricity and electrical devices

*“They feel much better and it increases their status when they know what is happening outside their village [from TV].”* - Village leader, male

*“It [access to communication and information] helps kids to become smarter, now kids know how to teach their parents how to take care and have better health. It helps to improve social status too.”* - Female, Vang Kham

*“Status increases because they know more about the outside world and know what is going on, not just information on the village but also on the province.”* - Village leader, male

*“[villagers] feel proud to have electric devices and feel like their families are better off as others.”* - Village leader, male

*“[electrical devices] make the families have a better status and get respect by others.”* - Village leader, male

*“First that a majority would purchase is TV, second CD and third fan and the other equipment. In average each household would spend around from 2-3 million kip to get entertainment equipments.”* - Village leader, male

*“Their social status has increased, they feel living standard is getting higher as they get more news and information from TV, and they feel better and happier and they want to even more develop their families and village.”* - Male, Vang Hinh(VL)

*“They think electric devices make their status better.”* - Village leader, male

*“My income has increased 70 percent compared to situation before electricity. It has changed my family status from a poor family to be enough to live family, and this is a big change. It makes me proud of my family, and also the family status in the society has increased.”* – Male, Phon Home

#### Electricity has enabled access to information and learning and made communication easier within and outside the community

*“You learn from TV, and it also makes the way of thinking change. You not only hear, you can see also.”* – Male, Vang Kham

*“If comparing before and after having electricity, it is like “to die and then reborn”. Now I feel like I have more knowledge and no one can teach so much in details than TV does. I feel like I learn something new every day. I have also become calmer person. I don’t want to shout on my wife or kids anymore.”* - Male, Vang Kham

*“She is now able to get more information from the news, and there is also a change in how she thinks now compared to before. She is also able to communicate with her friends by using telephone.” - Male, Phon Home*

*“Kids tend to believe me more on what I say and tell them because they can see with their own eyes on TV of what I tell them. We can learn from TV and see other countries.” - Female, Vang Kham*

*“We can learn good lessons from TV e.g. how to grow trees and raise animals, and there is no need to go somewhere else to learn this. We can also follow the outside world information and call to the municipal offices.” - Male, Vang Kham*

*“We were like cows or water buffalos, didn’t know anything. Before, sometimes, we had to travel for two days just to deliver information or to be able to communicate with the other part of the province or district. Now we just can call.” - Village leader, male*

*“Before electricity I visited friends to exchange knowledge since there was nothing to watch such as TV. Now I can together with my family prepare stuff to sell and watch TV at the same time. Now all information that I want to know is available on TV.” - Male, Vang Kham*

*“The situation is like earth and sky, before when I needed to communicate with relatives, I had to send a letter and when I went to see or visit my cousin and sometimes they were not there so I had to wait for them. That is because there was no advance communication. I can also order stuff through phone for my shop.” - Female, Phon Home*

*“I can give a ring to him [his son] and talk to him and it makes him happy, and even if I cannot see him I can hear the voice. I can watch with my own eyes and nobody can lie to me because this is what I can see [on TV], not somebody else telling me.” - Male, Phon Home*

*“We have no phone or TV but we go to other houses to call and watch TV. We especially enjoy watching TV, it makes us happy. After watching TV we have learned to compare ourselves to other people. We enjoy different music and dance very much.” - Male, Vang Kham*

*“Electricity has helped in increasing our knowledge because we can watch TV, we get news from TV and we can learn from TV for example skills related agriculture like how to use fertilizer.” - Village leader, male*

*“The villagers get news quickly from the TV, before they had newsletters and those came always very late.” - Village leader, male*

There is a lack of information on how to use electricity safely and productively especially to support livelihood and income generation activities

*“There is a high risk for electric shock and I am afraid my kid might die.” - Male, Phon Home*

*“People are afraid of electric shocks because there is no information on how to use electricity and make the connections”. - Village leader, male*

*“They [villagers] would want training for activities on how to get more benefits to the village, especially how to use electricity to make money for example on business activities, water pumping to the rice fields and how to use electricity wisely. They would need to get information on how to cook and use electrical appliances with electricity and use electricity safely.” - Village leader, male*

*“...people don’t know how to use energy, just waste it because electricity is available all the time throughout the day, but people don’t know much how to make use of electricity to make money.” - Village leader, male*

*“If I was younger I would like to learn how to use electricity for making business.” - Male, Vang Kham*

*“I want to get trained how to turn electricity into more business opportunities.” - Female, Phon Home*

*“We need more alternative job opportunities especially for women. At the moment there are many women at the village who have no jobs.” - Female, Phon Home*

*“They would need to have skills and knowledge on to how to use the electricity for income generating activities.” - Village leader, male*

**PHYSICAL CHANGES**

**Women and children have less workload, more productive time and choices when to work, improved status and more safety after the electrification.**

*“We had a two 200 liter water containers before electricity and we had to go to Nam Mong each day to get water for twenty four times back and forth to get the containers full. It took 10 minutes back and forth for once to go and collect the water. Now we use water [pumping] services. I feel safer, nobody can come and steal from our house, I am not afraid anymore. It (electricity) gives better status for us.” - Female, Phon Home*

*“Now it is easy to clean the house at anytime and there is no need to gather water. Also my children and daughter can study at night and it reduces their workload from water gathering.” - Female, Phon Home*

*“Electricity reduces workload especially for women, it is convenient to use water with pumping and we don’t have to go to collect water. Electricity also gives better status for us.” - Female, Phon Home*

*“I can use light bulb and do weaving at night and watch TV and it is much more convenient to do things a night.” - Female, Vang Kham*

*“Especially for the women it has become more convenient, they have choices to do household work in the morning or in the evening.” - Village leader, male*

*“... [electricity] helps to reduce workload for women from traditional rice milling and they have more time to do plantation, and also they can plant ginger or corn which can be sold sometimes, and the kids can study at night, and watch TV and get more information. The kids seem to be smarter. - Village leader, male*

*“...[There are] many benefits for women and kids. It [electricity] has reduced time and work load for females on traditional rice milling, also for collecting fuel wood (also for men), the children have more time to play, because they do not have to go collecting fuel wood.” Village leader, male*

*“No more going for gathering water and no more traditional rice milling. It saves labour and time and improves life.” - Female, Vang Kham*

*“Before they [women] needed a male to accompany them or use kerosene lamp for going around. Now it is very convenient for them to go around in the village at night. Kids also can study at night.” - Village leader, male*

*“Women can work conveniently at night or early morning. Before they were afraid and needed someone to accompany them. Kids can also study at night and don’t need to use kerosene for study and they don’t get smoke into their eyes anymore. Now you can see clearer and have more safety when traveling. It also reduces workload and time.” - Male, Vang Kham*

*“Electricity reduces workload for women; before they had to carry the baby while they were milling rice with traditional rice mills. Now there is no need to use traditional rice milling or go to gather water anymore.” - Male, Vang Kham*

*“Women and children have less workload from gathering water. Carrying water is the role of women. The security is also better; they don’t need to go to the river at night to take shower as before anymore. Now they can take the shower at home and don’t have to be afraid of snakes or people.” - Village leader, male*

*“Usually women wake up very early in the morning for preparing food before going to farming. Before having electricity their life was difficult, they had to look for a lighter before they could get out of the bed. As they did not see things clearly it was difficult for them to make fires. Now with electricity their lives become much more convenient as they can see things clearly when they wake up in the early morning by just switching on the light. Now they can start working from early morning.” - Male, Vang Kham*

*“I want to use even more electricity to reduce workload of my wife”. - Male, Vang Kham*

**Children have more choices when to study, studying is easier and they have become smarter and more active**

*“After having electricity the kids became so active in their studying at night at home.” - Village leader, male*



*“Kids can study at night and because they watch TV they become smarter. For example, there might be something that we don’t know how to do, but they know and can tell us, like how to operate a cell phone.”*  
- Male, Vang Kham

*“Students have a chance to learn more and have a chance to study at night time and it is also good for the teacher because he can prepare the lesson plan during the evening.”* - Village leader, male

**Electricity has created choices when to work and given people more productive time especially in the evenings and mornings**

*“Before electricity, lives were so difficult. We had to go up and down the hills to get water and fuel wood. Now we have more choices in time to work. Now we can work both day and night.”* – Male, Vang Kham

*“During the night some people do sticky rice boxes, fish nets or study and they feel they want to develop as a household and village because they get information from the news.”* - Village leader, male

*“Before we could not do many activities related to work during the evening.”* - Male, Vang Kham

*“Lives have become much more convenient, you can choose time to work, and it is easy to work at night.”*  
– Male, Vang Kham

*“It has helped to save time. We also can work at night now.”* - Female, Vang Kham

*“Now we can work with preparing vegetables and watch TV at the same time. We stay late and enjoy life. Before if we stayed late we had to use more fuel wood to have light and that meant using more fuel wood. So we wanted to save fuel wood and went to bed earlier before.”* - Male, Vang Kham

*“At night I prepare products for the markets by dividing them from big bags into smaller. It went fine when I was younger but when I got older it is hard to see if there is no proper light.”* - Female, Phon Home

*“We have light in the shop and if somebody comes to buy something they just go outside and sell. We can have the shop open until 7 to 8 pm.”* - Male, Phon Home

*“Life is more convenient, now I can work at night. Before I had to use fuel wood for lighting and it was so smoky that my eyes got easily infected and sore. Now we can slice bamboo and do mats for rice drying and remove rice grain from their branches during the night, before we could not do this.”* - Male, Vang Kham

*“During the daytime they go working in the fields and at night time they can do handicraft work such as sticky rice boxes or Kadong, which is equipment for removing the rice skins, which they can sell.”* - Village leader, male

**Electricity has enabled increase in income through new livelihood activities and by making old livelihood activities carried out easier and quicker**

*“Before electrification, it was a difficult to run any business activities. Now there are many restaurants and guesthouses after electrification and the quality of services of these businesses has improved. There are a few new businesses in the village including a small factory to produce noodles and water pumping service providing for local people and garages for vehicle fixing.”* - Village leader, male

*“Before they had difficulties to earn any income because of lack of experience and also they had no idea how to make money. After the electricity they get more ideas to do business because they get ideas from what other countries have done. That they have seen on TV.”* - Village leader, male

*“To us, livelihood has improved about 50 percent compared to time before electricity. Now we have a new [livelihood] activity which is making and fixing furniture”.* - Female, Vang Kham

*“Electricity is also used at the fish ponds [for lighting] for fish feeding, so that the fish are eating insects [that drop into the pond]. Electricity is used for rice milling too.”* - Village leader, male

*“[villagers] use the electricity for heating to keep small chicks and piglets warm, also some households use electricity for a small motors for water pumping for personal gardens”* - Village leader, male

*“Now after the electricity they have around 80 rice mills in the families, and they use electricity for the rice mills. Also building of houses has changed, cutting and smoothing of wood has changed.”* - Village leader, male

*"Now they can build houses faster." - Male Village leader, male*

*"I have more income because electricity provides techniques [through TV] how to farm better" - Male, Vang Kham*

*"Our income has increased even up to 70 percent after having electricity because now we can use electricity into rice milling and animal raising. We can feed them at night so then they grow faster and it is also easier for us to go around at night. Lighting at the animal house also reduces thieves so we can reduce the loss of our income and that's why our household income has increased." - Male, Vang Kham*

*"Income has increased about 50 percent. We also use electricity for water pumping to our vegetables, giving more vegetables and more income." - Male, Vang Kham*

*"It [electricity] has increased our income by about 70-80 percent. Basically the income from selling rice and NTFPs trading has increased. Before my customers could only come during day time, now they can come both day and night." - Male, Vang Kham*

*"Income has increased about 50 percent. As I can get more things done at night, I can prepare more vegetables to sell in the market. As I can see things clearly it makes me more active to work at night." - Female, Vang Kham*

*"Our income has increased about 50 percent because we can produce more agricultural products." - Male, Vang Kham*

*"Our income has increased, because we can now do mats for rice drying faster, more beautifully and with better quality work so we get a better price." - Male, Vang Kham*

*"We use electricity for water pumping for watering vegetables in the garden near the village, and for rice milling." - Female, Vang Kham*

*"It is very good for the business as now I can have more customers because I can provide better and faster services by using electricity." - Male, Phon Home*

*"Information [from TV] has helped to remind and motivate me to improve our family condition and overall it has improved livelihoods, now we have better livelihoods." - Male, Phon Home*

#### **Workload and working time have decreased for all**

*"Electricity has helped a lot in reducing workload. For example now we can use rice mill, to mill the rice even in the night time and both men and female can do the rice milling. Just turn on the switch and engine will start working by itself." - Male, Vang Kham*

*"Workload has reduced, we can enjoy life and don't need to go to work outside. In overall it has improved our quality of life." - Male, Phon Home*

*"After the electrification workload has reduced around 50 per cent especially from water gathering and collecting fuel wood." - Male, Vang Kham*

*"Quality of life has improved in the village as overall and specifically they have been able to use lighting and rice mills, and this is reducing the workload." - Village leader, male*

*"No longer we have to spend time on traditional rice mills, it reduces workload." - Male, Phon Home*

#### **Life has become more convenient, healthy and safe**

*"It is easy to go around. Even though we do not get any income from the electricity it is much better." - Female, Vang Kham*

*"It has also become easier to go around the village at night and avoid poisonous animals like snakes. It has made our lives safer. Before, we only knew when we had got bitten." - Male, Vang Kham*

*"Our life has become more convenient and more active." - Male, Vang Kham*

*"We don't need to eat spoilt food because we have fridge." - Male, Phon Home*

*"We can eat in the light and see clearly." - Female, Vang Kham*

*"One hand was to hold the fuel wood [to have light] and another for eating, it was so difficult". - Village leader, male*

*“People can eat with light and have a good meal, and when it is hot you can turn on the fan to keep you cool down. While having meal we can also have something to see from the TV.” - Village leader, male*

*“...benefit to the village is that they can now walk in the village with lights on, can go from one house to another. Have security and light in the dark.” - Village leader, male*

*“Electrical devices makes it even more enjoyable during gathering events, weddings or ceremonies, we can use CDs and other devices like amplifiers.” - Village leader, male*

*“Now it is easy to go here and there and we feel safer than before. We can also keep our food in the fridge nice and fresh for longer. Therefore, we don’t need to go to the market that often anymore” - Male, Vang Kham*

**All benefit from electricity. The ones who use more, benefit more, especially in income generating activities.**

*“Everyone can get benefits from electricity, mainly though business people because they use electricity to make money.” - Male, Phon Home*

*“The poorest also benefit from the light even though they cannot use much equipment, but they still get the lighting and can see in the night.” - Village leader, male*

*“People who do business and use electricity to make money [benefit the most]. They can work both day and night, and use more electrical devices.” – Male, Phon Home*

*“People who benefit the most are the families who have more activities that use electricity, like water pumping, rice milling, use it for agriculture activities such as animal raising, and also for lighting, wood chipping and the equipment they have for households convenience.” - Village leader, male*

*“The least benefiting are the ones with disabilities and the poor people who do not use the electricity for labor or use no machinery.” - Village leader, male*

*“The group of people that has less benefits are mostly farmers, because they only use it or lighting, and they have no other business activities that can generate income [from using electricity].” - Male, Phon Home*

*“People with indirect connection from their neighbors benefit the least; these ones cannot use the rice mills because it [electricity] is not enough.” - Village leader, male*

*“Those indirectly connected are basically connected through their neighbour or a cousin. Many do not have money for direct connection that costs around 700,000-800,000 kip.” - Village leader, male*

**ENVIRONMENTAL CHANGES**

**The micro hydropower dam has not have any negative impacts according to villagers, but the introduction of electricity has encouraged more people to move into the village, thereby causing less forest resources(animals and plants)and fish available and reduction in water quality**

*“Before, there were 40 households in the village now there are 80 households all together.” - Female, Vang Kham*

*“Before electricity this area was only forest, but when electricity came people even from the mountains moved to the village and tried to get land and build houses along the road in the village.” - Female, Phon Home*

*“We collect fuel wood and non timber forest products. Before it was very easy to go and collect, because the forest was very close to the village, and we did not have to go further, but now you have to go further and it is more difficult to find [these].” - Male, Vang Kham*

*“Wood collecting is reduced because only use fuel wood for cooking only not for light as before. Now it is quite difficult to get NTFPs or wood fuel. They need to go further because there are more people after dam.” - Village leader, male*

*“After electricity, for cooking mainly they are still using fuel wood and electricity. However, using electricity is only occasionally or when necessary.” - Village leader, male*

*“There is still a lot of cutting trees, because in the village the main fuel used for cooking is wood. Even after the electricity the cutting of fuel wood is still the same.”- Male, Phon Home*

*“...they are also reducing the time and amount of collecting fuel wood because they use more electricity for cooking and for the rice cooker, and importantly they are reducing workload.” - Village leader, male*

*“Currently, there are less fish because more people are going fishing. Before, we used it [the river] for bathing and washing and drinking. Compared to before, water is now dirtier. Dead animals are thrown into the river that’s why it makes the river even dirtier. Now we do not even want to go there to take a shower or to get drinking water from the river.” - Male, Vang Kham*

*“There is also used oil on the surface of the water [Nam Mong], which comes from washing motorbikes or/and cars.” - Male, Vang Kham*

## CULTURAL CHANGES

### **People are spending more time on watching TV, interaction amongst the community members has lessened and cultural ways of dressing, singing and living have changed especially amongst teenagers.**

*“Negative impacts especially for the teenagers are that they are now listening to too much Thai songs and they have been influenced by the programmes on TV, they imitate the actions they see on the TV. It also affects the traditional ways of life like dressing and also they are losing their culture.” - Village leader, male*

*“Negative effect is that traditional dressing changes and less people carry the traditional dress.” - Male, Phon Home*

*“The negative thing is when the kids are watching TV so like my son is starting to keep long hair in foreigner style and the dressing is also kind of western style or Thai style rather than what we used to wear before. They also spend too much time watching TV at night. They only study some nights and some nights watch TV only. This is not only in my house, but also other teenagers in the village have similar issues. For the adults, it does not have this kind of influence or have any changes, but with the teenagers it has very much influence.” - Male, Phon Home*

*“Now the kids don’t want to study that much because they want to watch TV all the time. They want fashionable clothes and ask parents to buy new clothes all the time. Now they also do not want to work as they see examples on TV. Before, we use our own voice to sing and this is not practice anymore because being replaced by CD and modern music after electrification.” - Village leader, male*

*“Before people would laugh at a woman wearing pants because they thought pants are for men only, but now it has become normal as they can see women wearing pants on TV.” - Female, Vang Kham*

*“I’ve been waiting for over 30 years before I can use electricity so I don’t want to waste time too much with working but should spend my time with other things such as entertainment. Before we could only relax at the field and have a chat but had nothing to watch.” - Male, Vang Kham*

*“We believe in TV, and believe it is good but sometimes we don’t understand why TV shows fighting and people having a second wife, but we just think that it is not appropriate in our culture and don’t take this into our lives.” - Male, Vang Kham*

*“These new communication devices have impact to under 15 year olds, especially if they are not watching good programs like teaching programs from where they can learn, but instead drama with love scenes and other bad things.” - Female, Phon Home*

*“Before we would do fishing nets and chat, and now in the evening we can watch TV.”- Male, Phon Home*

## ACCESS CHANGES

### **Electrification has not improved access to health and educational facilities, but has provided light to study at home and electricity for the hospital to do surgeries**

*“Before electricity, kids had to use kerosene lamps or candles for study at night. Now they can study at night easier. Kids organize group studies of approximately five persons to study at some one’s home during the night.”- Village leader, male*

*In the past when they did not have the electricity they had to use the fuel wood for lighting for study and that was very smoky. They [now] can use fan to get away the mosquitoes too.” - Village leader, male*

*“In terms of health services, there is a village volunteer group for providing health services, they have a lot of campaigns for protecting from dengue fever, malaria and diarrhea. Sometimes if someone is sick they will go to the district [Nam Bak town] and get medicine for the local people, we also have other services from the health service from the district, they usually come three times a year to give vaccination to the children and the female, and we have health services from the province that come once a year.” - Village leader, male*

**Roads to the markets and banking services are good. Electrification has not improved access to markets or banking facilities, but has been helpful in preparing products for market**

*“Mostly we do not have to go to take these [agricultural] products to the markets but people from Pak Mong would come to buy the products from them, and collect everything.” - Village leader, male*

*There are no credit or loan services in the village. If we want to loan some money, a group of like a group of 5 such as pig raising group, chicken raising group propose to bank in Nam Bak (Lang Xang development bank) and then they can loan the money. - Village leader, male*

*“They did not get any subsidies and there are no banking services in the village, but they do have village development fund, that can be used for getting money for different activities e.g. pig raising activities, cultivation or plantation where each month every house has to put 5,000 kips to the fund and if someone wants to loan money they have to pay 3% interest per month. There is also village health insurance, where they put money for hospital fund for 5,000 kip per person, so for example a family of 4 pays 20,000 kip per month for this.” - Village leader, male*

**Access to hygiene, sanitation services and clean water are considered very important**

*“I hope for water supply for the whole village, especially for clean drinking water.” - Male, Vang Kham*

*“First priority is primary school for 1-5 grade and more teachers. Second, the villagers want to have proper toilets. Health care services in the village [are also needed] because the village is about 10 km away and when people get sick at night it is difficult to go.” - Village leader, male*

*“I want the village to have a water supply and I want to have direct connection to electricity, have TV and Fridge so I can get cool drinks like other people.” - Male, Phon Home*

**POSITIVE AND NEGATIVE FACTORS IDENTIFIED ON THE PROJECT**

**Project has been planned for the benefit of the local people, including them in the project cycle and providing quick and efficient maintenance**

*“The project has been well taken care. When it breaks down, it is quickly fixed. They keep good maintenance and take care the equipment is fixed quickly, and it [project] also brings the benefit to local people.” - Village leader, male*

*“They even come to check and change the light bulb [if needed]. - Village leader, male*

*“They kept follow up every year for 3 years and involved the local people in the construction, which was good for them to get income.” - Male, Phon Home*

*“There was also always 24 hour observation at the plant, so if something got wrong they knew it immediately.” - Male, Phon Home*

**People are not satisfied on the local electrical authorities or the electricity billing, more electrical capacity would be needed and maintenance after the project funding ends is seen expensive to be handled by the villagers.**

*“It improves the standard of living of all the 7 communities that have been covered by the project. Sometimes though there is less water in the dry season and not enough water to generate electricity and many blackouts occur. Local electrical authorities cannot provide as good services as local need. Based on the people complaints, they are not happy about electricity bills (overcharge). It is not only my family but the same thing to all households in the village. We should pay for what we use only, not for overcharging.” - Male, Vang Kham*

*“When the meter has problem like running faster than it should, we had to ask them more than 3-4 times before they came to fix it.” - Male, Vang Kham*

*“This is a small project and when it is connected to the national grid, it has more capacity and we can even have industry in the area and maybe people can get work.” - Male, Phon Home*

*“They [EdL] have this service fee of 3000 kip/monthly per household whether they [villagers] use it[electricity] or not, we do not think this is good.” - Village leader, male*

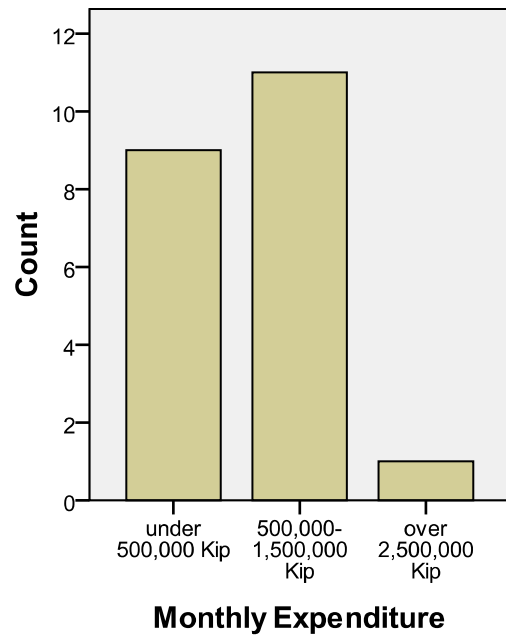
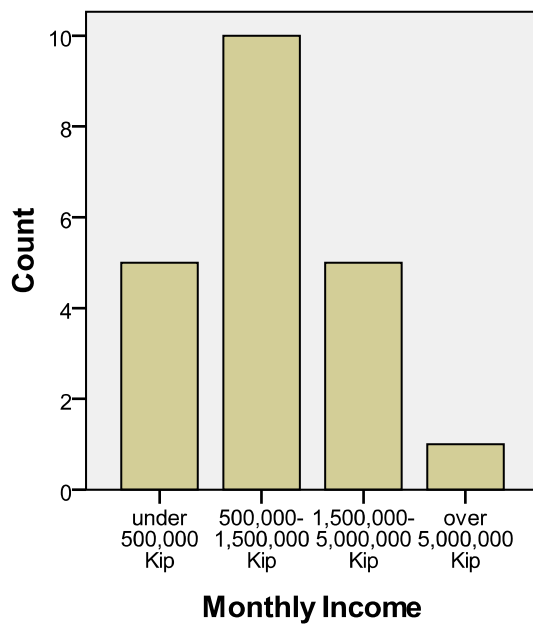
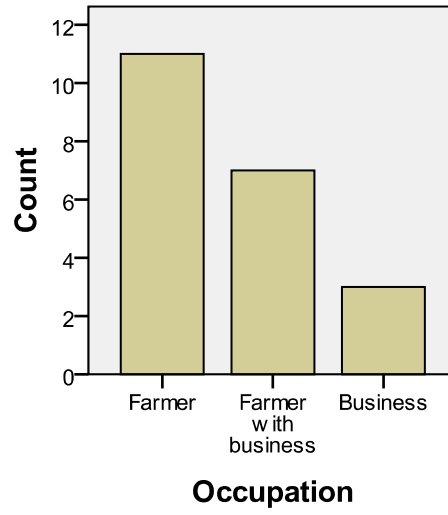
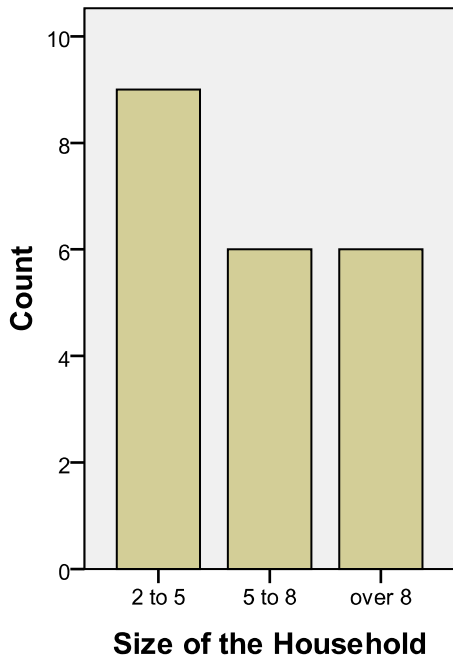
*“At the moment sometimes if we use lighting and many rice mills at once the engines do not run as fast and I think at the moment there is not enough electricity, so when it is connected to the national grid, it will provide more [electricity] and people can use it more.” - Male Village leader, male*

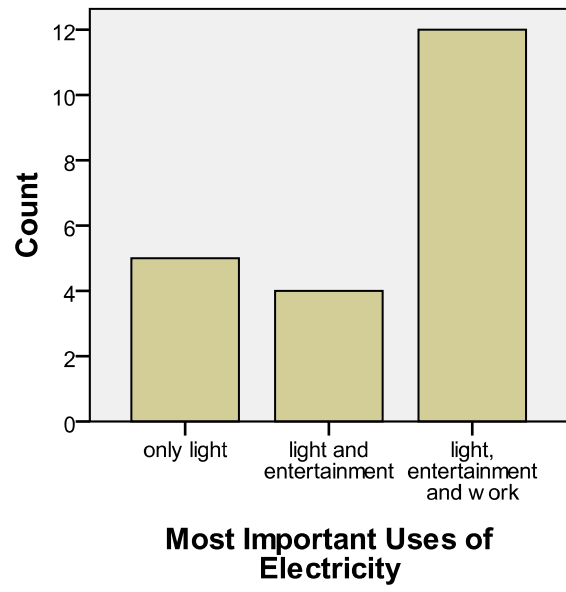
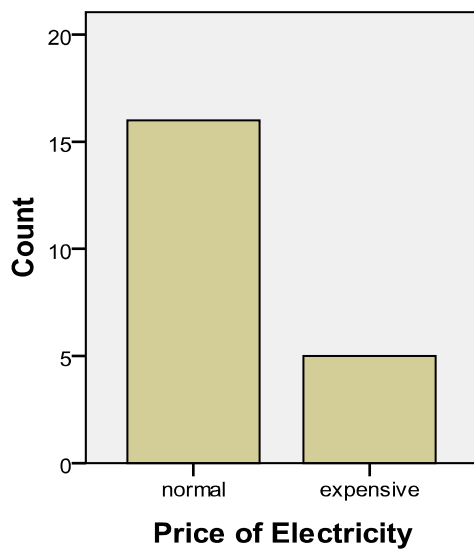
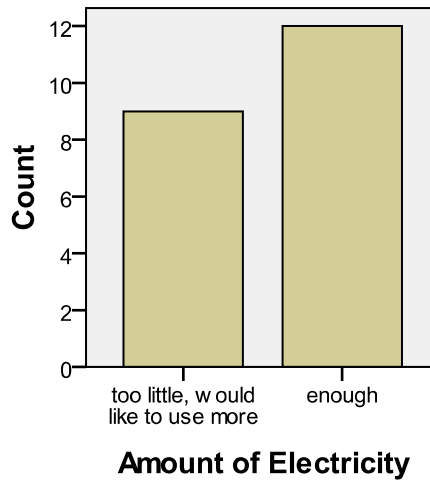
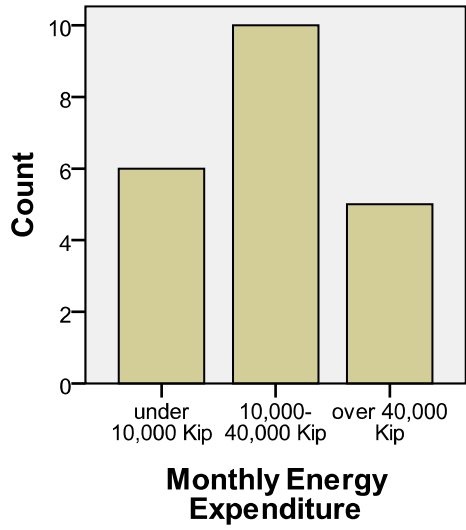
*“[Connecting to national grid] would be even better, because now when the support stops from Japan, it would be expensive for fixing or maintenance. If we are not connected to the grid, when something brakes, we would have to care the cost of maintenance, and had to ask money from the local people.” - Village leader, male*

*“With the same usage of electricity I paid 15,000 kip in March and in April the cost had increased to 24,000 kip. Also the other households in the village have had similar case. I am very upset for that. I do not understand how for exactly the same amount of electricity that I used in the previous month in April I have to pay more.” - Female, Vang Kham*

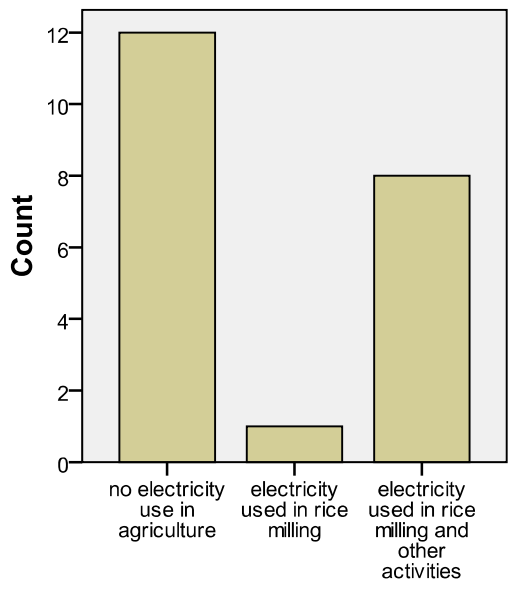
*“if they have to change the meters it might be that many people will not be able to afford to have new EDL meters, especially for the poor families because they have to work and save enough money to buy the meter to use the current system. Some people have just gotten electricity meters 3 months ago and now they have to change to the meter EDL uses.” - Male, Vang Kham*

**Appendix 5. Village data figures**

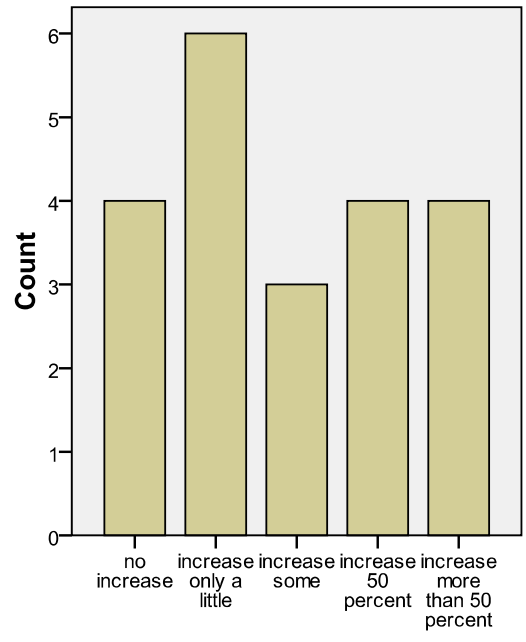




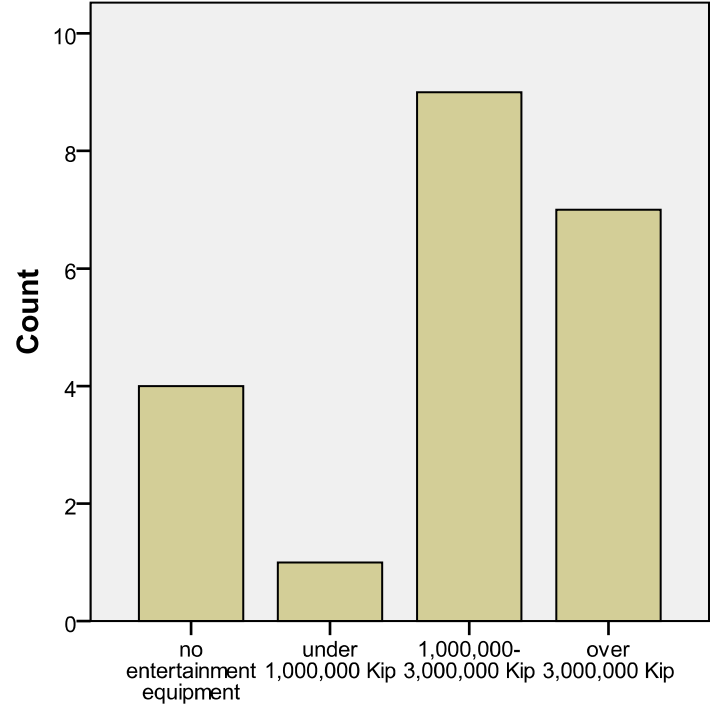




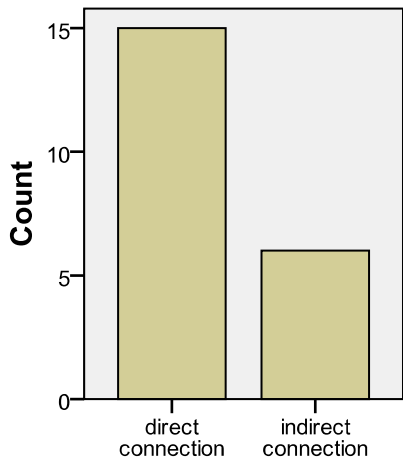
**Agricultural Changes After Electrification**



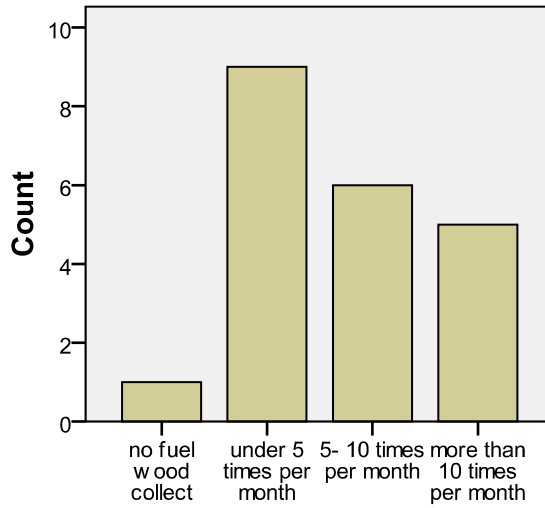
**Income Increase After Electrification**



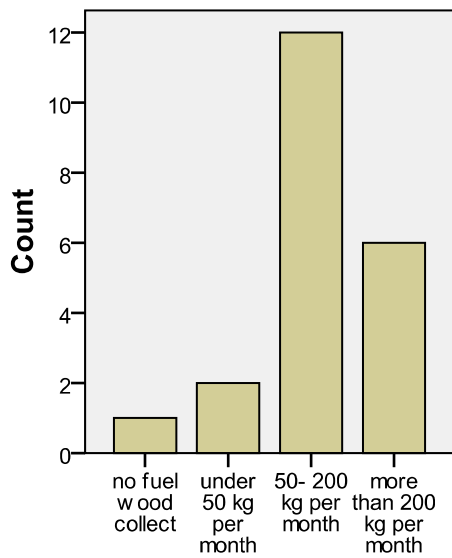
**Expenditure on Entertainment Devices**



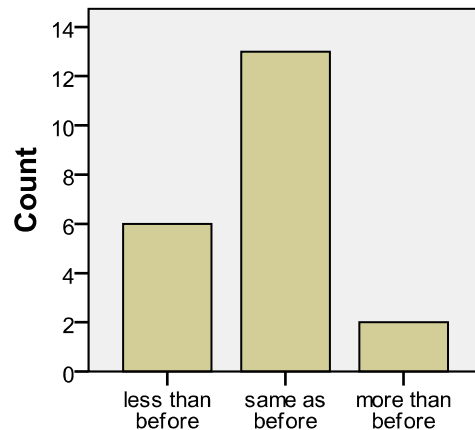
**Type of Grid Connection**



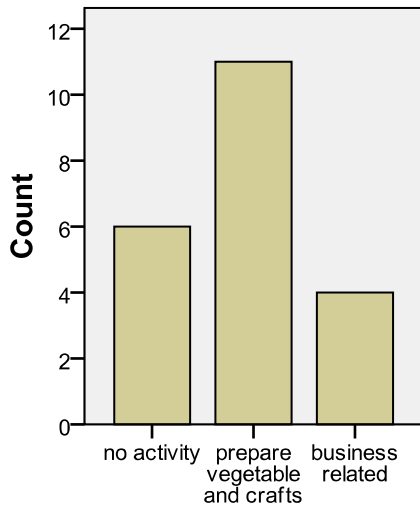
**Timeuse for Collecting Fuel Wood**



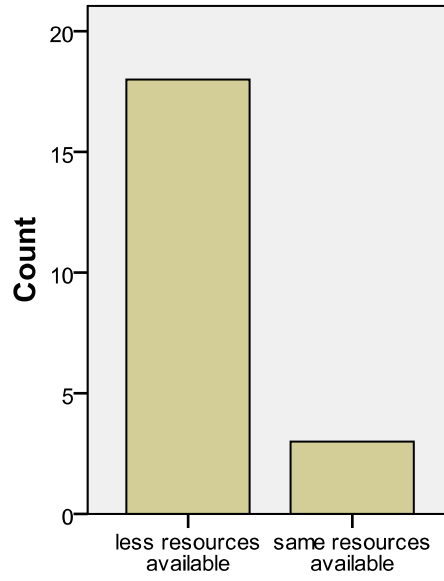
**Amount of Collected Fuel Wood**



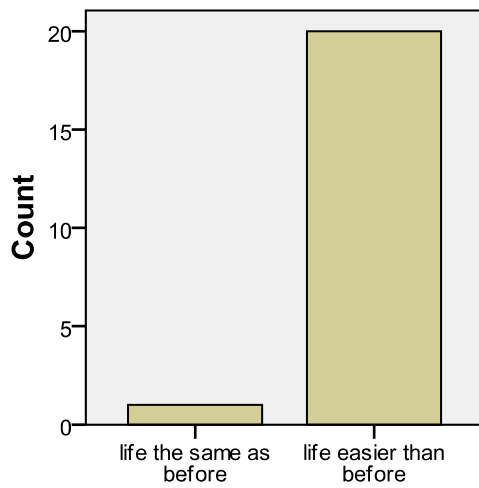
**Changes in the Time Used and Amount Collected**



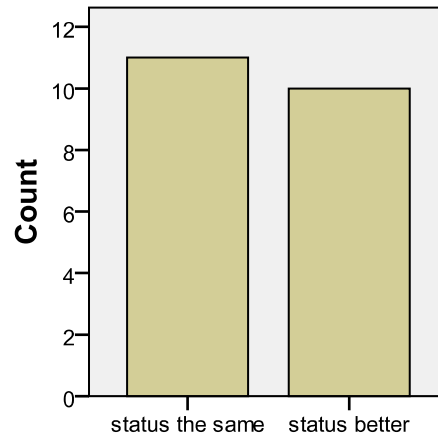
**Livelihood Activities in the Evening Time**



**Forest Resources Utilisation**

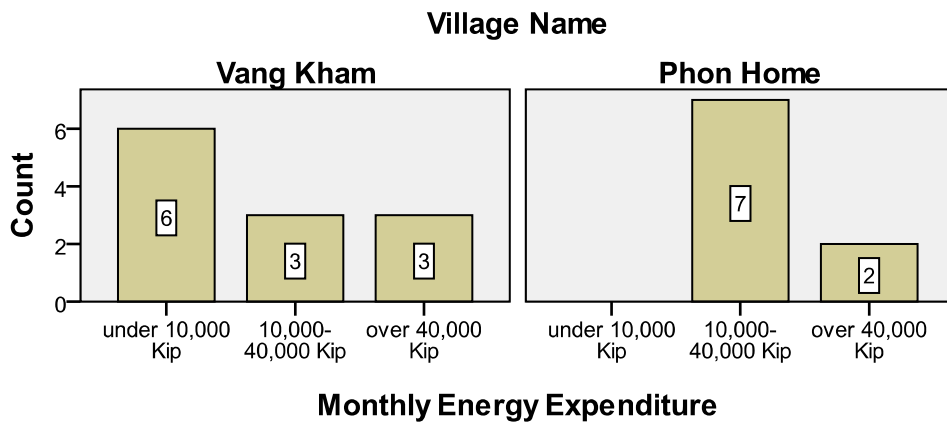
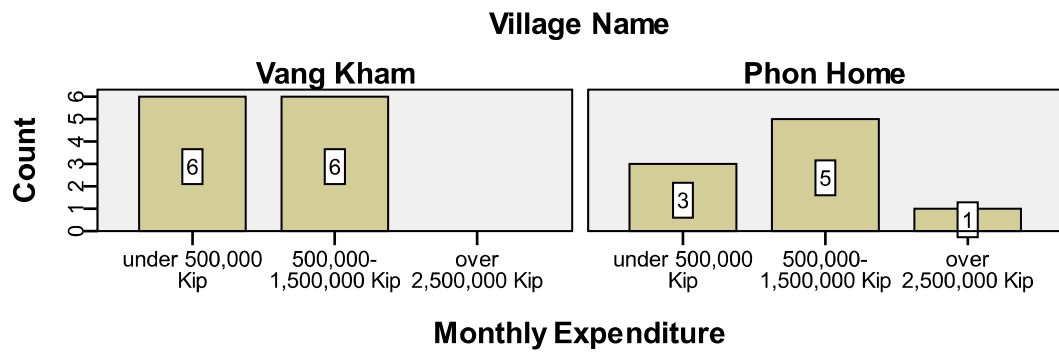
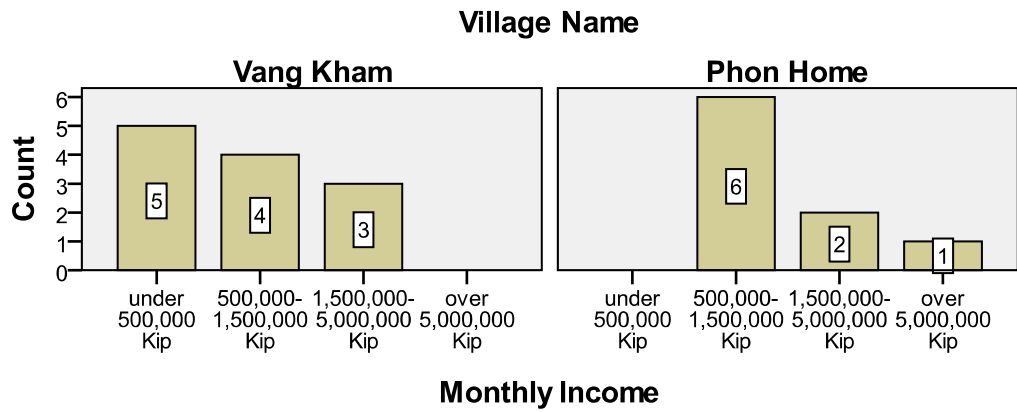


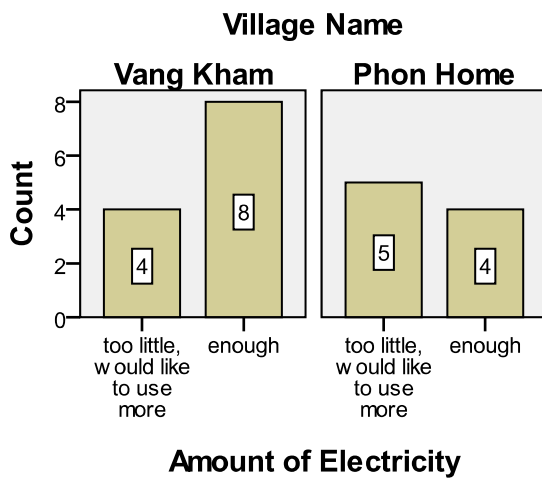
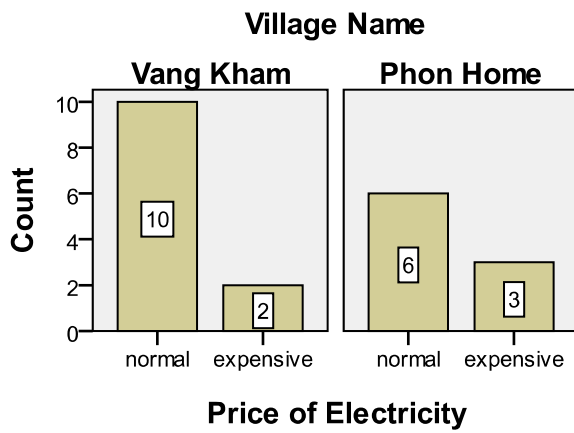
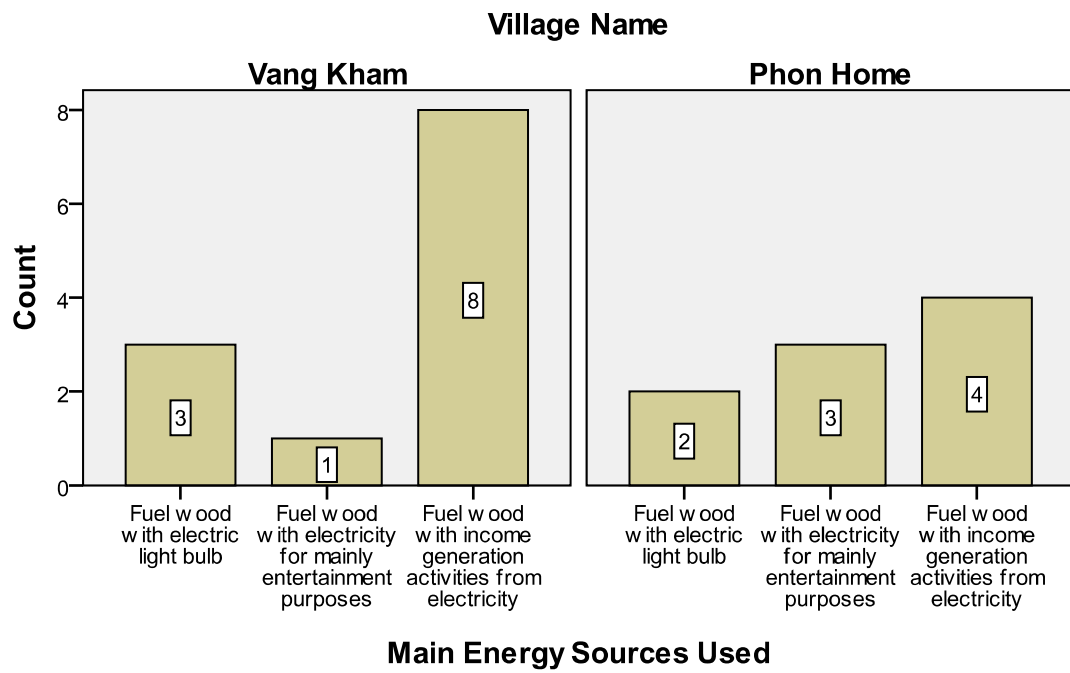
**Communication and Entertainment Improvements**

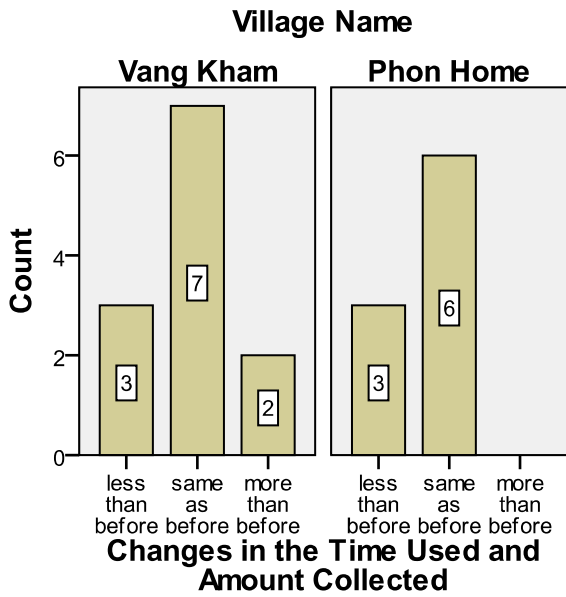
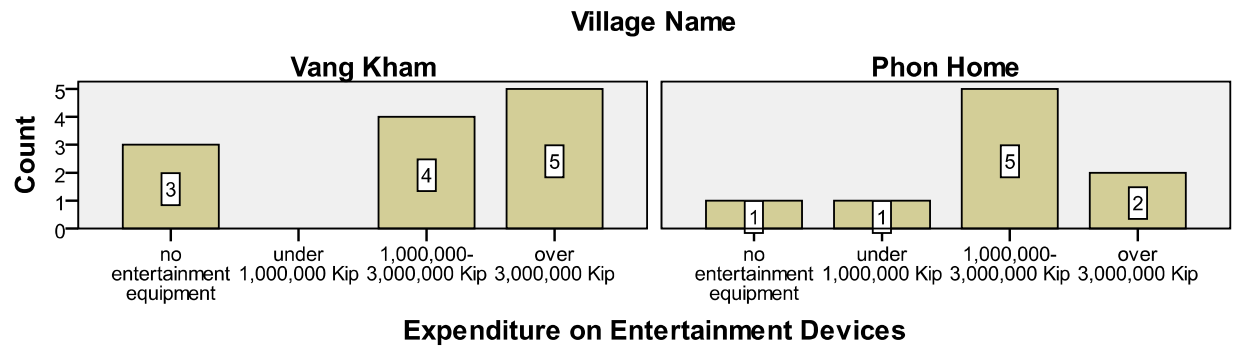
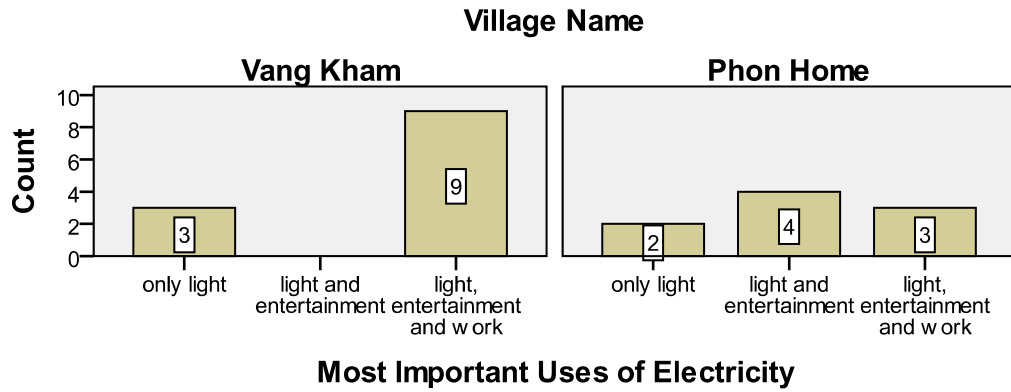


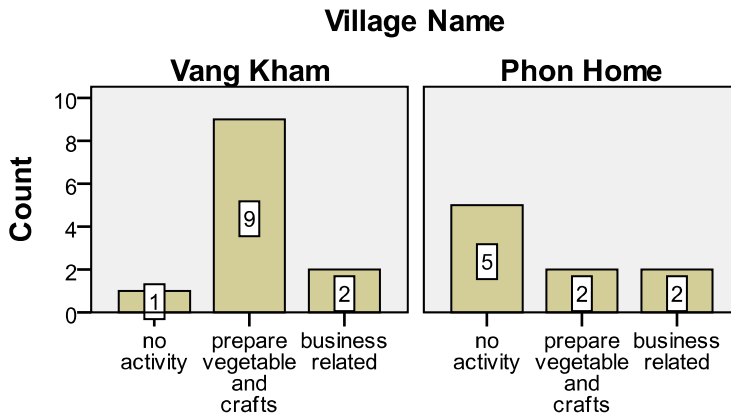
**Status after Electrification**

**Appendix 6. Comparison with Vang Kham and Pak Mong/Phon Home village figures**

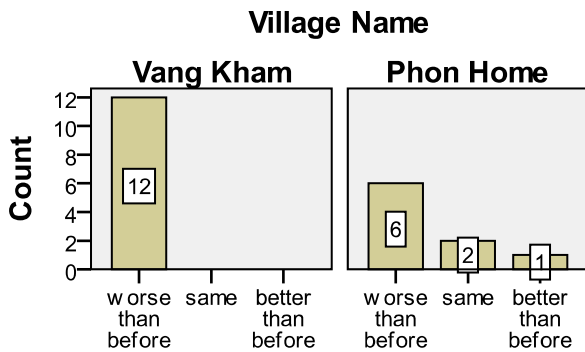




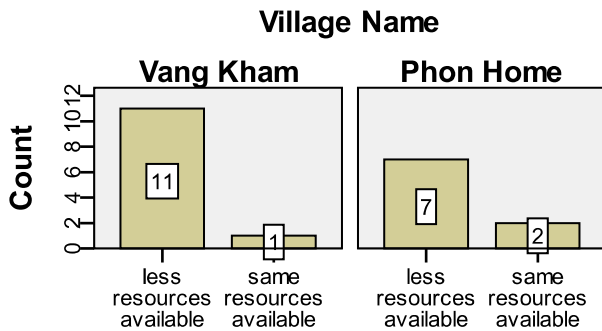




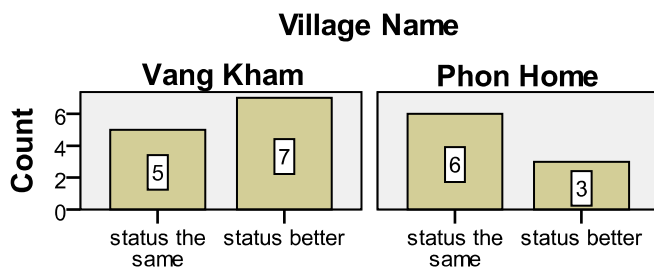
**Livelihood Activities in the Evening Time**



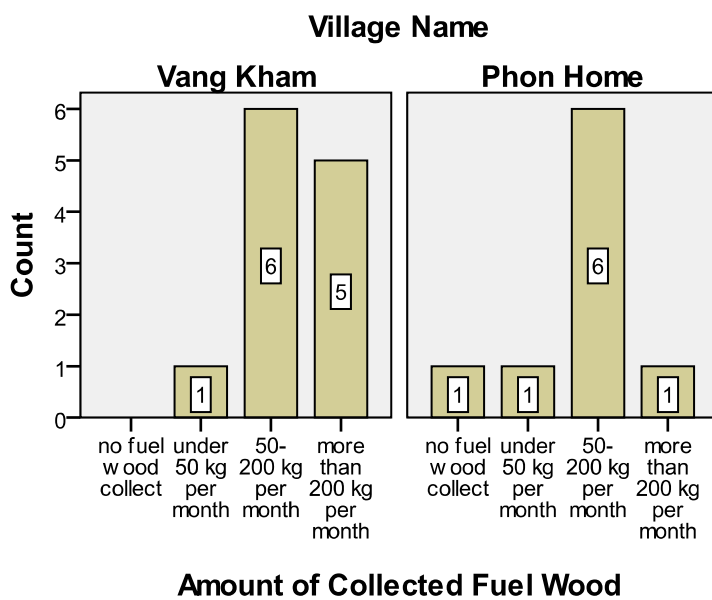
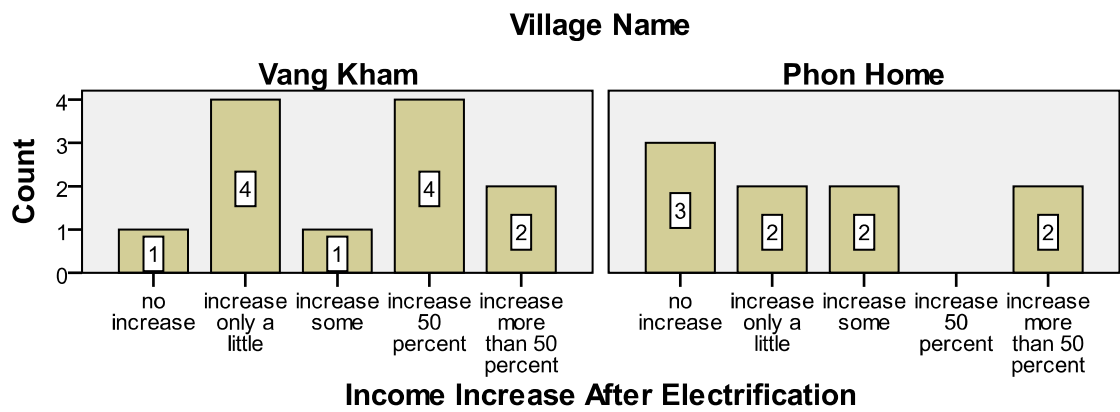
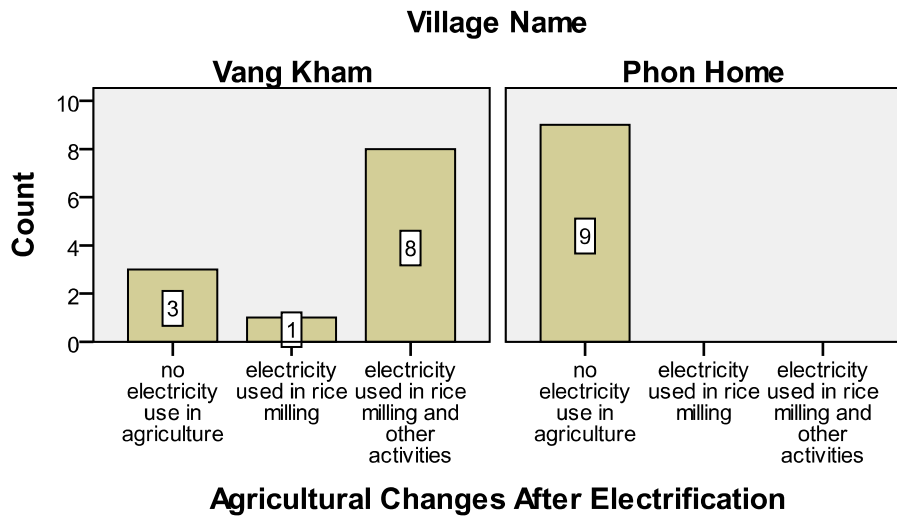
**Water Quality after the Dam**



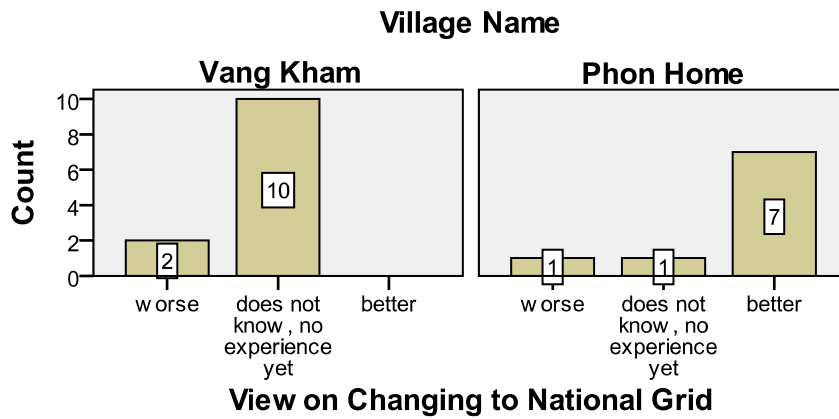
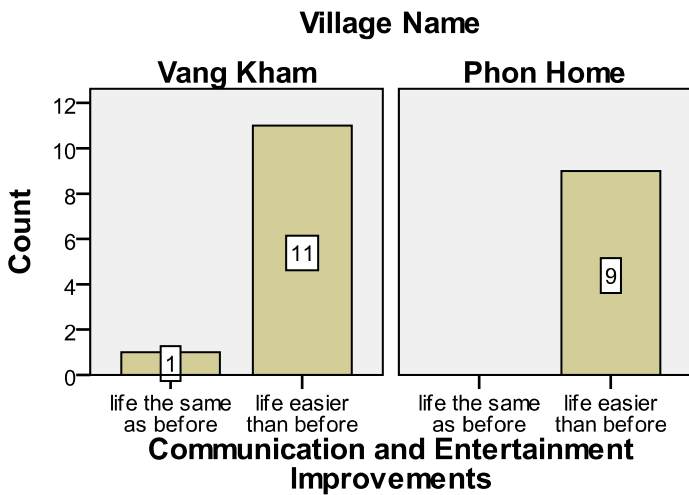
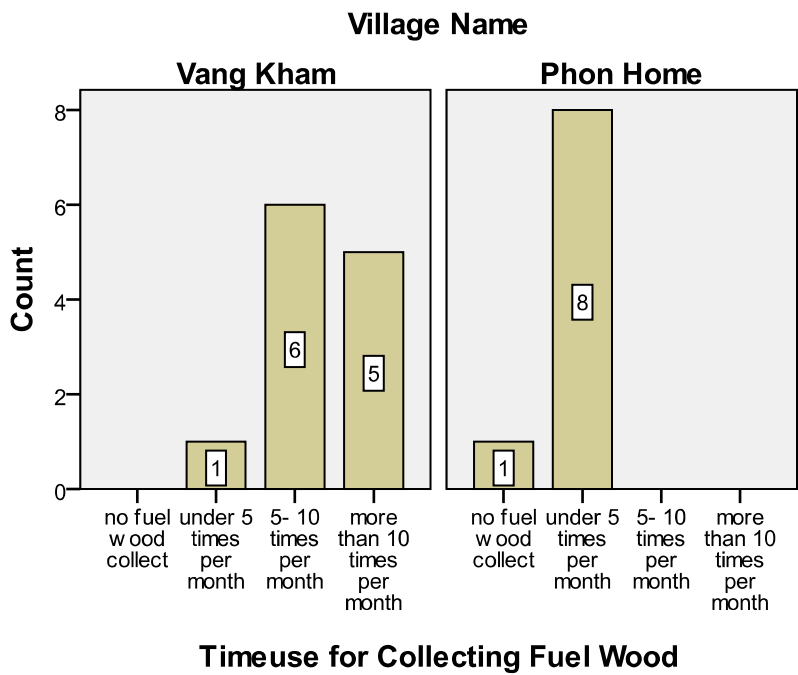
**Forest Resources Utilisation**



**Status after Electrification**







**Appendix 7. Type of connection comparison figures**

