January 2012

A Geographic Study Of The Laotian Hydropower Sector

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A GEOGRAPHIC STUDY OF THE LAOTIAN HYDROPOWER SECTOR

by

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Bachelor of Arts, Bemidji State University, 2009

A Thesis

Submitted to the Graduate Faculty

of the

University of North Dakota

In partial fulfillment of the requirements

for the degree of

Master of Arts

Grand Forks, North Dakota
May
2012

Title: A Geographic Study of the Laotian Hydropower Sector

Department: Geography

Degree: Master of Arts

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Dr. Paul Sum

This thesis meets the standards for appearance, conforms to the style and format requirements of the Graduate School of the University of North Dakota, and is hereby approved.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

I would like to thank my advisor, Dr. Enru Wang, and my committee, Dr. Devon Hansen, and Dr. Paul Sum for their advice and guidance during the progress of this thesis. A special thanks goes to Dr. Douglas Munski for his support and efforts on my behalf in attending the University of North Dakota. I would also like to thank my mentor from Bemidji State, Dr. Thomas Beech, for his continued support and guidance throughout my undergraduate and graduate career. Lastly I would like to thank several of my best friends including: Joshua Christensen, Ross Domeier, and Timothy Szargowicz, as well as the many friends I have made at Bemdiji State University, Purdue University, and the University of North Dakota for their support and friendship which has made this effort worthwhile.

ABSTRACT

The country of Laos is a developing nation that is geographically endowed with significant hydropower assets. Hydropower represents one of very few quick and profitable, exportable resources for Laos as a least developed country, and is seen as the avenue of escape from poverty for the nation. In the past two decades, Laos has seen both booms and busts in hydropower development, which has raised questions to hydropower's actual contributions to economic growth, and the consequences of large scale hydropower development.

This research examines trends and patterns in Laotian hydropower development in the past two decades. The study analyzes contributing factors to development patterns in terms of investment, policy, and geopolitic. Several consequences of hydropower development in Laos are also discussed. Overall I find that despite positive statements concerning hydropower, the actual contributions hydropower has in the Laotian context are smaller than anticipated. These benefits need to be weighed against the potential consequences that this type of development may have over longer periods of time.

CHAPTER I

INTRODUCTION

Hydropower development in the form of the building of hydropower dams for export revenue as well as domestic demand, has become a key element in national solutions for transforming an entire peripheral region, providing an escape from poverty and introducing an element of control over nature (Baghel and Nüsser 2010). Hydropower is currently the leading renewable energy source used by electric utilities to generate electric power with several advantages over conventional power production. The major advantages of hydropower include: a source of cheap power, little air pollution, long life span, and limited thermal pollution (Kaygusuz 2009, U.S. Dept. of Energy 2011). These advantages are critical when considering the concerns of energy production in the context of global climate change. Yet despite the apparent advantages, the construction of hydropower projects is not without controversy.

The development of hydropower due to its nature of affecting rivers and water represents what Hardin (1968) referred to as the "tragedy of the commons," where an un-owned resource can be subject to misuse and degradation. Previous research concerning hydropower development in general has identified several key factors that hydropower development has impacted or is affected by. These range from economic concerns in terms of markets and contribution to the national economy (Altinbilek 2002, Mansuell 2004, Virtanen 2006), socio-economic issues of livelihood loss and resettlement (Brown et al. 2008, IRN 2008b, Tilt et al. 2009, Virtanen 2006), environmental effects of

inundated land, altered hydrology and changed river basins (Graf 1999, Magilligan and Nislow 2005), the role of policy and planning in the mitigation of effects and in the development of hydropower resources (FIVAS 2007, Mollinga 2010), and the political/geopolitical situations of domestic and shared rivers (Hirsch 2010, Shmueli 1999). These factors have been at the center of a highly contested natural resource debate, especially in Laos and the Mekong River Basin for the last 25 years (Bakker 1999, Sneddon and Fox 2006, Smitts and Bush 2010).

The country of Laos is a developing nation that is geographically endowed with significant hydropower assets that is in the process of developing hydropower resources. Hydropower represents one of a very few quick, profitable, and exportable resources for Laos as a least developed country, and is seen as the avenue of escape from poverty for the nation and people (ADB 2002, EdL 2010b, Smits and Bush 2010). Investment in hydropower has been extensive within recent years as a result of Laotian efforts to spur economic development and decrease poverty. Much of this investment has come from donors and multilateral funding agencies such as the Asian Development Bank and the World Bank. Private investment has come from countries such as Thailand, China, and Malaysia as well as countries which on face value seem to have no stake in Laos such as Norway (Hirsch 2010, McDonald et al. 2009). As an example of this investment, the Nam Theun 2 hydropower project, which begun in 2005, represented the largest foreign investment in Laos at the time at over 1.6 billion dollars of foreign direct investment from various sources including Thailand, China, the World Bank, and the Asian Development Bank. The project is expected to produce revenues for Laos of nearly 2 billion dollars a year for the next 25 years and provide 7-9% of the government's annual budget (BBC

News 2005, Smits and Bush 2010). Another example is the Theun-Hinboun project which was the test case for the Nam Theun 2 project. This project has produced U.S.$ 275 million in its first four years of operation. Annual receipts from the Theun-Hinboun project alone represent 7.5% of Laos' domestic state revenue (Barney 2007, 14).

In the past two decades, Laos has seen different patterns of hydropower development, from very little development in the early 1990's, to rapid, large scale development in the new millennium. In the period of time leading up to the 1997 Asian Financial Crisis, hydropower development projects were planned and agreements signed to provide power to neighboring countries providing export revenue. Yet there was little actual construction undertaken on said projects and few projects actually came online. After 1998 and into the new millennium, a new spurt of hydropower projects have been built, or planned for the future resulting in increased energy production as well as an increasing number of potential dam projects. What explains this change in the patterns of hydropower development in the past 20 years? How do the key factors mentioned above to the patterns present? What has promoted or hinder development in the last two decades? What are the impacts of hydropower development in Laos? What are the future prospects of hydropower development in Laos given the past and current patterns?

Previous research has focused primarily on examining the consequences of hydropower development in terms of its economic, environmental, and socio-economic effects. An example of such research is a previous report by World Commission on Dams (WCD) in 2000 that attempted to find universally acceptable answers that would appease dam and hydropower supporters and critics, but was rejected by both sides of the debate on hydropower. The issues that the WCD attempted to solve however, are still around

and deserve further investigation (Moore et al. 2010). Research however has not examined the patterns of development as extensively compared to the effects of hydropower development in Laos. These patterns are in multiple forms including the spatial pattern of where hydropower projects are being built in Laos, production patterns, and the patterns of consequences. While the effects are important to understand, knowledge of what patterns are present and what influences them is also important for discussion.

The goal of this research is to study the Laotian hydropower sector, by providing a broad picture of hydropower development, and accounting for multiple factors that influence the hydropower development process. I ask what patterns have presented themselves in hydropower development in the past two decades. I also inquire to what factors have contributed to past and present patterns, as well as the consequences of these development patterns. Lastly, given the patterns and trends present, I discuss the future prospects of hydropower development in Laos in relation to constraints and enablers. The time period is chosen due to the availability of data for this era, as well as being a period where distinct changes in the patterns of development are present. This research does not attempt to mollify parties in either the pro-development or anti-development camp, but offers an independent insight into the issues at hand. Certain patterns may be present when examining past and present trends in hydropower development. This raises the question of how they are influenced by the key factors that are linked to development. Several key factors have been identified due to their prominence to their contribution to hydropower development and the amount of debate they entail when discussing hydropower in general. I highlight five key factors that have a relationship to hydropower

development patterns in Laos in terms of contributions, causes and consequences, then analyze these factor's relationship to hydropower in Laos. Contributions to hydropower development include: economics in terms of investors, government policy and plans that have promoted development, and the regional geopolitical situation, with a lack of development by regional neighbors have contributed the development of hydropower. Consequences of the subsequent development include changes in socio-economic variables, changes in mitigation, compensation, and resettlement strategies and policies, and the creation of potential geopolitical conflict due to the development of the Mekong River. Research on examining the influences and consequences of hydropower development is necessary in order to create better policy, supporting better practices in terms of the awarding of hydropower projects, and creating sustainable development, and mitigating the negative effects of hydro-development, all which may serve to influence the future of hydropower in general.

Why Laos?

Hydropower's importance to the Laotian state is paralleled within scholastic literature (Smits and Bush 2010), government documents (EdL 2010a), and mainstream media (BBC 2005), there is still room for more analysis. As Caetano de Souza (2008) points out, developed nations have more than 70% of their hydropower potential already utilized, while the developing world is the new focus for hydropower development. Hydropower is extremely important in Laos for its economic and social development, entailing costs and benefits at multiple spatial scales, both of which are important to understand when considering hydropower development in a global as well as local and regional context. Hydropower development in other nations may take paths created by

the Laotian experience. Understanding the Laotian effort at hydropower development may offer solutions to the primary issues that can be applied on a global context in support of or as a caution against future large scale hydropower development.

The study of Laos also represents a chance to gain a further understanding of geopolitical relations concerning the Mekong River, which is shared by six nations, all who have some stake in the development and usage of the river. Development plans for the Mekong have ebbed and flowed with events and ideologies over the past 50 years (Hirsch 2010, 313). The changing geographic, political, and economic environment of the region is a major influence. These environments, both promote it, and serve as a detriment to further hydropower development not only on the Mekong, but on hydropower development in the region as a whole. Laos's position on the Mekong gives it an array of options in its development strategy. Studying Laos's hydropower development provides in general an opportunity to examine how various factors affect not only the development strategy of a state, but the debate over social, economic, and environmental effects as well. By examining the patterns of development, we can better understand the processes that are involved in decision making, and hopefully provide more realistic recommendations for future action that will both promote hydropower development, while attempting to mitigate the negative effects.

The thesis is laid out as follows. First, a literature review is conducted that surveys the key factors as well as current studies of hydropower, and the sector in general. I then present the methodology of the thesis detailing the data sources, their utilization, and how the data is analyzed. The next chapter details past development and establishes the context that Laos presents in geographic and historical terms. Then,

utilizing primarily qualitative analysis, but supported in certain cases through quantitative descriptive statistical analysis, I examine the patterns of hydropower development in Laos, and the influence the key factors have had in shaping them. I also examine the impacts of development in terms of mitigation and resettlement consequences, as well as the impact of development upon socio-economic variables. Through document analysis and descriptive statistical analysis of official documents, reports by international organizations, non-governmental organizations (NGO's), and other secondary documents, I seek answers to how these factors affect hydropower development patterns. Following this, I discuss the results of the analysis, and open inquiry on future trends and patterns of hydropower development in Laos. Lastly I conclude with a summary and recommendations for future research.

CHAPTER II

LITERATURE REVIEW

Introduction

Hydropower assets are continuing to be developed throughout the developing world, financed commonly by some developed nations who may have a major stake in the developing state (McDonald et al. 2009). The hydropower sector and its impacts have been the subject of a vast amount of literature and from multiple disciplines. As alluded to in the introduction, previous research has identified several primary factors that hydropower development affects or is influenced by. Several disciplines ranging from geography, economics, and political science have contributed to the understanding of the issues through careful analysis of problems related to the development of hydropower. Yet gaps remain in the discussions on patterns of development, and how these can affect outcomes related to hydropower. This literature review covers some of the various important geographic, political, economic, and environmental aspects that have been identified by previous research as concerning the hydropower sector and development.

Scale

Starting from a geographic perspective, hydropower development entails elements of scale, not only on what scale impacts happen, but to what if any scale is the appropriate one for analysis. Essentially scale presents two problems: the first being what scale is appropriate to study a phenomenon at while the second problem is how scale can affect real-world outcomes. Scale in this context refers to what level decisions are made

and action occurs. This is not to be confused with the concept of size, while important, is simply examining how large or small a project is in several different ways. The question of spatiality and geographic scales is not a new one for those working from a geographic perspective. Agnew (1994, 2002) notes that research has moved from a static view of analysis at one scale or another (ex: national or global), to a more comprehensive view that accounts for the recent trends in world politics and the world economy, ever more critical in issues of hydropower. Agnew (2002) also offers what we mean by geographic scale, which "refers to the level of geographic resolution at which a given phenomenon is thought about, acted on, or studied (139)." Howitt (2003) as well discusses what is meant by scale, noting that scale is not an ontological given (Howitt 2003, 140). For Howitt, scale is not a fixed, dichotomous concept such as global and local. Issues such as hydropower are not reducible to a single dimension; there is a need to conceptualize and analyze the interconnections between scales and the simultaneity of those connections (Howitt 2003, 139). This raises the question of what if any geographic scale we should analyze the patterns of hydropower development. Concerned with how geographic questions tied to international relations were being addressed, Agnew (1994) focuses on the tendency for political science and international relations to be focused primarily on the state level, and how this understanding of the "state as a container," view can distort analysis of various processes, such as water related issues and in essence hydropower development (Furlong 2008, 812). Furlong (2006, 2008) in her analysis of trans-boundary waters adds to the idea of scale and transcendence by illustrating that some issues are illuminated, but obfuscates many more by focusing only on the state level of analysis (Furlong 2006, 454).

Research concerned on a general level about human interaction with the environment has not until recently considered the effect scale may have upon perception and outcomes. Giordano (2003) notes this gap in his research on applying geographic concepts to the problem of the commons in relation to natural resources. Giordano focuses on how the concepts of scale and space affect not only the definition of the commons problem, but the geographic nature of the problem as well (Giordano 2003). He notes that as a result of scale and space, the movement of natural resources, such as a river will not only influence exploitation outcomes, but will influence perceptions of risk and time as well (Giordano 2003, 370). Giordano concludes that solutions to commons problems need to vary by both scale and spatial nature.

In general, concerns of natural resources and watershed management entail an element of scale. Populist accounts focused at a broad national scale have stated that a superior process will dominate, disrupt, and extract resources from a subordinate place; however this perspective may not provide a complete picture (Steinberg and Clark 1999, 479). Questions of perception of benefits and costs across different geographic scales are raised as well. Tilt et al. (2009) correctly notes that analysis at different spatial scales will result in very different conclusions raised. Giordano (2003) as well comes to the same conclusion, and also advocates that the transferability across scales of resource policy in general and commons policy in particular should be questioned, not merely assumed (Giordano 2003, 372). Policies and practices that were created on a certain scale by actors at specific scales may not be as applicable at a different scale. The nature of the natural resource problems as well can change whether one is focused upon one specific scale or another, which highlights the necessity of better understanding cross-scale applicability.

What is clear from this analysis of scale is that processes and actions can and do transcend geographic and political levels. Clearly an analysis of the hydropower sector and of the patterns of development in general that wishes to provide a holistic picture must take into account multiple scales, with no one scale being better or more important than the other. Scale itself must also be considered as an additional context when examining the issues of hydropower development. Reports with a national scale of focus may state very different conclusions and recommendations that reports conducted with a local scale focus. There must be recognition of the relationships between scales, not just simply jumping between them (Howitt 2003, 141). At times a focus upon a specific scale can as Furlong (2008) and Mollinga (2010) have pointed out, serve as a useful level of analysis, but we must be aware that this focus can result in different perceptions and conclusions raised. While different scales will result in different privileges, one scale should not be privileged over another for example, as more political or environmental (Morrill 1999b, 48). Scale is helpful in this context that it allows for the realization that hydropower development can have effects across scales, but we must keep in mind that a focus on one scale or another will result in distorted perceptions and conclusions.

Environmental and Social Impacts

The environmental impacts of hydropower development are well documented from a geographic perspective. Geographers and NGO's concerned with water resource issues have noted the destructive capability of large and even small scale hydropower development projects (Magilligan and Nislow 2005). The geomorphic and hydrological consequences of dam building in the American context have been linked to large scale environmental disruption. The building of dams for hydropower, flood control, and

agricultural uses has resulted in greater change to the environment than climate change (Graf 1999, 2005). Literature about the environmental and social aspects of hydropower examines the environmental risks; the hydropower production potential; and the social impacts of hydropower, such as impacts upon livelihoods, personal economic stability, and resettlement (Altinbilek 2002, Anderson et al. 2006, Bakis 2007, Banfi et al. 2010, Kundzewicz et al. 2009, Li 2002, Shmueli 1999). These analyses have focused upon the effects of the building of hydropower projects, yet in general, have had little to say on the patterns of hydropower development, or how those patterns are influenced.

From a technological standpoint, researchers concerned with the environmental consequences and hydropower potential have made a number of inroads in estimations of impacts and potential for development. Assessments of hydropower projects have utilized a multitude of methods of analysis. Kusre et al. (2010) used a combination of GIS technology and hydrological modeling techniques to identify potential dam sites in India, as well as estimate the power production potential. Caetano de Souza's (2008) assessment of Brazilian hydropower plants examined the role the climate and physical geography play in hydropower production, while attempting to use an environmental index to account for potential barriers to the installation of a hydropower plant. These works however, are not overly concerned about the possible social, economic, and political effects of dam building. Caetano de Souza recognizes that environmental indexes are important tools for decision making, but they do not take into account economic, social, financial, and political factors (Caetano de Souza 2008, 1860). An attempt at working between the two perspectives is represented by Brown and McClanahan's (1995) analysis of Thailand's dam proposals for the Mekong River. Using

a measure of value called EMergy (energy memory); a quantitative analysis of how best to manage resources, populations and regional economies was included (Brown and McClanahan 1995). While their analysis of dam proposals was novel in that they attempted to account for economic and social variables in hydropower development in addition to traditional physical variables such as rainfall and sediment levels through a quantitative analysis, the methods and technical ability needed to fully understand EMergy are fairly complicated and may result in some confusion over how exactly estimations are made.

The environmental/hydropower potential research tends to focus on specific scales which may hide processes and effects that are working across scales. For example, Altinbilek (2002) is focused primarily on the national level when attempting to account for the role of dams in Turkey's development, citing the contributions to Turkey's economy and how hydropower in general is a renewable natural resource (Altinbilek 2002, 11). Altinbilek recognizes that controversy exists over dam construction, but confines his analysis on the effects at the national scale, which does not account for potential protests and issues that may arise at both the international and local scales, which could possibly derail development schemes and force a new strategy and pattern of development.

Those concerned with the social aspects focus on such concerns as migration and resettlement, land loss and equitable use agreements (Brown et al. 2008, Li 2002, Parveen and Faisal 2002, Sneddon and Fox 2006, Tilt et al. 2009). Research in this area is also multi-disciplined resulting in specific focuses by discipline. An exception to this is a study by Steinberg and Clark (1999). From a general broad level of watershed

management, Steinberg and Clark discuss the inherent conflict of social power and environmental transformations which require crossing scales in order to fully understand the conflict present. Research taking the populist perspective of resource conflict states that there is an inherent division between 'us'/local and 'them'/urban/higher levels. 'Us' is portrayed being ecologically holistic, small-scale, and sustainable, while 'them' is the complete opposite (Steinberg and Clark 1999, 479). While this narrative may accurately depict development situations in some cases, this view may be incomplete. The relationship between development and the environment will not be harmonious at all times, yet not a zero-sum game (Steinberg and Clark 1999, 482).

Resettlement and livelihood disruption is perhaps one of the most controversial issues concerning hydropower development. The social effects of displacement include landlessness, joblessness, homelessness, food insecurity community disarticulation, increased morbidity, loss of community resources, and depression among displaced residents (Brown 2008, 621). Tilt et al. (2009) using the tool of social impact analysis found that large scale dam projects in general result in the disruption of rural economies and livelihoods through the loss of water resources, loss of agricultural sources, and forests for building purposes. Additionally, resentment and distrust of business and government is fostered as a result of poor compensation policies and the inability to rebuild after resettlement.

The influence of NGO's who tend to focus their efforts on smaller, local, village scales is also noted by their contribution to the debate on the issues of hydropower. NGO's have made a large contribution to detailing the socio-economic issues and effects of hydropower, especially at the local level. The NGO, International Rivers Network

(IRN 2011), has periodically published reports on various hydropower and dam building projects. IRN's (2008b) report on the impact of rapid dam development in Laos is focused heavily on the effects of hydropower development at the local level. Multiple case studies within this report of past, present, and future projects constantly discuss the impacts on local villages, livelihoods, and resettlement. Overall, the report is critical on most actions taken by the government of Laos, developers, and international government organizations, for what they perceive as failures to the people who are affected by these projects. Reports like this offer a localized perspective, for a region that has not been studied as extensively as in other literature. Yet, they suffer from the biases of the organization and elements of the 'territorial trap' of scale in that they fail to recognize the interaction of perceptions, actions, and effects, at their scale of focus and across different scales. Reports like this also have a tendency to romanticize rural life and ties to the land (Steinberg and Clark 1999, 479). An example is found within several case studies of the Theun-Hinboun Hydropower Project in Laos. These reports conclude that many people in the area of the dam will be or have been affected in relative terms. Additionally they emphasize the loss of traditions and culture as well as their deep rooted connections to the land. Yet there is little or no mention of what benefits the project has brought in absolute terms, or on the provincial, regional, national, or international level (FIVAS 2007, IRN 2008b, 2009). Here we see disconnect in the perception of hydropower by the focus on localized, relative costs, forgetting that these hydropower projects do provide benefits, just not at the level of concern for the party involved.

Principles of equitable use are another aspect that concerns hydropower. Extremely related to the political aspects of hydropower development, the principle of

equitable usage and its corollaries of prior consultation and notification are a major point of contention in hydropower projects (Sneddon and Fox 2006, 190). These principles, however, are often couched in terms of the national rather than local. For example, many affected peoples are merely informed of the project, having very little recourse, while the concept of prior consultation is meant between nation-states. Research on trans-boundary waters focuses on the question of who is in control of the water in terms of policies and decision, and what the effects are as a result of development. Sneddon and Fox's (2006) analysis of the Mekong river basin notes that cooperation is not the goal of governments, but merely a tool in the development of basins. Similarly Brichieri-Colombi and Bradnock (2003) find that questions of rights of usage become central in trans-boundary water policies as well as issues of competitive resource extraction versus cooperative development policies. Most of the issues and questions brought up by these authors are primarily ones of the national and international scales that have little interaction with lower scales. Solutions to problems framed at the national and international scale reflect actors operating at that scale, but solutions made at the international scale will not necessarily solve remaining problems at smaller scales (Giordano 2003, 368).

Research from those concerned with the environmental effects and hydropower potential, and those concerned with the social issues offer valuable information about the effects of hydropower development. Yet there is little discussion on how these factors have affected patterns of development. It can be surmised that there is a relationship of some kind between patterns and effects, quite possibly with a feedback loop being present. What is not clear is what these patterns are and how key elements of hydropower development play a role.

Economic Impacts

The physical and social impacts of hydropower are also connected to economic effects which in turn are linked to the pattern of hydropower development. Hydropower and economics are inherently connected through issues of financing, monetary benefits; power sales agreements, and international economic relations (Banfi et al. 2005, Gilpin 1987, Li 2002, McDonald et al. 2009, Virtanen 2006). A primary motive for hydropower development is economic development, growth, and stability. Virtanen (2006) details how hydropower development is part of Laos's goal of exiting the group of least developed countries by 2020. Large scale hydropower projects are considered one of the few available alternatives for attracting investment and gaining export earnings, given the country's resources (Virtanen 2006, 183). Li's (2002) analysis of the Chinese hydropower sector shows that the building of hydropower projects has enabled China the means to pay for irrigation, flood control, and water supply projects (Li 2002, 1248). On a regional scale, Li notes that via export of surplus energy, additional income for regional development can be utilized. In general, hydropower development, like other development projects can help states escape geographic disadvantages that have hampered growth and development such as poor terrain, being landlocked, and lack of profitable non-renewable resources (Przeworski 2004, Sachs et al. 2000, Woods 2004).

The role of international development and multilateral funding institutions such as the Asian Development Bank and the World Bank are a consistent feature in the literature as these organizations have provided large amounts of the funding for the construction of hydropower projects (Hirsch 2010, Li 2002). These organizations in general cite their involvement as being beneficial to all in absolute terms as the funds they provide are

meant for development and realization of national goals such as poverty reduction. Additionally, Virtanen (2006) finds that foreign direct investment is critical to the financing of such projects, as well as being extremely dependent upon outside sources, whether it is for financing or technical expertise. What is less clear at times is how these institutions view hydropower development, and how that has affected their actions, for example in terms of negotiation and distribution of funds for hydropower development. This raises a question of not only if international institutions have been able to significantly influence hydropower development patterns, but what consequences have resulted as well. These sources of external funding are critical, as they can add additional requirements in the development process, such as a social impact analysis, increased oversight, and stricter environmental guidelines in the building process which may suggest supremacy of roles for international funding institutions.

The literature on economic development and funding sources raises the issue of economic dependence. Countries that wish to develop their hydropower resources may be completely dependent upon the industrialized nations for funding and technological expertise. Possibly, there is a degree of autonomy that countries rich with hydropower potential have in terms of being the owner of the resource in question. Dependency theory in general suggests that the rich states of the world system use economic forms of control, in essence informal control most often found in the multinational corporations of the world, to further their own gains, as well as keep subordinate states in their place (Gilpin 1987, 284). McDonald et al. (2009) touch upon the idea of dependence in their paper on the exporting of Chinese hydropower technology. China appears to be offering "no strings attached" financial assistance to countries that wish to develop their

hydropower. Yet this is not completely altruistic. As McDonald et al. describe, while China is offering assistance in the form of loans and technological advice, this may also serve as quid pro quo for the rights to resource extraction, which China has had a growing need of in the past ten years (McDonald et al. 2009, S297).

Overall, economics' focus on a broad, national level draws attention away from more regional and local levels of economic concern in relation to hydropower development. This is where NGO's tend to pick up in that they focus on the economic costs at lower levels of analysis. Yet there still is a divorce between the levels, with neither quite recognizing costs nor benefits at different scales and levels. This disconnect has helped to exacerbate debates in the political arena as well.

Political and Planning Aspects

The hydropower sector's interactions with politics have also been examined in various contexts and at various scales. Sharing concerns with those working in the social realm and those concerned with the economic impacts, work in this field has examined the role politics plays in the hydropower sector and how the sector itself has political implications. In very general terms, concerns over the decision making process, planning, public participation, equitable usage, and the role of the external political environment have been the focus of research for those concerned with the political aspects of hydropower. Morrill's (1999a, 1999b) analysis of decision making concerning natural resources does not specifically address hydropower, but is still helpful in understanding the decision making process with concern to natural resources. Essentially, Morrill is concerned about the distribution of power and outcomes across geographic scales which relates to the literature about the effects of hydropower projects. Outlining various

reasons for the supremacy of higher levels such as interdependence, dependence, and power, Morrill notes the competing claims of governments needing to acquit the needs and desires of business and households, the two foundations of modern society. However, the use of the Hanford case study raises questions of generalizability to other cases as the role of the federal system of the United States plays a large part in setting the context of inter-scale relations, such as the perception of limited autonomy at the local level (Morrill 3, 1999). These concerns were addressed by Fainstein (1999), Martin (1999), and Swanstrom (1999) who question the findings of Morrill. Notably, Swanstrom is highly critical of what he perceives as Morrill's bias for leaving land use decisions in the hands of local powers, which may create local dependence relations between the rich and poor of an area (Swanstrom 1999, 31). Here we see a divide on where decision making should take place, whether on the state or local level which can have an effect on the overall patterns present. All of these analyses are couched within the context of the U.S. federal system, which is significantly different than authoritarian and socialist regimes where much of the hydropower sector's activities are taking place. It is unclear whether these findings on the decision making process hold in a different government context.

Other political concerns have also contributed to debates about the planning, control, and usage of resources, specifically rivers, which are the critical component of hydropower. Related to the principle of equitable use as mentioned before, the literature has focused on trans-boundary water systems in relation to dam development, and how rivers are viewed in relation to policies of development (Baghel and Nüsser 2010, Bakker 1999, Brichieri-Colombi and Bradnock 2003, D'Souza 2004, Furlong 2006, Sneddon and Fox 2000). The perception of rivers and hydropower projects in political debates is

critical to understanding not only patterns, but the effects that development can have upon a state and its people. Political control of the resource is a vital aspect of hydropower and in general as it may provide an important source of political patronage and punish opponents in the broader struggle for political power (Bakker 1999, 226, Barney 2007). For Mollinga (2010), the nation-state is the primary level of control, with states assuming ownership of water resources and governing and management at the national level (Mollinga 2010, 514).

Governments have viewed rivers, specifically trans-boundary river basins, as important engines of regional economic development; bases of livelihood resources; and critical sites of biodiversity conservation. These competing roles make governance of rivers a particularly challenging endeavor (Sneddon and Fox 2000, 182). National and local level concerns are at the center of many disputes that center around hydropower. Through framing involvement and development as efficient, creating jobs, the rights of the many over the few, and advocating the precedence of more economically productive and socially beneficial uses of resources, the government and higher level justifications of development are very powerful (Steinberg and Clark 1999, 479). Unfortunately agreements and institutions created in the political realm to deal with conflicts of usage and control are in stark contrast to the physical realities of nature (Sneddon and Fox 2000). A state cannot simply move a river it claims as its own to a location within its borders in order to develop as it pleases.

As rivers and dam projects are important parts of development agendas for many states in the post Cold-War era, increasing scrutiny on how governments handle such projects has emerged. D'Souza (2004) presents the view that dams are viewed as a

commodity, which encompasses territory different from political boundaries of the state, including resident populations who are affected by this development (D'Souza 2004, 704). The view of rivers as a commodity is reinforced by Bakker (1999) in her analysis of hydropower development on the Mekong River. Her analysis used as a starting point the assumption that the Mekong is an immensely valuable resource that is almost completely uncommodified, and that the Mekong River has been transformed from a Cold War frontline to a corridor of commerce (Bakker 1999, 209). Hydropower development at any scale will operate as a means for commodification, and as an extension of state control into largely rural areas (Bakker 1999, 212). In this sense rivers are seen as both a resource for income as well as an extension of state control.

Political control of rivers and hydropower resources has also entailed discussions on the role of democracy. D'Souza (2004) focuses on the dynamics of democratic development, which in itself is an oxymoron, comprising two very different ideas; democracy; entailing devolution of power to nations and communities within nations, and development, which entails conceding power to global economic institutions, public and private (D'Souza 2004, 702). Further, western assumptions on the role of democracy and the concept of an authoritarian state have influenced water policy analysis. Mollinga (2010) describes how existing policy analysis frameworks have used assumptions about the liberal parliamentary democratic state form, notably assumptions on the power and independence of electoral voting, and the presence of civil society organizations engaging in the policy process and upholding the rule of law (Mollinga 2010, 512). The normative aspect of western policy analysis may not be suitable where these assumptions do not hold, as well as in places where different types of government are present.

Geopolitics

An area where the literature has found a new focus is in the area of geopolitics. This also has become a new scale of analysis in the debates concerning hydropower at the international level, with concern ranging from international water law to issues of cooperative development. Beeson's (2009) study of regionalism in East Asia draws ideas from economic geography, noting that political science has felt ambivalent to hostile about the utility of geopolitics. While not directly concerned about hydropower, Beeson's study shows the importance that historical, strategic, and material contexts play in the impact of influences that concern geopolitics (Beeson 2009, 500). Water disputes are a common element in geopolitical studies. Emmers (2010) comes closer to the hydropower sector in his analysis of East Asian maritime disputes. Despite being focused on offshore water disputes, Emmers uses a framework consisting of three parts that are interconnected: territory, natural resources, and power, which all interact in the realm of geopolitics (Emmers 2010, 17). This triangular relationship is exemplified via the concern of the energy considerations of a state, whether an area is important for its energy reserves. This may lead to territorial and sovereignty considerations of a region, which raises questions of power relations and symmetry (Emmers 2010, 18). Again, while not specifically dealing with the hydropower sector, Emmers' framework of territory, natural resources, and power is relevant in the discussion of the role of hydropower on an international and regional scale. When water flows across political boundaries in trans-boundary water systems, nation-states are the primary participants in the negotiations that hydro-politics involves (Mollinga 2010, 515). More attention is

being paid on how hydropower development may affect a region's geopolitical situation and how geopolitics affects hydropower development.

Work specifically dealing with the geopolitical dynamics of hydropower development and the sector itself is focused upon relations between riparian states, and the universal effects of dam development, in terms of social, economic, and political effects. and how a state's geopolitical position may be improved via dam building (Baghel and Nüsser 2010). Southeast Asia and Laos in particular are of interest as this region was a frontline during the Cold War and the site of numerous violent conflicts in the past fifty years, which has prevented and stalled much development in the region. Hydropower itself is a peacetime resource, that only during peace is the potential for development fully realized (Bakker 1999). Geopolitically, the idea of dams as bargaining tools is also recognized. McDonald et al. (2009) note this fact prominently in the case of China, which has a market advantage in dam building, combined with favorable government policies which allow the export of dam building as a bargaining chip in negotiations. As previously mentioned, while China touts this export of knowledge and technology as "no strings attached," the possibility of the expectation of reciprocation remains a looming factor for many of the African and South East Asian nations that have benefited from China's hydropower knowledge.

The potential for geopolitical conflict is another issue that hydropower is connected with. Many river systems in the world transcend national boundaries, or create borders for states. The "water war" hypothesis of interstate conflict states that when a river shares a common boundary or there are downstream and upstream parties involved, the risk factor of conflict should increase, due to issues of water quality and water

quantity (Toset et al. 2000). Hydropower development on shared river systems may exacerbate regional and national tensions, perhaps even to the point of armed conflict. Toset et al's (2000) study of shared rivers and interstate conflict used new data on rivers that they correlated with the Correlates of War data by Singer and Small (1994) to examine whether shared rivers resulted in increased conflict. Their analysis did not specifically address the role hydropower development may have, but indirect references to scarcity and quality issues relate to many debates about the physical effects dam building can have. This study did not find significant systematic evidence of rivers being the primary factor in conflicts, but they still believe that rivers may increase conflict. Hydropower development on trans-boundary water systems involves by its nature all of the states that have some manner of control of the resource. The possibility of cooperative arrangements between states is always a possibility; however, conflict is also another choice open to states in their handling of geopolitical resource issues. Geopolitical conflict may also be found within states at the provincial level in terms of the distribution of positive effects, as well as negative ones.

As mentioned before, many disputes over hydropower concern national versus local interests, especially in terms of absolute and relative benefits. Another way of diffusing geopolitical hydro-conflict has been to change the scale of focus (Sneddon and Fox 2000). By utilizing a different scale for geopolitical objectives, such as the construction of a dam to increase wealth, industry, and building a prosperous region, criticism can be mitigated through a shift in scales. Framing the project in a national scale of focus presents the idea that the project is for the benefit of all, overshadowing criticism

that may be present at the local level. In contrast, shifting down in scale can bring attention to those who would otherwise be minimized by a shift up in scale.

Perhaps most importantly, an analysis of hydropower's relationship with geopolitics must take into account context (Hirsch 2010, Mollinga 2010). Context can take many forms from local, national and international to historical. Even with context having an influence there is still room for comparison. Future hydropower development according to several scholars should take account of geopolitical implications and dam building within the context of a regions geopolitical history (Mollinga 2010, Parveen and Faisal 2002). Lastly, while much of the literature has focused on the effects of hydropower development, more attention should be paid to the causes as well, which include geopolitical effects (Baghel and Nüsser 2010, 242).

Conclusion

The issues detailed in this literature review are certainly important to consider and understand when attempting to explain any aspect of hydropower development in general, including the patterns of development, given the Laotian context. Much of the literature has focused upon the effects of hydropower, with less concerning the actual causes of development and the patterns present. Additionally, a feedback loop may exist as a result of the effects of hydropower development upon subsequent patterns. In order to analyze patterns and effects, there must be a recognition that the hydropower development process does not simply operate at one specific scale in terms of processes, and level of analysis. While focusing on one specific level is beneficial in many studies, an analysis like I am conducting requires examining how processes and actions operate and flow at and between different scales. This is similar to Steinberg and Clark's (1999)

study of watershed management which advocated a middle ground between populism and utopianism when interpreting environment-development conflict. This study examined views and perspectives from both an urban and local level and compiled them into a holistic analysis that attempted to offer a more balanced viewpoint on development conflicts. As this is also a multi-discipline approach, the need for an analysis at multiple levels and scales is even more critical. Only through a multi-level analysis can the complexities and issues related to the patterns of the development of hydropower be more fully understood.

CHAPTER III

METHODOLOGY

INTRODUCTION

As stated in previous chapters, the goal of this research is to study the Laotian hydropower sector and provide a broad picture of hydropower development in the past 20 years, and provide an analysis of future prospects. I seek to explain several things: what patterns are present in the past two decades; what changes have occurred during this time period; and what influences said patterns again during this period, and lastly what consequences have resulted. Next I provide an analysis of the consequences of hydropower development in the past 20 years. Analysis of various reports, statistics, and accounts from multiple sources will allow for in-depth comparison and discussion on these issues. Finally I address the future of Laotian hydropower development in terms of prospects and constraints, as related to the pace, scale, efficiency, equitability, and sustainability of development.

General Methods

In order to examine how patterns have changed, as well as speculate on their future in terms of hydropower development, a mixed method approach of geographic visualization, descriptive statistical analysis, correlation analysis, and qualitative document analysis of secondary data is used in this research. These methods are well suited to the large amount of secondary data that is available and utilized for this study. Secondary data is utilized primarily due to availability and being relatively through for

the time periods of focus. A mixed method approach does not simply use qualitative and quantitative data to answer research questions. Instead, it integrates both qualitative and quantitative methods into data collection, analysis, and discussion that set it apart from other methodologies. Additionally it allows two other goals in research. First is the ability to ask questions that could not be asked if only one method were used. Statistical analysis may tell how much something has changed, but what influences are present cannot simply be derived through pure statistics. Second is to look for inconsistencies in the partial knowledge produced by different techniques and treat them as opportunities for further research (Rood 2010).

Geographic visualization is the usage of visual representations to make spatial patterns and problems visible (St. Martin and Pavlovskya 2010). In this study geographic visualization allows the spatial pattern of Laotian hydropower development to be visually seen. Utilizing geographic information systems (GIS) to produce visual representations (maps) of the general location of major Laotian hydropower projects, spatial patterns can be visualized.

The usage of descriptive statistical analysis provides insight and allows for analysis of the trends and patterns that are present in past 20 years of Laotian hydropower development. Through a comparison of specific descriptive statistics such as amount of hydropower produced and the amount of export revenue, statistical analysis can garner insight to how patterns have changed the during this time period and the magnitude of change.

Data for statistical analysis is from a variety of sources and deals with a variety of subjects pertaining to hydropower development and patterns. Statistics of hydropower

production for instance are a key indicator of patters of development. Statistics of economic growth and health are compared to levels of production in order to determine whether economic growth and hydropower production are actually related, as posited by the proponents of hydropower. Other statistics deal with some of the consequences of hydropower development. Statistics from the UN on the levels of agricultural and food production are indicators of whether hydropower development has caused decreases in said levels due to loss of land via flooding and land acquisition.

Qualitative document analysis serves the purpose of processing data that is not available or feasible to work with in quantitative forms. Document analysis as a method entails the collection, review, interrogation, and analysis of various forms of text as a primary source of research data (O'Leary 2004, 177). As O'Leary (2004) notes, document analysis involves both examining the credibility of documents, as well as the exploration of the 'witting' evidence or the contents within the document (180). Document analysis is used to extract backgrounds, positions, stances, justifications, and consequences of hydropower development in relation to development patterns over the past 20 years from documents pertaining to hydropower. By extracting these elements, it becomes possible to analyze how the factors listed above have either promoted or hindered hydropower development in the time period specified.

Numerous documents that pertain to hydropower are utilized in this study to provide data in the form of descriptions, viewpoints, and perspectives that cannot be garnered from pure statistical analysis. Document analysis of developer reports, government reports, laws, and policies help show the processes and rationale behind supporting hydropower development. Document analysis of reports and studies by

NGO's, academics, and other international organizations reveals other viewpoints of hydropower development that focus on the consequences, both negative and positive of development. Through document analysis, I am able to overcome the deficiencies and lack of in some cases, of quantitative data for this study.

Framework

The analysis of Laotian hydropower patterns utilizes aspects of the framework found in PEST (Political, Economic, Social, and Technological) analysis. PEST analyses, also known as PESTEL (Political, Economic, Social, Technological, Environmental, and Legal) are used as an analysis framework of macro-environmental factors to analyze multiple factors influencing either the position of a particular organization or particular sector (Gillespie 2010). PEST analysis can also be used to analyze the viability of general management solutions in a business environment. The usefulness of PEST relies upon the assumption that the success of an organization or solution cannot be understood without having the information relevant to the specific operation environment (Peng and Nunes 2007, 230). Without the relevant information, any conclusions or solutions drawn from the analysis will be deficient by not taking into account as many specific factors as possible. PEST classification is broken down into various factors that are known to affect macro-environmental decisions by businesses. In this analysis, the political, economic, social, environmental, and legal factors are examined in relation to their relationship to hydropower development patterns in Laos, in both causes and consequences.

I utilize a modified variant of this framework, essentially a PESL (Political, Economic, Social, and Legal) analysis to examine the influences as well as identify effects of Laotian hydropower development. This framework allows for identification of

specific factors that are relevant to the development of the hydropower sector. Specific political factors include the Laotian political system and the regional geopolitical situation. Economic factors consist of the strength of the hydropower market, levels of hydropower revenue, and the contribution of hydropower revenue to the Laotian economy. Specific social factors include mitigation and resettlement measures, and measurements of socio-economic variables as related to food, agriculture, and health. Lastly, the legal factors include the role specific pieces of government policy have had upon the promotion of the hydropower sector.

When working with a PEST framework it is important to consider the level at which it is applied (Gillespie 2010). For example in relation to economic factors, one needs to realize that there are effects at multiple scales when dealing with hydropower development. At the local level, there needs to be a consideration of loss of income due to loss of land in the creation of hydropower reservoirs. At the national and international level there needs to be consideration of national macroeconomic status and power trade markets respectively when analyzing both the causes and consequences of hydropower development patterns. An analysis under the umbrella of a PEST framework is valuable in that it helps develop an in-depth understanding of the contexts present when analyzing a specific sector and country.

The PEST framework and analysis however has faults, it can be imprecise and primarily that it can allow an almost unlimited number of variables to emerge from each dimension (Gillespie 2010, Peng and Nunes 2007). This must be compensated for by thinking about which factors are most likely to change and which ones will have the greatest impact upon the specific sector or industry (Gillespie 2010). In my analysis, I

specify which elements from each realm (economic, political, etc.) are important in relation to hydropower development patterns which help narrow the context of the study.

Specific Methods and Data

In order to describe patterns present in hydropower development in Laos as well as analyze influences, consequences, and future development, data from a variety of sources is used to answer the questions at hand. Much of this data comes from Laotian government and developer documents. Other data is provided by international organizations such as the World Bank, Asian Development Bank, and the United Nations, who keep databases of statistics and documents related to hydropower development and its effects. Specific data dealing with patterns, factors of development, and consequences requires specific methods used and answers different aspects of the research goals. The specific data and associated methods are discussed below. Analysis of the data is undertaken under a variant of the PEST analysis.

Hydropower Development Patterns

To describe and explain initially what patterns are present in terms of hydropower development, descriptive statistical analysis and spatial visualization are the primary methods used. Hydropower development in this study is measured in terms of hydroelectric production and quantity of projects during the time periods of focus. Electricité du Laos, the state owned electric corporation produces a list of planned, under construction, and operational hydropower projects on an irregular basis, the most recent being in July 2011 (EdL 2011). The list includes: operational date of project (if available), province location, and capacity of the project (Mw). These statistics were then compiled into a separate data base that allowed for the calculation of project capacity and

the number of projects operational/under construction/planned in a given year. Statistics from this database are also integrated into ArcGIS in order to map the spatial distribution of Laotian hydropower projects.

Summary statistics including the total amounts of electricity produced (Billion Kw), and net generation of hydroelectricity (Billion Kw). These are used to determine how much total electricity is produced by Laos, and what share of that is due to hydroelectricity. This information along with data on the total amount of electricity exported (Billion Kw), and total installed capacity come from the U.S. Department of Energy Information Administration from 1990 to 2008. This database serves as the most complete archive on certain measures of electricity production as direct data from Laos is either unavailable or non-existent. This data, both statistic and spatial helps to describe patterns specific not only in overall production, but spatial as well which may suggest more subtle influences geographically and in the macro-environment.

Electricity export revenue is the primary indicator of hydropower profitability. Exact statistics for Laotian hydropower revenue are not readily available which requires an estimation of these amounts for the past two decades. Utilizing a base rate established by the Electricité du Laos in 2007, a rough estimate for each year of the study period is calculated by multiplying the base rate by the amount of exported electricity for each year.

Foreign direct investment is an additional factor that is considered in relation to hydropower development as both an enabler and a measurement of hydropower development. FDI inflow amounts come from the World Bank (2011b) for the past two decades.

Contributing Factors to Hydropower Development Patterns

In order to analyze contributing effects of economics, government policy, and geopolitics, document analysis of secondary data is utilized, as much of the information that discusses contributions is in the form of documents produced by various sources including: official Lao government reports, Asian Development Bank and World Bank reports and briefs, reports by NGO's and academics. Document analysis serves several purposes including: providing information on how hydropower is supported via political actions, regional views and positions of increased hydropower construction and development, and lastly providing a picture of current constraints facing hydropower development by Laos.

Consequences of Development

Several methods including descriptive statistical analysis and document analysis are utilized to describe the consequences of hydropower development. Again, these methods are utilized as they work well with secondary data. Several indicators of socio-economic statuses as indicated in various literatures are analyzed in relation to the measurements of hydropower development as well. Due to data limitations in the form of a lack of annual data for a multitude of indicators, several proxies of secondary socio-economic data must be utilized. As noted by Brown et al. (2008), Tilt et al. (2009), and IRN (2008b), food insecurity and agricultural production are two primary concerns related to hydropower development. These are reflected in the usage of agricultural statistics from the World Bank (2011b) and the United Nations Statistical Division (2011).

To examine other socio-economic justifications of hydropower development and how they are affected by patterns of development, several proxies are used. Data on health expenditures per capita (U.S. $), infant mortality rate, and life expectancy, serve as reasonable proxy variables of poverty indicators. This data comes from both the World Bank (2011b) and the World Health Organization (2011) for 1990-2009, and 1995-2009, depending on data availability.

Documents concerning the issues of mitigation, resettlement, and compensation plans and policies are analyzed in relation to the patterns of development in order to determine the consequences of increased hydropower development. These documents are in the form of reports put out by various agencies and organizations representing a wide variety of interests, ranging from donors and multilateral organizations (ADB 2002, 2004b, 2010b, World Bank 2010b) to project developers (NTPC 2008, World Bank 1998), and critics of hydropower development (Barney 2007, EDF 2004, 2005a, 2005b, FIVAS 2007, IRN 2008b).

In order to describe geopolitical consequences of hydropower development, media reports discussing dam projects and development along the Mekong River are analyzed to further illustrate the role geopolitics has upon either halting, or promoting development.

CHAPTER IV

HYDDROPOWER DEVELOPMENT IN LAOS: ACHIEVEMENTS, CONTRIBUTIONS AND IMPACTS

Introduction

The hydropower sector in Laos in the last 20 years experienced two stages of development. The first is that of stagnant development with little change, while the second is a picture of rapid growth which seems to have no limit. In order to analyze explain the pattern of development; this chapter is broken down into several parts. First in order to establish a geographic, historical, and political context, a short section detailing the backgrounds of each of these contexts is given. Next an analysis of Laotian hydropower patterns is conducted. This chapter is meant to examine the measurements of hydropower development described in the previous chapter. These measurements are analyzed and discussed individually. Following the analysis of the patterns present, the next sections analyze contributing factors, and the consequences of hydropower development in relation to the key factors. I conclude this chapter with a short summary of the major effects upon the patterns of development in relation to the key factors. Lastly in the conclusion, I present a sedge way to a discussion of future trends and patterns as related to Laotian hydropower development.

Geographic Context

Laos is a landlocked state covering 236,000 square kilometers in the center of the Southeast Asian peninsula. Figure 1 shows Laos' position in Southeast Asia as several major bodies of water present in the form of rivers and lakes while Figure 2 shows the provinces of Laos. As evident from Figure 1, one of the most prominent physical features of Laos is the Mekong River that after entering the country from Myanmar generally follows the western boundary of Laos. Figure 1 also displays several prominent rivers that have seen or have plans for hydropower development.

Surrounded by Myanmar and China to the north, Thailand and Cambodia in the west and south, and Vietnam to the east, Laos' location has made it a buffer state between its more powerful neighbors as well as a crossroads for trade and communication (Savada 1994, 81). A mountainous region that is characterized by steep terrain, narrow river valleys, and low agricultural potential, Laos' physical geography presents a heavy obstacle to development in terms of agriculture, transportation, and infrastructure development. Roughly only 4% of the total land area is considered arable (Savada 1994, 82). Laos' total renewable water resources are measured at 333.6 km^3 with a total freshwater withdrawal rate of 3 km^3 (The World Factbook 2011). Combined with a tropical monsoon climate and dry seasons, irrigation is a major concern. Regional rainfalls can vary with the highest amounts in the area of 3700 millimeters annually. Regional droughts are a concern for rice cultivation which is a primary staple for the people of Laos. Average temperatures range from a minimum of 25°C to a maximum of 38°C. The northern part of the country is prone to droughts, while the central and southern area are flood prone (UNDP 2008, 5) As a result of the mountainous terrain and

Figure 1. Physical map of Laos

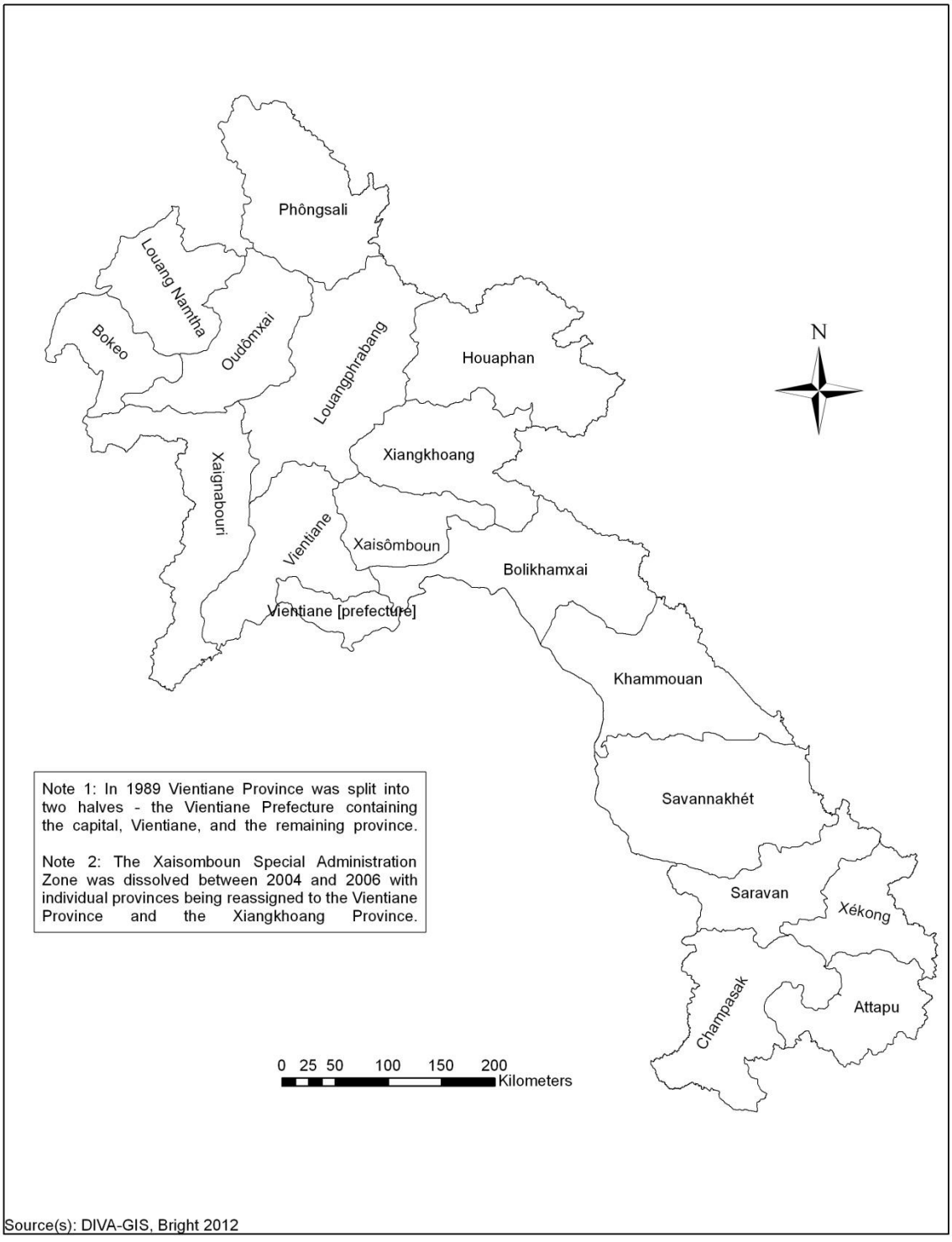

Figure 2. Provinces of Laos

general lack of development, the road networks in Laos are few and unreliable, limiting government presence in areas distant from the national capital (Savada 1995, 85). As of 2007, Laos had only 36,831 km of roadways, placing it 92nd in the world (The World Factbook, 2011).Laos is home to several natural resources. Timber, hydropower, gypsum, tin, gold, and gemstones are all found within Laos, with hydropower and timber reserves being the most important resources for profit (The World Factbook, 2011). The physical geography of Laos with its abundance of rivers and mountains provides the country with significant hydropower potential which has been highly undeveloped at this point. Hydropower is thus seen as playing a pivotal role in the present and future development of Laos through the funding of the national development framework which has been a part of Laos' National Growth and Poverty Eradication Strategy. Climate change is also a concern in Laos in relation to natural resources in terms of effects to agriculture, energy, and forestry. The United Nations Development Programme has attempted to raise awareness of the impacts of global climate change upon Laos' natural resource base. The UNDP has recognized that Laos is highly dependent upon natural resources for economic and social development. Changing climate and weather patterns can result in severe environmental degradation and natural disasters that have the potential to destroy livelihoods and hinder development (UNDP 2008, 6). Data on current climate change effects in Laos is sparse, but reports of increased floods and droughts suggest that combined with hydropower development, climate change may be having an adverse effect in Laos (ADB 2004b, FIVAS 2007, IRN 2008b).

Historical Hydropower Development

While Laos' hydropower production potential was recognized as early as the post World War II period, it was not until the late 1960's that development of hydropower resources begun in Laos. The first large scale hydropower project in Laos was the Nam Ngum 1 project. Nam Ngum 1 with a total capacity of 150 Mw, was designed originally to provide power for domestic industry as well as provide for exports and domestic demand (ADB 2002, 2-3). Constructed in the late 1960's and becoming operational in 1971, Nam Ngum 1 today is considered to be a highly effective development project, offering a wide range of benefits to the country (ADB 2002, 2-17). Nam Ngum1 was largely conceived and implemented with coordination by the Mekong Committee, with the national power agency taking over responsibility during the post construction period. While at the time the dam was considered a stand-alone project, today Nam Ngum 1 is seen as a component of the wider development of water resources in the basin as well as being part of the national growth and development plans (ADB 2002, 2-2).

Geopolitics during this time helped to discourage further development in the 1970's. Laos was entangled in the Second Indochina War through the Pathet Lao, the communist element within Laos. Following the communist victory in Vietnam in 1975, and with support from North Vietnam, the Pathet Lao became the Lao People's Democratic Republic in March of 1975 (Savada 1995, 68). Further large-scale development was halted and the Mekong Committee disbanded with the Second Indochina War and the communist victory in Vietnam in 1975. Regional hydropower development has ebbed and flowed with broader events and ideologies. For example, hydropower projects were planned not only in Laos but in Cambodia, Vietnam, and

Thailand during the Cold War period as barrier to communism through regional development (Hirsch 2010). Support for hydro-projects continued with the spread of communist governments in Southeast Asia, but was hampered by a lack of resources, planning, and most importantly funding.

Major hydropower development was stalled throughout the 1980's due to war and political instability (IRN 2008b, 13). Political isolation also played a part in the lack of development during the 1980's. This is a historical example of how politics under the PESL framework have influenced the development of hydropower. Limited amounts of foreign aid and limited government revenue resources contributed to a lack of investment in infrastructure and revenue projects such as hydropower (ADB 2002, 2-17). With the end of the Cold War in the early 1990's combined with regional rapprochement between non-communist Thailand and its communist neighbors, interest in hydropower once again grew. Thailand was seeking outside sources for electricity, while Laos sought to gain revenue from the sale of its natural resources in the region (Hirsch 2010, 314).

The 1990's represented rejuvenation in Laotian hydropower with multiple memoranda's of understanding signed with Thailand and Vietnam for the purchase of electricity, resulting in the planning of multiple hydropower projects to increase hydropower capacity (IRN 2008b, 13). The 1997 Asian Financial Crisis however helped to put a damper on the revival of hydropower in the region. Economic growth was slowed throughout Southeast Asia especially in Thailand where the crisis started and had affected the most. Thai energy demand had been one of the key driving forces behind the push for Laotian hydropower which became stalled due to lack of demand and emerging problems such as revenue management, and mitigation efforts with dams that had been funded by

public institutions such as the Asian Development Bank and World Bank (Hirsch 2010, 314). Economic recovery following the financial crisis combined with increased demand for electricity in both Thailand and Vietnam in the new millennium has resulted in a new hydropower boom. Memorandums of understanding were signed with both Thailand and Vietnam for the purchase of 7000 Mw and 3000 Mw of electricity respectively (IRN 2008b, 13). Hydropower projects have also found support from international funding groups such as the Asian Development Bank and World Bank who have contributed significant financial support for hydropower projects. In the Nam Theun 2 project which became operational in 2010, the World Bank provided a 20 million dollar (U.S.) grant and risk guarantees of over 42 million dollars (World Bank 2009, 4). The Asian Development Bank provided 120 million dollars in the form of loans and guarantees in support of the project (ADB 2010b). Overall Asian Development Bank assistance to Laos for the development of the energy sector totaled approximately 290 million dollars from 1988 to 2009 (ADB 2011a).

Development and Achievements – 1990-2009

Laotian hydropower development can roughly be divided into two distinct time periods; pre-1998 development, and post-1998 development. This distinction is made due to the large increases in hydropower production and investment starting in 1998. 1998 also marks the start of operation for the Theun-Hinboun hydropower project, which was the first major project since the 1970's. Starting with the measurements of total energy generated, total hydropower generated, and total amount exported, certain trends in the patterns become evident.

Production Levels and Project Numbers

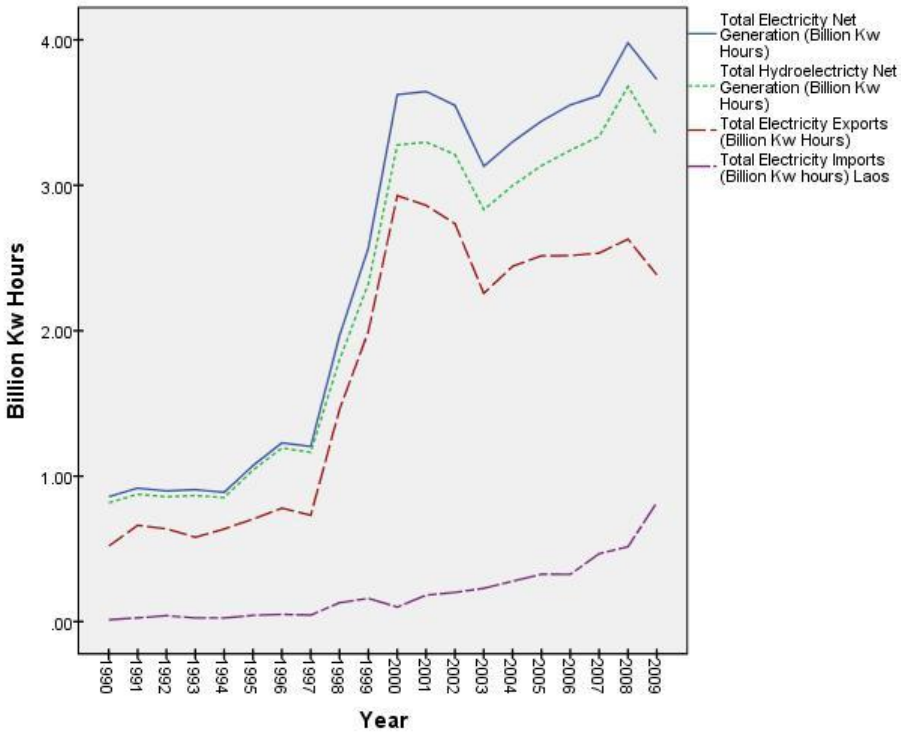

Figure 3. Laotian electricity production, exports, and imports – 1990-2008
Source: U.S. Energy Information Administration 2011

As can be seen in Figure 3, until about 1997, total energy generation as well as hydropower generation hovered around 1 billion Kw hours annually, while exports stayed constant at around 500,000 to 700,000 Kw hours. Despite the Asian Financial Crisis in 1997 when energy demand regionally plummeted, hydropower generation and net generation saw major increases in the next 4 years. Increases and declines in export amounts closely mirrored the total net generation. A period of brief decline in generation is found from 2001 to 2003 for both hydropower generation and net generation, rising again in 2004. Another period of decline is also present from 2008 to 2009. Interestingly total electricity exports after reaching a peak in 1999 have experienced patterns of muted increases and stronger declines. This can be explained partially by a reduction in the

amount of electricity imported by Thailand, one of Laos' primary customers for its hydroelectricity production as well as competition from alternative sources of energy such as coal and natural gas, which Thailand imports for the production of electricity (Maunsell 2004, 50).

This pattern of increased generation and decreasing exports is both interesting and surprising given the emphasis hydropower production has had in multiple contexts as related to Laos. As an example of this emphasis, Electricité du Laos (2010b) states, that due to the physical and human geographic challenges to development, Laos is constrained in its opportunities for generating income to alleviate poverty and achieve social development goals. The physical geography of Laos with its abundance of rivers and mountains, provides the country with significant hydropower potential which proponents contend, has been highly undeveloped at this point.

Percentage wise, the amount of electricity exported by Laos has experienced extreme fluctuations in the past two decades. Figure 4 shows the amount of exported electricity as the percentage of total net generation. This was calculated by dividing the total amount of electricity exports by the total net generation.

In the period before 1997-1998, export percentages ranged from a low of about 60% to highs over 70%. 1997-1998 saw a drastic increase in export percentages rising to around 80% of total net generation. From 2000 to 2003 a decrease was present percentage wise, with a slight increase in the following year. However, since 2004 the percentage has seen decreasing totals due to increasing domestic energy consumption, increased domestic production, and periods of decline in Thai electricity imports. This is illustrated in Figures 5 and 6.

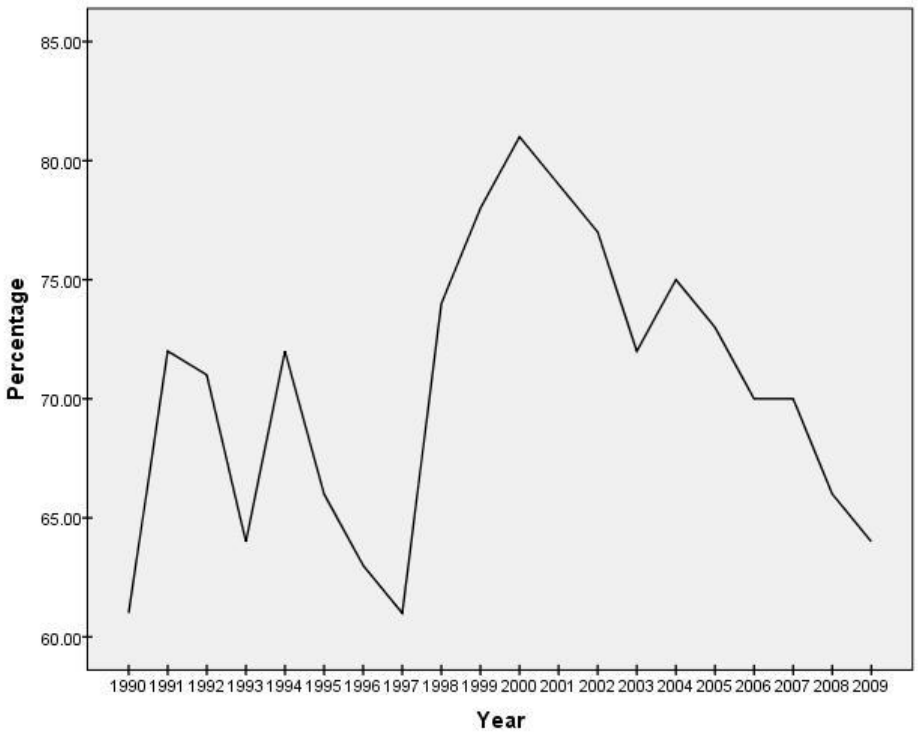

Figure 4. Laotian exported electricity as percentage of total net electricity generation
Source: U.S. Energy Information Administration 2011

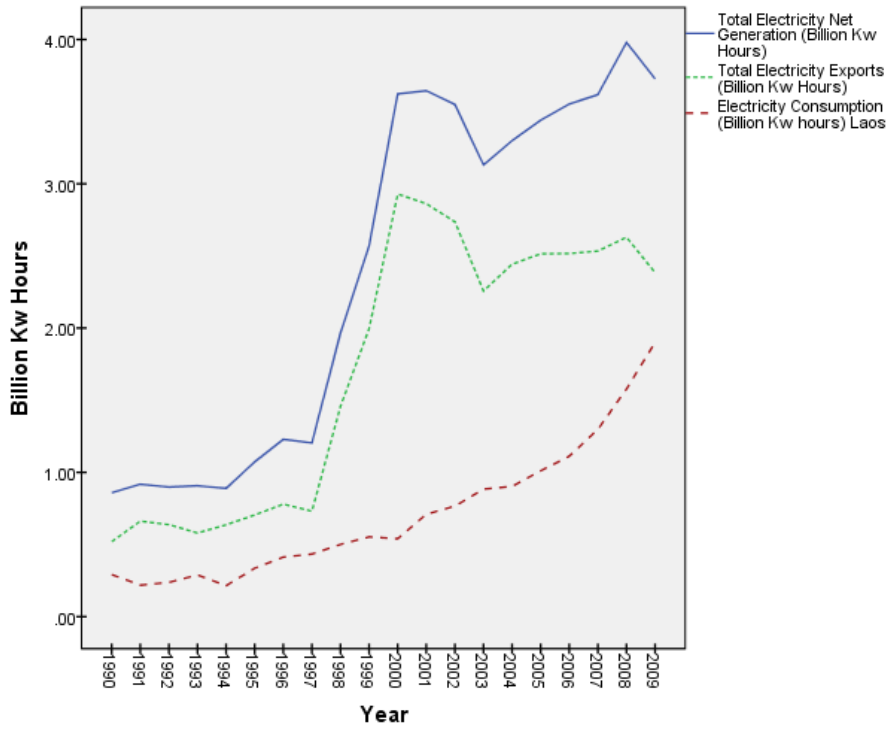

Figure 5. Laotian electricity production, exports, and consumption 1990-2008
Source: U.S. Energy Information Administration 2011

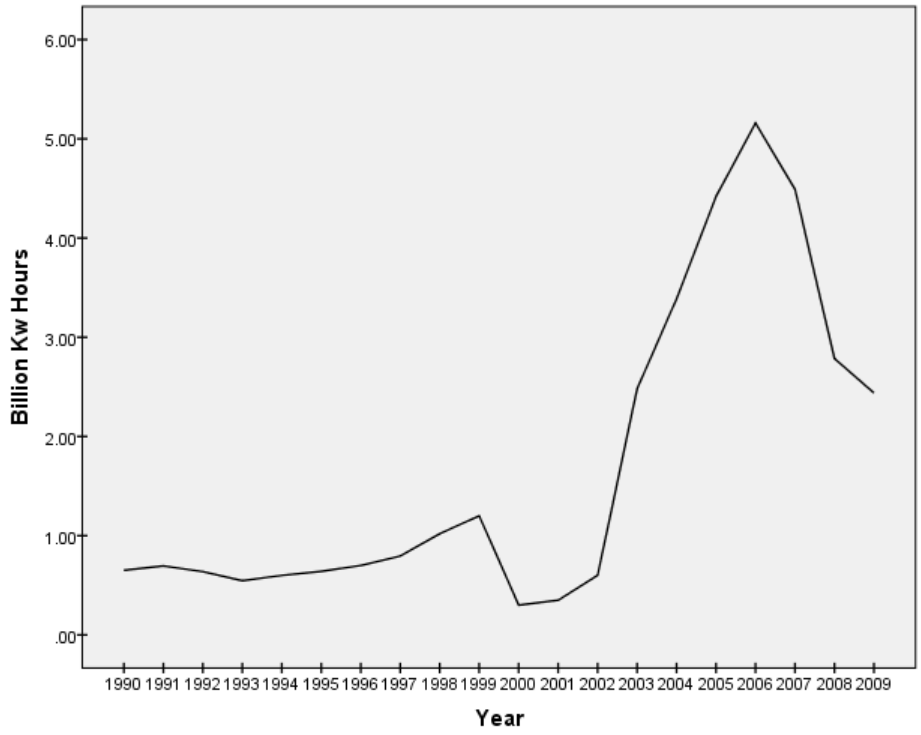

Figure 6. Thai Electricity Imports 1990-2009
Source: U.S. Energy Information Administration 2011

Hydropower consists of a major percentage of Laotian electricity totals. Percentage wise, hydropower has accounted for at least 90% of total generation in the past 20 years as evidenced by Figure 7. This was calculated by dividing the net hydropower generation by the total net generation.

Beginning from the start of the study period, hydropower has constituted at least 90% of total net generation. A decrease is present in 1997 lasting until roughly 1999 where percentages stayed constant until small increases in 2003. Clearly hydropower is the key source in Laotian electricity production.

The number of projects operational, under construction and planned has also risen in the past two decades. Table 1 presents a summary of project statuses.

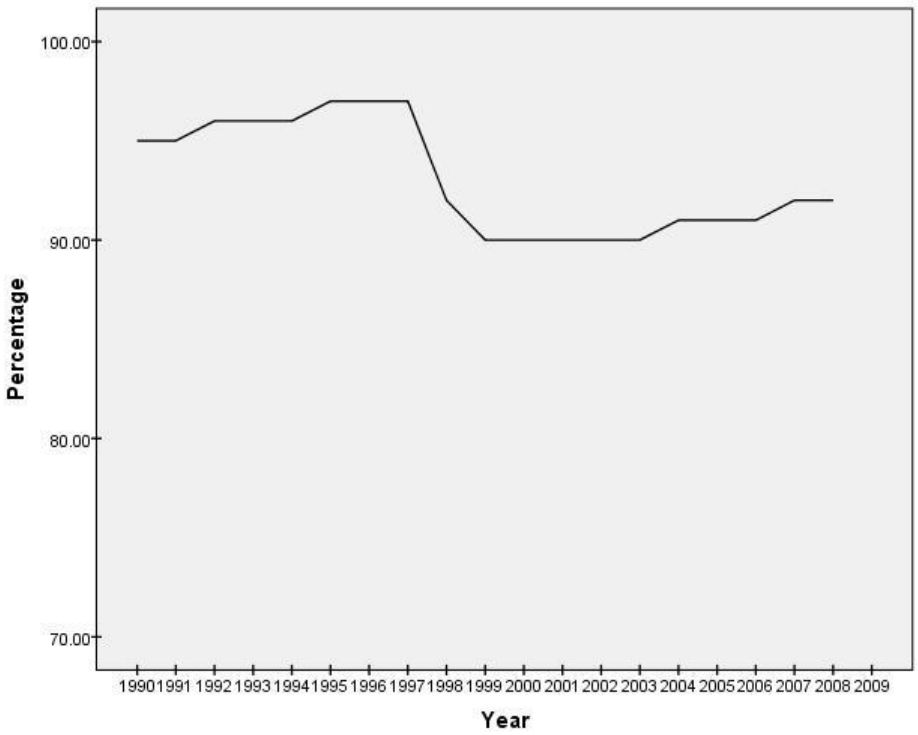

Figure 7. Total Laotian hydroelectric generation as a percentage of total net generation
Source: U.S. Energy Information Administration 2011

Table 1.
Status of Laotian hydropower projects 1970-2020

Status	Number of projects	Percentage
Operational	14	16.5
Under construction	9	10.6
Planning stage	62	72.9
Total	85	100

Source: EdL 2011

As of 2011, 14 hydropower projects are currently operational, producing power and revenue for developers and the Lao government. 9 projects are currently under construction in the Laos with a further 62 in various stages of planning (Edl 2011).

Operational projects span to the beginning of hydropower development in Laos beginning in the 1970's as shown in Figure 8.

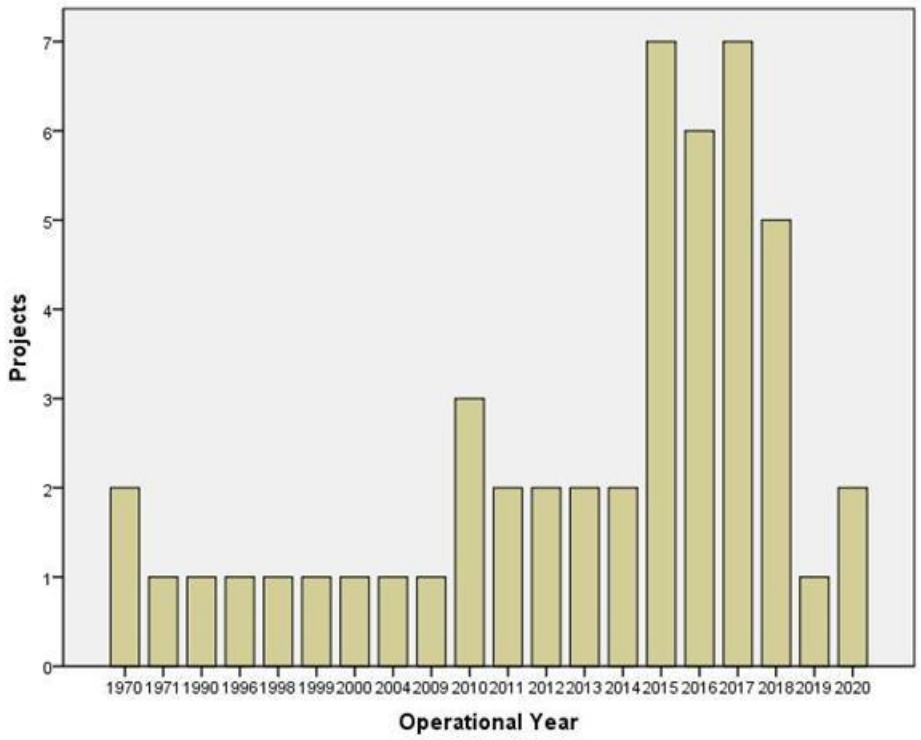

Figure 8. Total number of operational, under construction, and planned hydropower projects by given commercial operational year, 1970-2020
Source: EdL 2011

As evidenced by Figure 8 which shows the commercial operational year for operational, planned, and projects under construction, only six projects came online from 1970 to 1998. In contrast, between 1999 and 2011, 8 projects have either come online or are scheduled to begin operation. Compared to an average of 0.21 projects per year between 1970 and 1998, the last 12 years have seen an average of 0.66 projects becoming operational. While of course there cannot be a half or a quarter of a hydropower project, these numbers are clearly reflective of a pattern of increased hydropower development in Laos. While Table 1 indicates 62 projects currently in the planning stage, only 32 of those currently have projected operational dates due to the nature of planning and securing funding for said projects (EdL 2011).

Spatial Patterns

The spatial distribution of Laotian hydropower projects also shows patterns present. Figure 9 presents total number of projects operational, under constructed or planned, while Table 2 shows the number of projects and associated statuses by province. As Figure 9 and Table 2 show, the highest numbers of projects are located in the Vientiane Province as well as the Champasak Province. Figure 9 also shows the location of the Mekong River and other major bodies of inland water in Laos. Northern Laos has a higher amount of projects due to the terrain in the northern region, which is conductive to hydropower construction.

High numbers of projects in both Vientiane and Champasak are due to the location of the Mekong River and associated tributaries that are suitable for hydropower development. Unfortunately, specific locations of projects are not available at this time for geo-visualization.

Capacity

Another measurement of hydropower development is in the form of the installed capacity in terms of electricity generation for new projects in a given year. Measured in Megawatts (Mw), the total installed capacity can give some idea to the extent of the size of projects built or planned. For reference, 1 Mw = 1000 Kw. Figure 10 shows visually the sum of the total capacity for newly operational, planned, and projects under construction for each year.

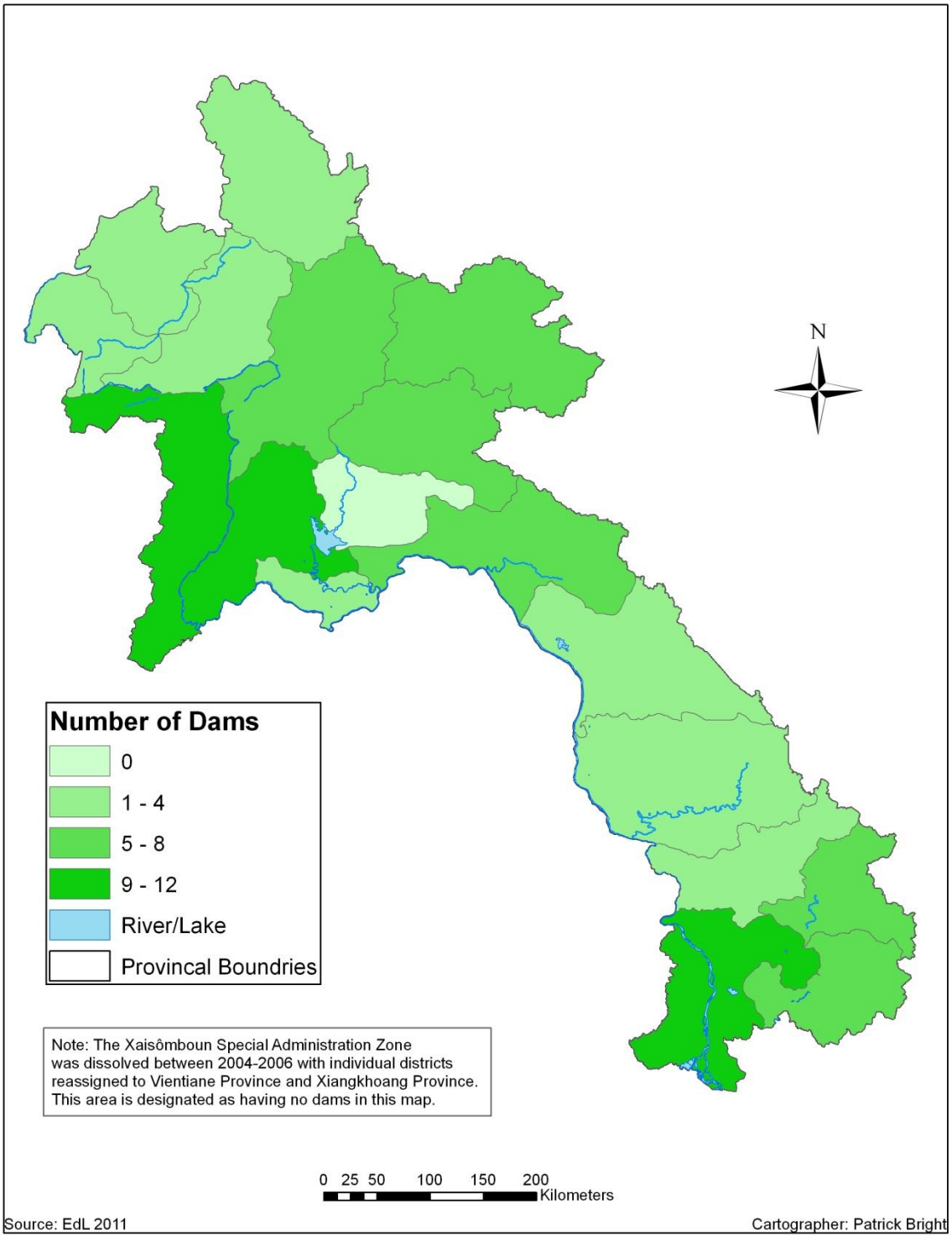

Figure 9. Distribution of operational, under construction, and planned hydropower projects from 1970-2020

Table 2.
Number of operational, under construction, and planned hydropower projects by province

Province	Operational	Under Construction	Planned	Total Number of projects	Total Percentage
Attapeu	0	1	7	8	9.4
Bokeo	1	0	1	2	2.4
Bolikhamxay	1	1	5	7	8.2
Champasak	2	0	8	10	11.8
Houaphan	0	1	5	6	7.1
Khammouane	1	0	1	2	2.4
Luangnamtha	0	1	1	2	2.4
Luangprabang	1	1	5	7	8.2
Oudomxay	1	0	2	3	3.5
Phonsaly	0	0	1	1	1.2
Saravane	2	0	1	3	3.5
Savannakhet	0	1	3	4	4.7
Sekong	0	1	5	6	7.1
Vientiane	5	0	7	12	14.1
Vientiane Municipality	0	0	1	1	1.2
Xayabouri	0	1	5	6	7.1
Xiengkhouang	0	1	4	5	5.9
Totals	14	11	62	85	100.0

Source: EdL 2011

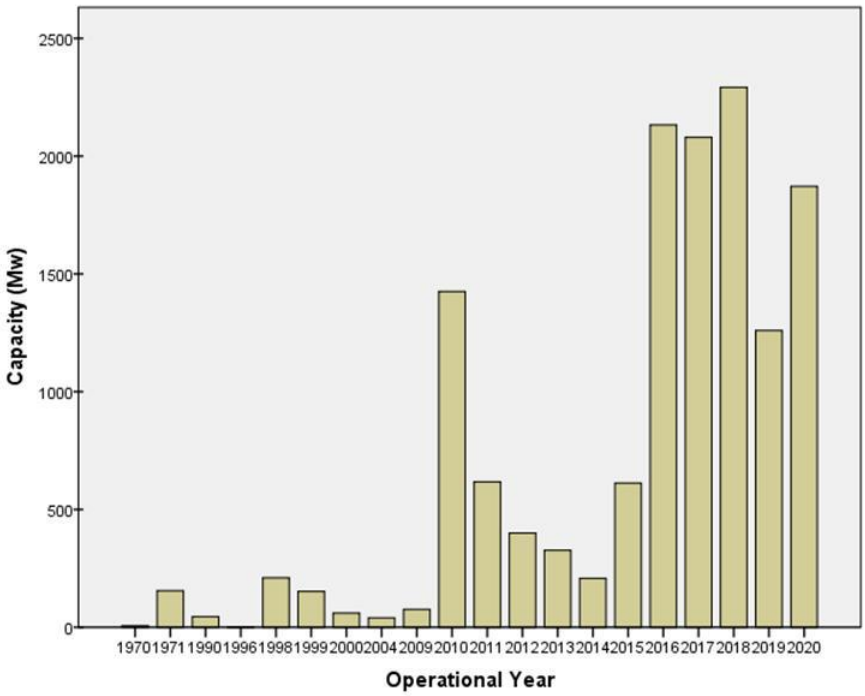

Figure 10. Sum of installed hydro electricity generation capacity for operational, planned, and under construction projects, 1970-2020
Source: EdL 2011

Clearly before 1998, the installed capacity of new projects was quite small with the only significant contributions to capacity coming in 1971 and 1990. Post-1998 however, we begin to see a change in terms of installed capacity. Starting with the Theun-Hinbou Hydropower Project which came online in 1998, additional projects in terms of numbers and capacity begin to come online as well. 2010 saw the most significant increase in capacity in the last two decades with the addition of nearly 1500 Mw of capacity added to the Laotian electrical system. While 2011 shows a decrease in new capacity until 2014, a slew of new projects are expected to be built and increase the hydroelectric capacity of Laos even further. In 2018 alone, planned projects are expected to contribute at least 2200 Mw of new capacity. Individual project capacity over this time span has ranged from small scale projects of only 1 Mw, to large scale projects of greater than 500 Mw that utilize the Mekong River's hydropower potential. Installed capacity

has shown constant increases since 1993. Figure 11 shows the trend present in hydropower capacity.

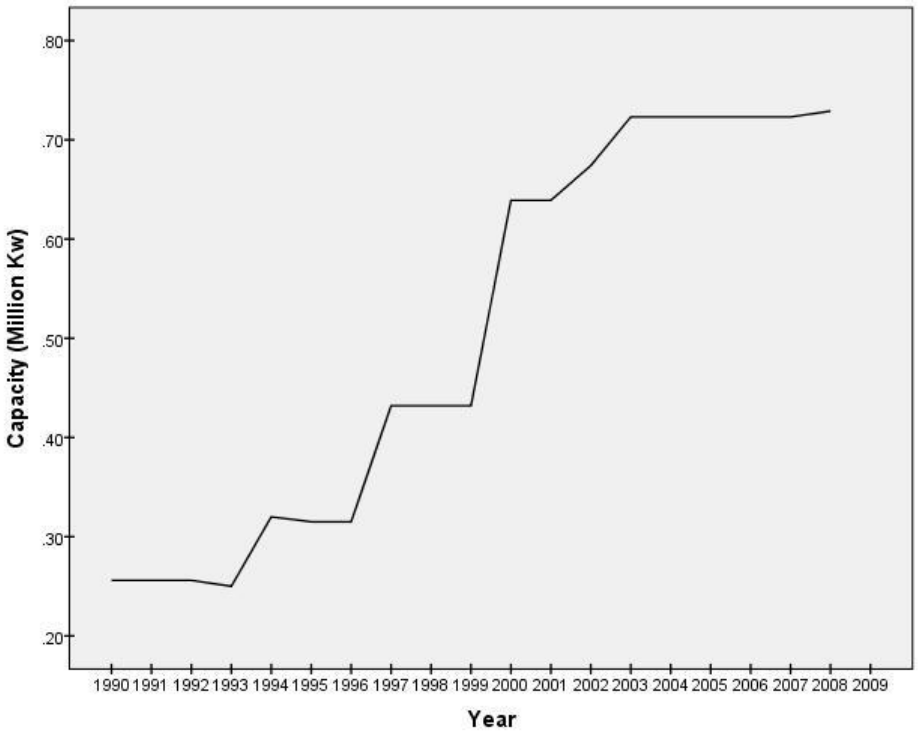

Figure 11. Total installed hydropower capacity 1990-2009
Source: U.S. Energy Information Administration 2011

Major increases came at different years, notably 1993, 1997, 2000, and 2003. Since 2003 capacity has stayed at a constant level around 0.72 million Mw. This number should increase with the projects currently under construction as well as the amount of planned projects in the next 10 years. Overall, capacity in both new projects and total has increased since 1990. Electricity production as well has seen increases with several periods of decline, but currently displaying an upward trend. The absolute number of new hydropower projects has also experienced an increase since the beginning of the 1990's and shows little sign of declining. This is in contrast to the declining amount of exported electricity which raises concerns about the intake of revenue from export sales.

Revenue Estimates

Revenue from the sale of hydroelectricity is the most common reason used for the development of large scale hydropower projects. Laos is no exception in that it states that the revenue will be used for various purposes related to poverty reduction and improvements in socio-economic status (ADB 2004b, EdL 2010b, World Bank 2010b). Hence under the PESL framework, revenue is a major factor within the economic realm in terms of influences of development. While official statistics for hydropower revenue are not readily available, it is possible to estimate the profitability of hydropower in the last two decades for Laos. Utilizing the total amount of electricity exported in billion of Kw hours, this amount is multiplied by US$0.0345/Kwh for each year to determine a rough estimate of electricity export revenue. The amount per kilowatt hour is from the 2008 Electricité du Laos power development plan, which assumed an average yield of 0.0345 cents per kilowatt hour (EdL 2008). It is assumed that the average yield fluctuated from 1990 and was not a constant amount. The amount used in the 2008 plan serves as a general indicator of average revenue across the time period due to a lack of comprehensive information on revenue income and rates. Again this should be considered a rough estimate that provides a general picture of the amount of revenue generated by electricity exports. Figure 12 shows estimated revenue from 1990 to 2008.

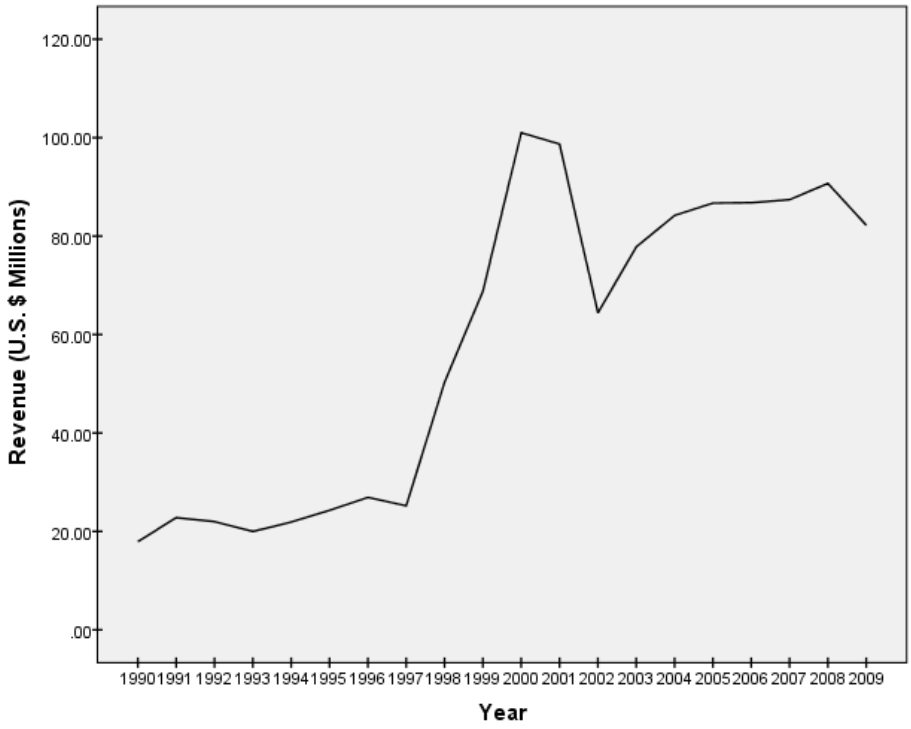

Figure 12. Estimated Laotian electricity export revenue
Source(s): EdL 2008, U.S. Energy Information Administration 2011

Estimated revenue until 1998 stayed fairly constant around 20 million U.S. dollars. In 1998, the Theun-Hinboun Hydropower Project became operational, which is reflected in the major increase in revenue for the next three years reaching a peak of 101 million dollars. From 2001 until 2002, export revenue experienced a decline rebounding in 2004 with the beginning of operations at the Nam Theun 2 project. When compared to Figures 3 and 4, the pattern mirrors the decreases in electricity exported and produced. When estimated revenue is calculated as a percentage of the GDP, a concerning pattern becomes present. Figure 13 displays GDP from 1990 to 2009, while Figure 14 shows the revenue as the percentage of the GDP.

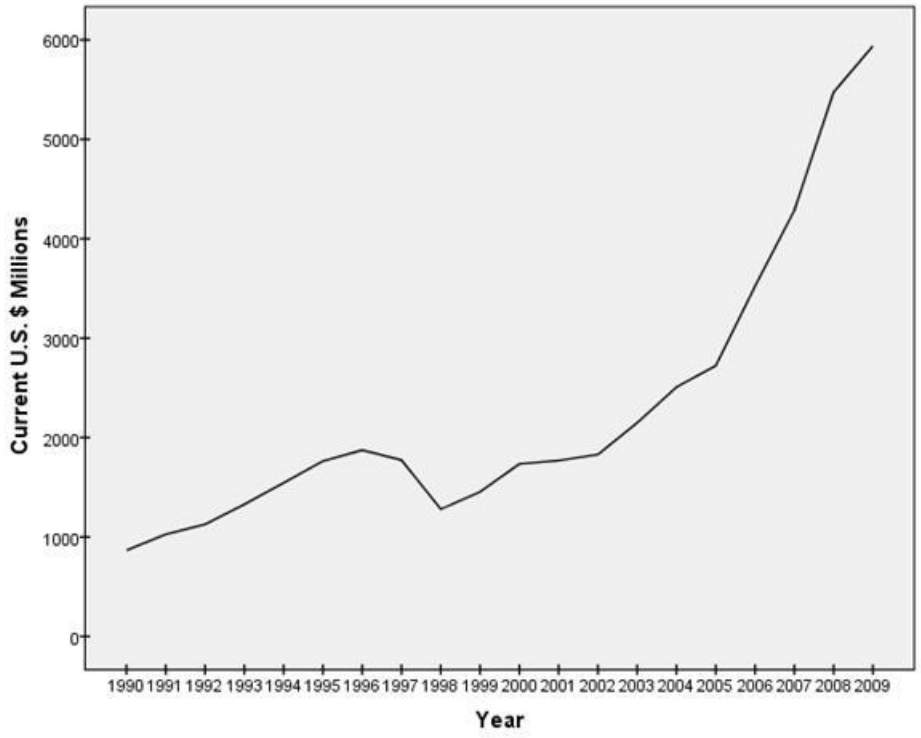

Figure 13. Laos GDP 1990-2009 (Current U.S. $ millions)
Source: World Bank 2011b

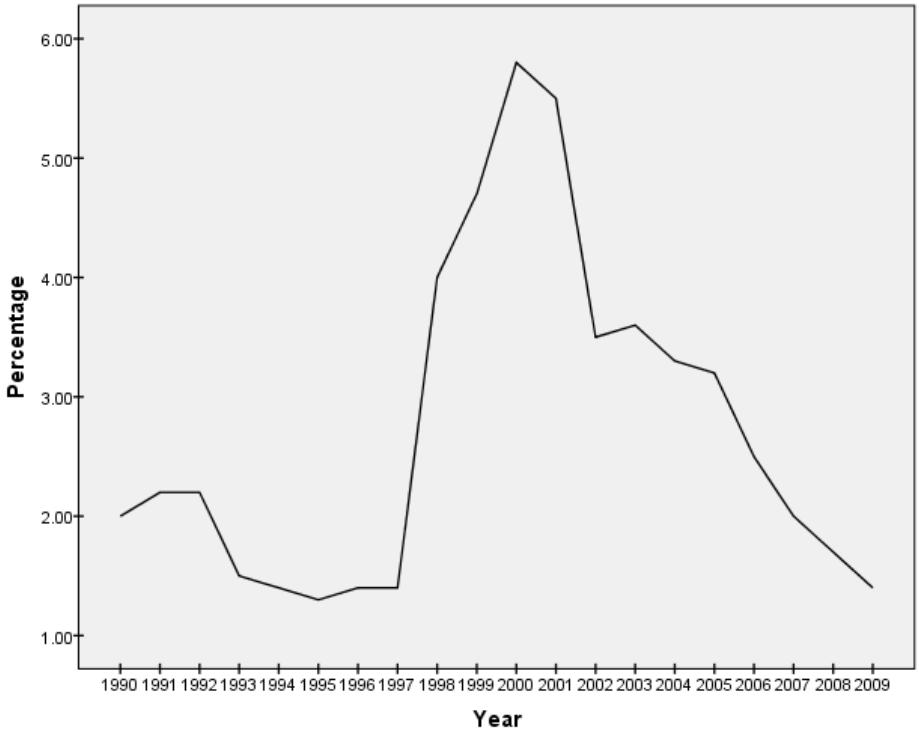

Figure 14. Estimated Laotian electricity export revenue as percentage of GDP
Source(s): EdL 2008, U.S. Energy Information Administration 2011

While the GDP has shown constant growth since 1998, revenue presents a different story. Electricity export revenue at its highest represented 5.8% of Laos' GDP in 2000 following steep gains in the previous 3 years. Since 2000 however, this percentage has fallen, and in 2009 represented only 1.4%, the second lowest total since 1995. While the Laotian GDP growth rate must be taken into consideration as displayed in Figure 15, attention is drawn to the decreasing impact electricity export revenue is having upon the national economy.

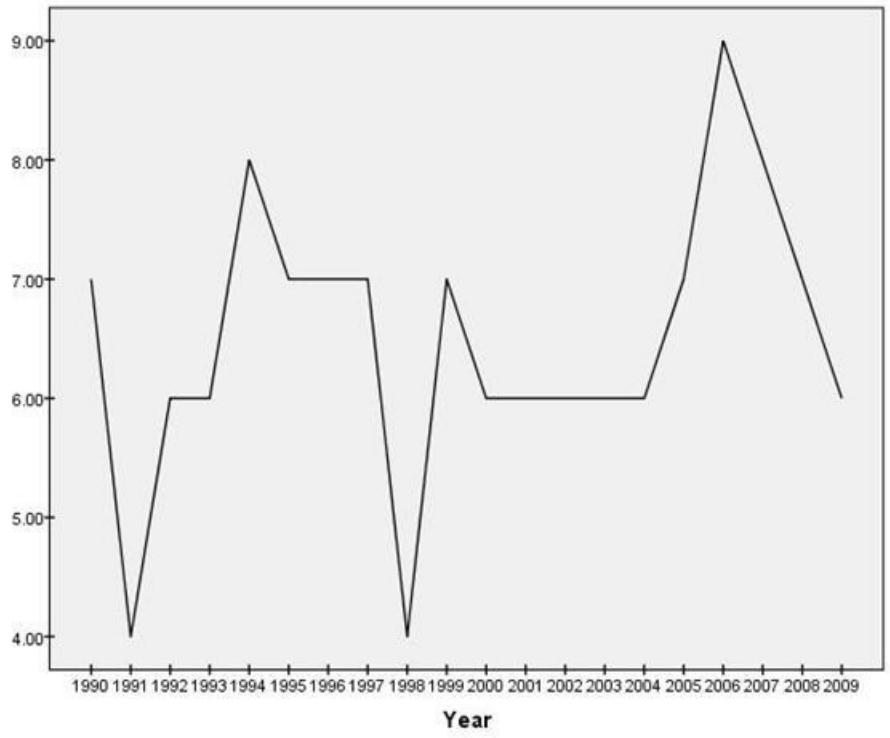

Figure 15. Laotian GDP growth rates (%) 1990-2009
Source: World Bank 2011b

Economic Benefits

The Laotian macro and micro-economic situation has never been one of prosperity. Laos is poor and underdeveloped with a small domestic economy, limited trade opportunities, poor infrastructure, and low education and health levels. Additionally the weak capacity of government and economic institutions contribute to the challenges

of building a prosperous nation (ADB 2009, EdL 2010b, World Bank 1998, 2011a). Hydropower revenue is seen as a strong, sustainable source of foreign revenue that can increase government returns and help to raise social standards such as the standard of living (ADB 2002, 2004b, 2009, EdL 2010b). Utilizing the PESL framework, these economic benefits are identified as a critical factor for the continuation of hydropower development.

Revenue from hydropower projects is framed as highly beneficial on the national scale and seen as the major reason for increased hydropower development in the nation. The Asian Development Bank's Study of Large Dams (2002) stresses that the reasoning behind the construction of large scale hydropower projects is usually made in terms of the realization of macroeconomic strategies or sectoral development objectives such as industrialization and poverty reduction (ADB 2002, 2-2).

The Asian Development Bank has found in general macroeconomic benefits are positive, but dam building cannot be taken for granted as the best answer for a country's macroeconomic needs. These benefits are seen as supporting the nation as a whole primarily in terms of the economic rate of return, contribution to economic growth, GDP growth, and the strengthening of the nation's external balance (ADB 2002, 2009, World Bank 2010a, 2011a). Hydroelectricity is stated to have contributed at least 3 percentage points to the economic growth of Laos, while contributions from hydropower projects are not only reflected in the revenue from the operation of the project, but through foreign direct investment (FDI) by international investors, which helps increase net capital inflows on a national scale (ADB 2009, World Bank 2009, 2010a, 2011a). Inflows of FDI are also considered an enabler of hydropower through the financing of growth

investments such as hydropower projects (Virtanen 2006, 183). FDI inflow totals for Laos in the past two decades have varied as shown in Figure 16.

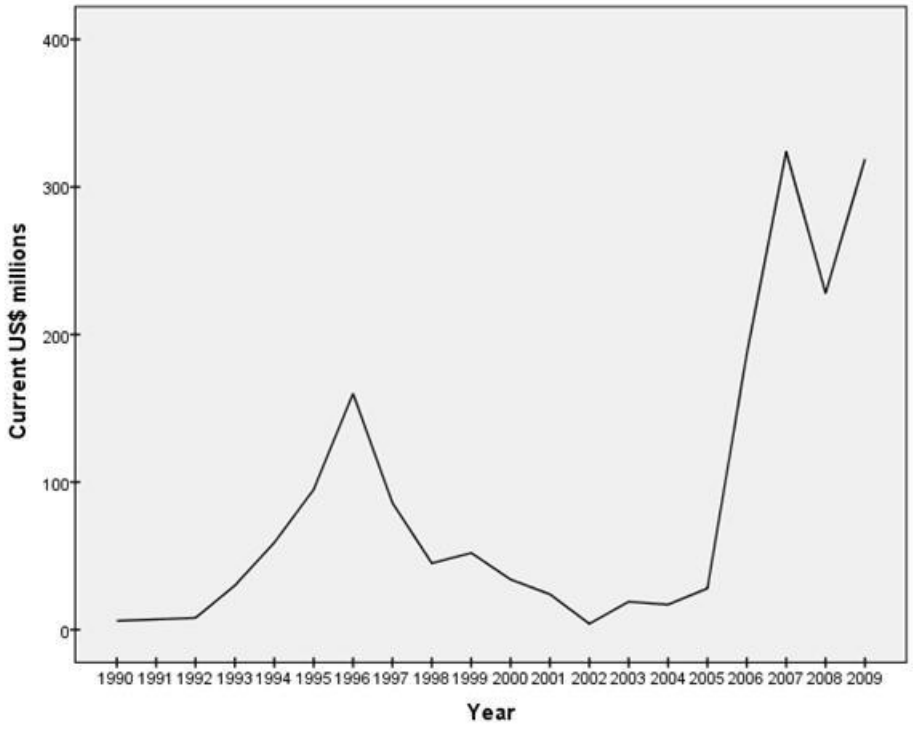

Figure 16. Laotian FDI inflows 1990-2009
Source: World Bank 2011b

FDI inflows pre-1998 peaked at 160 million dollars in 1996, partially from investment in the Theun-Hinboun project. The Asian Financial Crisis is reflected in the loss of FDI following 1996, reaching a low of 4 million dollars in 2002. 2006 marked a significant increase in inflows due to investment in the Nam Theun 2 hydropower project. Inflow for 2007 reached a high of 324 million dollars although decreasing in the next year reflecting the most recent global recession. Figure 17 shows these amounts as a percentage of the GDP. There is evidence that FDI inflows have been affected by the two major financial crises in the last 20 years. In 1997 and 2008, inflow decreased significantly, representing smaller amounts of the GDP.

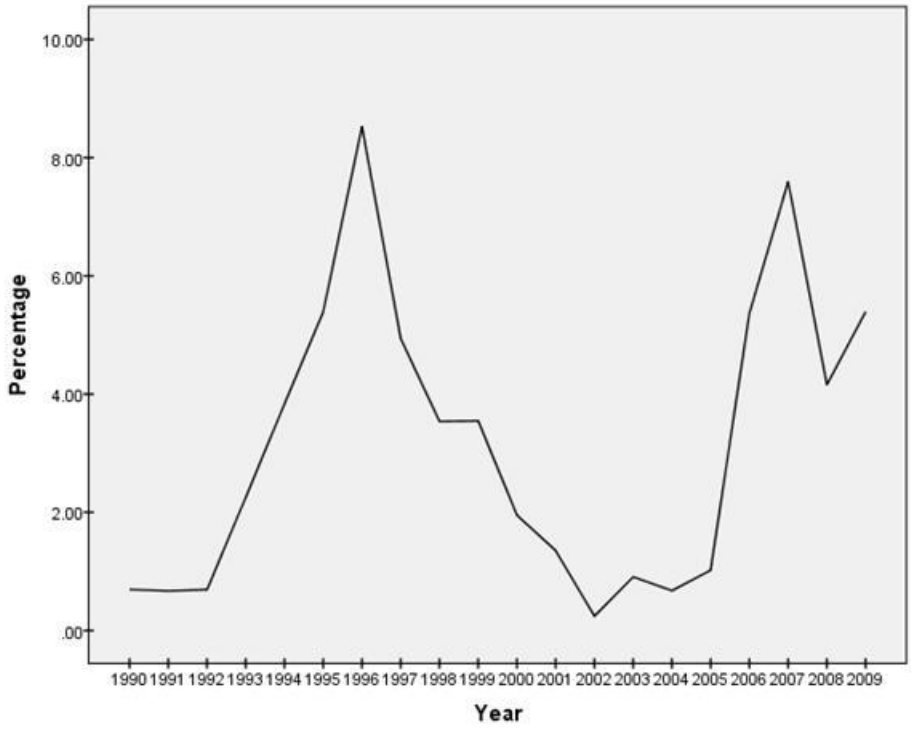

Figure 17. Laotian FDI inflow as percentage of GDP 1990-2009
Source: World Bank 2011b

Continuing increases in GDP serve as further reason for continued hydropower development which is in concurrence with official Lao government positions regarding the macroeconomic benefits of hydroelectricity. Figure 13 above showed the pattern of GDP increases since 1998. The Lao government views hydropower as the primary avenue of escape from its status as a third world nation. This is evident within the government's official economic development plans where references to hydropower as playing a pivotal role in achieving the social and economic development goals of the Lao PDR are a common theme (EdL 2010b, ADB 2009). Laos' power system development plan states in its overview of the Laotian power sector, that the earning of foreign exchange is one of two vital national priorities and is at the heart of the Laos' strategy for earning needed revenue for development (Maunsell 2004, 21).

Additionally, hydropower is integrated as part of Laos' National Poverty and Eradication Programme by the Lao government, which plans for the elimination of poverty via sustained, equitable economic growth, and social development (Virtanen 2006, 185). In order for this to be achieved, the economy has required investment in industrialization and modernization and a growth rate of no less than 7% per year of which hydropower development is considered a major part of. When the growth rate of the GDP is compared against the electricity export revenue and the amount of FDI inflow, and electricity export revenue, interesting trends become present. This is evidenced in Figure 18 which compares the three amounts over the past 20 years.

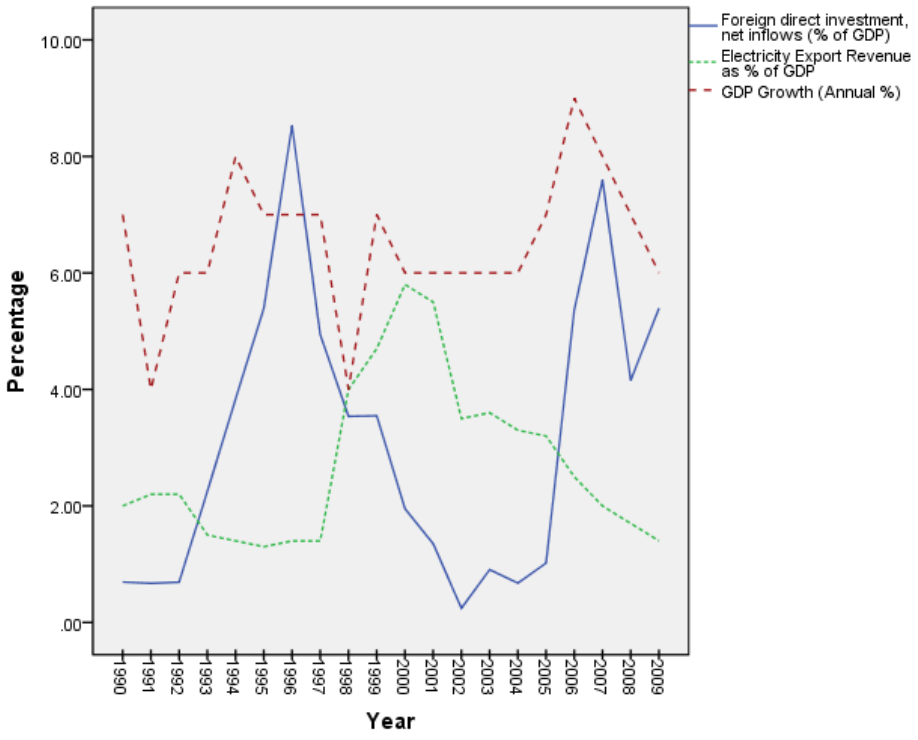

Figure 18. Comparison of FDI inflow, electricity export revenue, and GDP growth 1990-2009
Source: EdL 2008, U.S. Energy Information Administration 2011, World Bank 2011b

From Figure 18, there appears to be no strong relationships present between these three variables. While electricity export revenue at its peak represented 5.8% of the GDP, in

2008 FDI inflows represented just over 4% of the GDP compared to only 1.7% for electricity revenue. From roughly 2004, GDP growth and FDI level saw an increase suggesting that FDI had a slight positive effect upon economic growth versus electricity export revenues in this period. What remains unknown is how much of the FDI inflow is used in the investment of hydropower projects. This highlights concerns that critics have over the actual contribution large-scale, export oriented hydropower projects make towards national economic goals as well as strengthens concerns about potential macroeconomic benefits (EDF 2005b, IRN 2004, 2008b).

Factors Contributing to Hydropower Development

Economics – Investors and Financing

One of the primary economic factors under the PESL framework that is a contributing factor is the role sponsors and investors have had in the Laotian hydropower sector. Multiple parties including the Electricité du Laos, World Bank, Asian Development Bank, foreign development agencies, and private investors from a variety of countries make up the map of investors in Laotian hydropower. This in turn can influence the patterns of development by parties who may exhibit rent-seeking behavior. The listing of projects by Electricité du Laos (2011) and International Rivers Network (2010) lists shareholders and sponsors in individual projects, as well as tells whether a project is built for domestic usage, or is an independent power producer project built primarily for export. Of the 85 projects listed, at least 48 are sponsored in part by the Electricité du Laos, Laotian government, or domestic companies. Some uncertainly is present due to the ambiguity in where specific sponsors are located or operate from. Sources originating from Thailand number at least 16, while approximately 12 projects

are sponsored or funded by Chinese sources. Additional sources include sponsors from Korea, Malaysia, Japan, Europe, and the U.S. (EdL 2011, IRN 2010). While the high number of domestic sources suggests that decisions to build projects are driven primarily by domestic investors, it is important to note that domestic shares in projects can range from full ownership to as little as 10 percent (EdL 2011, IRN 2010). This may indicate that decision making process concerning the building of projects may not always be primarily in Laotian hands. While sponsors are an important influence to patterns, they also require a source of funding. Sponsors have had two options in securing funding, public and private financing. More sponsors are moving to non-traditional private sources of funding, compared to past projects which relied upon public funding from development and international lending agencies (Maunsell 2004, 22).

Private financing has a key role in affecting hydropower development patterns. More and more projects are shifting away from public to private financing (Maunsell 2004). Under the build, own, operate, and transfer (BOOT) financing model, the government enters into a concession agreement with a private investor or developer, who under the terms of the agreement, construct, operate, and own the project, while the government, at times through Electricité du Laos, holds 20-25% of the equity in the project (Smits and Bush 2010, 118). Often, private owners will also pay royalties to the government in exchange for being allowed to operate the dam. After a term of years as defined by the concession agreement, the ownership of the project is transferred to the government at no additional cost. Usage of the BOOT model is heavily promoted by both the Asian Development Bank and the World Bank (ADB 2009, Virtanen 2006). BOOT agreements are seen as promoting the development of hydropower by complementing

government financial, technical, and human resources, as well as building government capacity. They are also seen as being commercially viable and being effectively implemented, as well as allowing for environmental standards to be built into the project from the beginning (Viratanen 2006, 184). In essence, BOOT agreements allow for the mass development of hydropower in a developing country by circumventing financial and capital deficiencies the host country may have. They also reduce the burden international donor and development agencies may have in supporting these types of projects.

BOOT agreements are not always seen in such a positive light. While BOOT projects offer a promise of cheap electricity for domestic usage and the opportunity for export revenue earnings, they also provide a venue for rent-seeking behavior by the parties involved. This in turn can push a drive for further large scale expansion that has little reflection on potential environmental and social costs (Smits and Bush 2010, 125). According to Smits and Bush (2010), at least 70 Laotian hydropower projects are being implemented under a BOOT model. If indeed rent-seeking behavior is driving BOOT projects, there is cause for alarm in relation to the negative consequences of hydropower development.

The private financing model itself has weaknesses that are inherent. This was recognized in the power system development plan for Laos developed by the Manusell consultation group in collaboration with the Laotian Department of Energy and Ministry of Industry and Handicrafts (Maunsell 2004). The selection of projects to be funded and constructed is ad-hoc and suboptimal. There is often little discrimination of bad projects in terms of economic return and development costs by investors who exhibit rent-seeking

behavior. Power purchasing agreements set up for each individual project give advantages to the purchasers of electricity who are not dependent upon buying electricity from a single project. Additionally low transparency in terms of true costs to the Lao government is a common feature of private financing. Combined with infant standards concerning the procurement of private financing as well as being un-enforced at times, the private financing model presents an environment of massive uncertainty concerning the actual benefits of private financing (Maunsell 2004, 24).

Another interesting fact is despite the Asian Development Bank being one of the leading public funding sources for Laotian hydropower development, next to the World Bank and private investment, the Asian Development Bank itself has recognized that large dam building may not be the best answer to Laos' economic problems. As mentioned before, the Asian Development Bank has admitted that dams cannot be taken for granted as the best answer to the macroeconomic needs for import substitution or exports (ADB 2002, 3-8, IRN 2008a). Yet, hydropower remains a primary focus for these institutions in the form of continued funding and promotion for large scale projects and is still seen as a key element in the development schemes of Laos. It appears that the absolute benefits in terms of national economic growth and strengthening the nation's fragile economic portfolio, as well as the physical geographic situation, outweigh any major relative risks and costs of continued funding of these projects.

Policy, Planning and Regulation

Government policy is recognized under the PESL framework as a significant legal factor. In general, government policy has had a positive effect upon hydropower development patterns by creating favorable conditions for development. Recent projects

have seen new levels of transparency, disclosure, and participation since the initial processes that were formulated during the construction of Nam Ngum 1 in 1971. New laws and policies related to the development of hydropower have been created such as the National Policy on Resettlement and Compensation (Lao PDR 2003a). The result has been the development of new standards and procedures such as the release of various development plans, technical reports, requirements for public consultation and participation, and the creation of international panels of experts to provide an international review of projects (POE 1997). While this is remarkable in a country not known for disclosure, transparency, and participation, it must be remembered that the creation of these new policies and laws, as well as the higher level of disclosure and participation are now required in order to gain the large amount of funding needed for large scale hydropower projects from international donors and lending institutions (Singh 2009, Winn and Baardsen, 2010).

In the present more extensive planning and information is now required by policy and law to go forward with such large scale development plans. As a result of the amount of capital and investment necessary for the construction of major infrastructure projects, the 1990's saw the creation of the Water and Water Resources Law (Lao PDR 1996), and the Law on Electricity (Lao PDR 1997). These two laws helped to establish firm policies and create frameworks for establishing procedures and creating management strategies related to the environment and revenue management. This helped to show that Laos was taking steps towards creating an investor friendly environment in terms of protection and public image. This was also during the time when memorandums were signed with Thailand and Vietnam for the purchase of electricity, resulting in the planning of multiple

hydropower projects. While the 1997 Asian financial crisis saw a limited number of projects actually built, the ground work was laid for future large scale hydropower projects

Further policies and laws have been created in the last decade, creating further legal frameworks that have helped to accommodate increased private investment in infrastructure projects such as hydropower dams (Lao PDR 2006a, 2). Table 3 lists several significant policies and laws created in the past 20 years and detail their significance.

Table 3.
Significant policies and laws related to hydropower development

Name	Year	Significance
Water and Water Resources Law	1996	Established rights and ownership of water resources in Laos
Law on Electricity	1997	Established procedure and policy as related to the development and production of electricity
National Policy on Resettlement and Compensation	2003	Detailed eligibility, responsibilities, and obligations as related to resettlement and compensation concerning infrastructure construction
Law on the Promotion of Foreign Investment	2004	Defined rights and responsibilities of foreign investors in all sectors and areas
IPP Hydropower Procurement Manual	2006	Established framework and procedure for independent power producer acquisitions
National Policy on the Environmental and Social Sustainability of Hydropower	2006	Built upon policies and procedures developed in the Nam Theun 2 project and codified them for all hydropower projects post 1990

Sources: Lao PDR 1996, 1997, 2003, 2004, 2006a, 2006b

Of interest especially related to the spatial aspect of hydropower development is the Law on the Promotion of Foreign Investment. Articles 17 and 18 of the law detail special benefits and concessions concerning the investment in certain regions of Laos. Three zones of investment are laid out relating to the geography of the zone and suitability of foreign investment. Table 4 details these zones and associated benefits.

Table 4.
Foreign investment zones and benefits

	Description	Benefits
Zone 1	Mountain, plain, and plateau zones with no economic infrastructure to facilitate investment	Profit tax exemption for 7 years, profit tax rate of 10%
Zone 2	Mountain, plain, and plateau zones with moderate level of economic infrastructure suitable to accommodate investment to some extent	Profit tax exemption for 5 years, thereafter reduced profit tax rate of 7.5% for 3 years, thereafter 15% rate
Zone 3	Mountain, plain, and plateau zones with good infrastructure to support investment	Profit tax exemption for 2 years, 10% reduced profit rate for 2 years, there after 20% rate

Source: Lao PDR 2004

As shown by Table 4, zones 1 and 2 offer the greatest incentives for foreign investment in terms of tax rates, exemptions, and time frames. This has a direct impact on investment in hydropower. Hydropower development takes places generally in zones 1 and 2, where physical geographic conditions are favorable for hydropower potential. These areas are generally rural, isolated places with little infrastructure present. Investors find a high level of benefits when involved in hydropower projects that are constructed in these zones. While the law does not offer a strict spatial definition of the investment zones, a comparison of the description of the zones to Figures 1, 2, and 7 shows interesting

patterns present. Keeping in mind the low levels of economic, infrastructure, and social development in Laos, it seems that the provinces with the highest number of projects are the most beneficial in terms of foreign investment. Given the importance of investment and profitability in hydropower development, it is not unreasonable to assume that development in these provinces was in part influenced by the benefits of investment in specific regions.

The effect of the creation of new policy and law is reflected in part in the numbers related to hydropower development. Without the right investment environment created by law and policy, the number of projects planned and under construction, as well as total hydroelectricity produced, would be significantly less. This would be the result of the reluctance of investors to become involved without protection and a firm position on benefits received. Investors would not likely risk involvement in high-risk projects without subsidies and guarantees from the government or international funding institutions (Virtanen 2006, 184). In the Nam Theun 2 project, in addition to a 50 million dollar loan to the Nam Theun Power Company and a 20 million dollar loan to the Lao government, the Asian Development Bank provided a 50 million dollar guarantee to investors in the event of project failure (ADB 2010b, Winn and Baardsen 2010). The World Bank as well has provided financial guarantees and security in hydropower projects to investors. Through risk guarantees of at least 132 million dollars, the World Bank has provided security for loans made in support of Nam Theun 2 (World Bank 2009, 4). It must be noted that the creation of these policies and laws was meant to mollify critics of hydropower development, as well as prove to outside investors that

Laos was taking steps toward building modern policies that would encourage quicker and larger investment towards such projects (Singh 2009).

Geopolitical Factors

Laotian hydropower development has been affected by the influence of regional geopolitics. As mentioned previously, PESL recognizes that geopolitics are a major political factor. The region in general has a long and turbulent geopolitical history that has helped to shape hydropower development by both inhibiting and promoting it in different time periods. A long history of conflict had helped to stall major large scale development in the region and especially in Laos, which as stated previously, experienced high levels of conflict and political instability from the World War II era up to the 1980's.

Plans for hydropower development have been affected by broader events and ideologies for the past 50 years (Hirsch 2010). The Mekong Committee formed in 1957, the predecessor to the Mekong River Commission, was instrumental in the period pre-Second Indochina War for the promotion of development by establishing links between the states and fostering communication and the exchange of ideas (Hirsch 2010, Bakker 1999). The committee was formed under the auspices of the United Nations, but under the de facto hegemony of the U.S. as part of its efforts to de-rail the spread of communism in the region. The committee's plans included building a series of dams on the mainstream Mekong River, creating a series of stepped lakes from northern Laos to the head of the delta. These plans were part of a development based geopolitical effort to pre-empt communism through building prosperity and enhancing the influence of the U.S. (Hirsch 2010, 313). Elements of western influence were also part of the early

development models and strategies for Laos. Dam building was seen in the west as a key element of a national solution for transforming an entire peripheral region, which found its origins in the Tennessee Valley Authority projects of the 1950's (Baghel and Nüsser 2010, 236).

Despite these plans and western support, the only large scale hydropower project to emerge out of the efforts of the Mekong Committee was the Nam Ngum 1 dam in Laos (ADB 2002). Further development was halted and the committee disbanded with the Second Indochina War and the communist victory in Vietnam in 1975. Even though hydropower development had elements of western influence, it still found support from communist governments in Southeast Asia. This is apparent in the case of Nam Ngum 1. Despite fighting and civil strife in Laos during the construction period, the Pathet Lao, the predecessors to the future Lao PDR, were fully committed to the project. The project was seen by communists in Laos as a valuable resource for the whole country (ADB 2002, 2-17). Hydropower development in the 1980's was hampered by a lack of resources, planning, and most importantly funding. This was in part due to the prevailing political alignments which prevented cooperation as well as political isolation of Laos from 1975 to 1987 (ADB 2002).

With the end of the Cold War in the early 1990's, opportunity for rapprochement between non-communist Thailand and its communist neighbors became possible. This also coincided with an increased demand for energy by Thailand due to its economic growth and industrialization in the latter part of the 20th century (Hirsch 2010, 314). Thai economic growth spurred interest in purchasing Laotian hydropower. Thailand had attempted to develop its own substantial hydropower resources, but due to opposition by

domestic and international environmental groups, most hydropower development has been halted (Maunsell 2004, 62). Vietnam also had interest in Laotian hydropower during this time period. Memorandums of understanding with Laos for the purchase of electricity were signed with Laos in the mid 1990's (IRN 2008b, 13). However the Asian Financial Crisis killed much interest in demand for Laotian hydropower until the beginning part of the 2000's. Bi-lateral investment however in the new century has seen an increase between Laos and its neighbors, which has spurred the construction of new dams. From the perspective of the regional governments, bi-lateral investment reduces the need to go through the hoops of safeguard policies of international funding institutions and offers a more independent process in terms of supporting new projects (Hirsch 2010, 319). Official statistics however are not cited.

The 21st century has seen the emergence of a new geopolitics in the regions which has had implications for the development of hydropower in not only Laos, but the region as a whole (Hirsch 2010, McDonald et al. 2009). Perhaps the most significant development in the last two decades has been the rise of China both politically and economically. With a growing economy driven by industrial development and an ever increasing population, as well as increased demand for power, China has seen a growing political influence and development role via investment, aid, and trade (Hirsch 2010, 319). Chinese electricity consumption in the past two decades has also increased as evidenced by Figure 19.

China due to its own experiences in the hydro-industry has begun to provide funding and technical expertise to other states that are in the process of developing hydropower. McDonald et als. (2009) study of the influence of China on hydropower

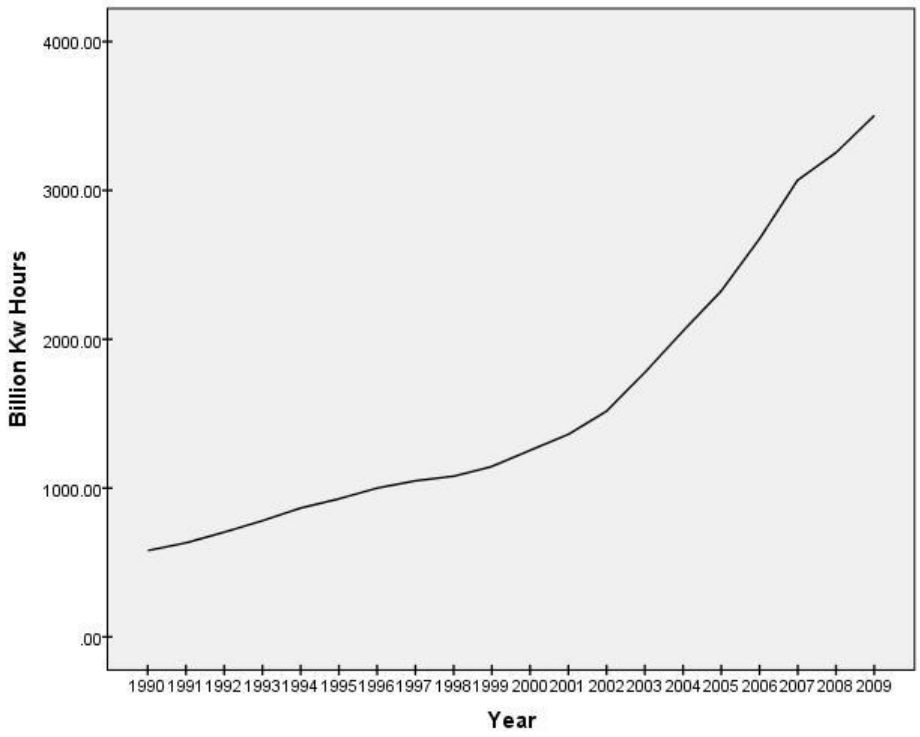

Figure 19. Chinese electricity consumption – Billion Kw hours, 1990-2009
Source: World Bank 2011b

development in the region serves as the primary source of information for geopolitical contributions due to their extensive search of Chinese government documents, company web sites and ground-based fieldwork. Chinese influence in the Laotian hydropower sector is reflected by investment in Laotian tributary and mainstream Mekong River projects. As of 2009, at least 13 projects were noted by McDonald et al. as being funded or sponsored by Chinese parties (McDonald et al. 2009, S298). Although Chinese companies are at the forefront of investment in Laotian hydropower, they are also part of a rapidly growing influence and deeper role for China in the region via investment, aid, and trade relationships (Hirsch 2010, 319).

While at times this aid is “no-strings” attached, McDonald et als. have suggested that China has much to gain by exporting its money and expertise in hydropower This has been spurred by China’s success economically, which has required more resources China

as a growing economy and nation has required natural resources and energy to support this growth. Chinese electricity consumption has risen as evidenced by Figure 17 above. Hydropower has represented one avenue to acquire resources via concession agreements for resource extraction in exchange for aid for hydro-development as well as power purchasing agreements with its neighbors for electricity (McDonald et al. 2009). While signs are certainly present that suggests China's increasing role in the Laotian hydropower sector, a lack of solid evidence such as investment levels for hydropower projects in Laos weakens the potential effect that China as a geopolitical factor may have.

Regionally, the goal of the Southeast Asian nations has been one of creating a "sub-region that is prosperous, integrated, and harmonious" (ADB 2011b). Laotian national goals have fallen in line with the regional goal of developing a prosperous and integrated region. Beginning in the 1990's, Laos has set a goal of becoming a "battery" for the region in terms of hydropower (IRN 2008b, Loo and De Clerq 2007). This goal has been made easier in part due to the lack of or slowing of hydropower development by Thailand, Cambodia, and Vietnam (ADB 2004b). In order to achieve this, Laos has had to gain access to resources and revenue that under its past political and economic system, it was unable to access due to political isolation during the Cold War. This in turn has required a shift to a market economy as well as greater integration via the Greater Mekong Subregion (GMS) to create a favorable investment environment. Isolated during much of the Cold War period, Laos has also attempted to move from a landlocked to a landlinked nation through the development of transportation networks, agricultural ties, and energy production connections with its neighbors (ADB 2011b, Smits and Bush 2010).

Consequences of Hydropower Development

Hydropower has numerous benefits ranging from being clean and renewable source of energy for domestic usage, generating revenue for poverty reduction and environmental protection, and contributing to national economic growth (ADB 2002, World Bank 2010b). Yet it also entails consequences that are present in various realms and across multiple geographic scales. The PESL framework, besides helping to identify specific factors that influence the hydropower sector, also helps to identify areas of key consequences in political, social, and economic realms. Negative consequences of hydropower development in Laos are said to be present in terms of socio-economics, mitigation, resettlement, and compensation practices, and in the geopolitical situation of Laos. Most often, Laotian hydropower projects have been condemned for damaging the environment and negatively impacting the livelihoods of vulnerable rural communities (ADB 2010a, 8). Yet the scale and magnitude of these consequences is often debated between proponents and critics of hydropower development.

Socio-Economic Consequences

Much of the debate and controversy concerning the Laotian hydropower sector concerns the socio-economic effects and consequences of development. Improvement to the socio-economic status of the Laotian people is a key rationale used in the building of hydropower projects for export revenue. Yet there exists a sharp divide on whether hydropower has helped accomplish any kind of socio-economic improvement. Current positions on the socio-economic effects and consequences of hydropower range between two extremes. The first is a very pro-hydropower position that emphasizes hydropower's positive effects. These are primarily stated as helping transition from poor, rural lifestyles

that lack life's basic elements such as electricity, running water, and education, to providing modernized settlements and a modern infrastructure that leaves not only project affected people, but the nation as a whole better off than they were before (ADB 2009, 2010a, 2010b, NTPC 2008, Winn and Baardsen 2010).

The second position represents a strong anti-hydropower stance that focuses on the relative costs of large scale hydropower projects on the local, village level in Laos, which believes that the negative track record of dam projects in Laos in environmental, social, and economic terms does not justify the construction of further projects. Additionally this position emphasizes the large number of people that will be affected by not only the construction, but by the operation of, and institutional processes related to the revenue generated by these projects (EDF 2005a, 2005b, FIVAS 2007, Imhof 2006, IRN 2004, 2008a, 2008b, 2009).

If hydropower is actually helping to improve socio-economic statuses, a positive relationship should exist between the two. Essentially, if socio-economic indicators continue to improve, in conjunction with increases in hydropower development, this can be seen by hydropower proponents such as the Lao government and the Electricité du Laos as stronger reasoning for increased development. While the quantification of benefits is admittedly difficult for some variables, a fact admitted by both sides of the debate, other indicators of socio-economic consequences can be examined from a quantitative perspective via descriptive statistical analysis (ADB 2002, 4-21, FIVAS 2007). While direct statistics relating hydropower's contributions to socio-economic variables are either not disclosed or do not exist, through the usage of proxy variables, the

relationship between hydropower development and socio-economic variables can be approximated.

A key area where proponents and critics disagree is the effects of hydropower on agriculture and food. Agricultural land loss as a result of inundation, flooding or erosion is a common concern that is voiced by critics at the local village scale (IRN 2004, 2007, 2009). Without agricultural land, food security becomes a major risk especially at the village level, resulting in requests for rice and food assistance. This is especially poignant considering that, "access to rice is still the most important factor in determining the welfare status of the Lao people in rural areas" (ADB 2009, 43). Given these effects, an inverse relationship in regards to land loss and rice production, against hydropower production should be expected. This however does not seem to be the case.

Losses of land have varied. For example the Theun-Hinboun project resulted in the loss of an estimated 68 ha of river terrace to erosion, while villages reported losses range from 30 ha to 70 ha of agricultural land to flooding (FIVAS 2007). In other areas 1000 to 2000 ha of paddy land was reported to be abandoned due to flooding as a result of the THPC expansion project (IRN 2008b, 39). For reference, 1 ha = 2.47 acres. Additionally, critics note the decreases at the local level of rice paddy production both at resettlement sites as well as village sites down river of dam projects (IRN 2004, 2008a, 2009, FIVAS 2007). Yet national level statistics for rice paddy production in general show increases in both tonnes harvested as well as area harvested as illustrated by Figures 20 and 21.

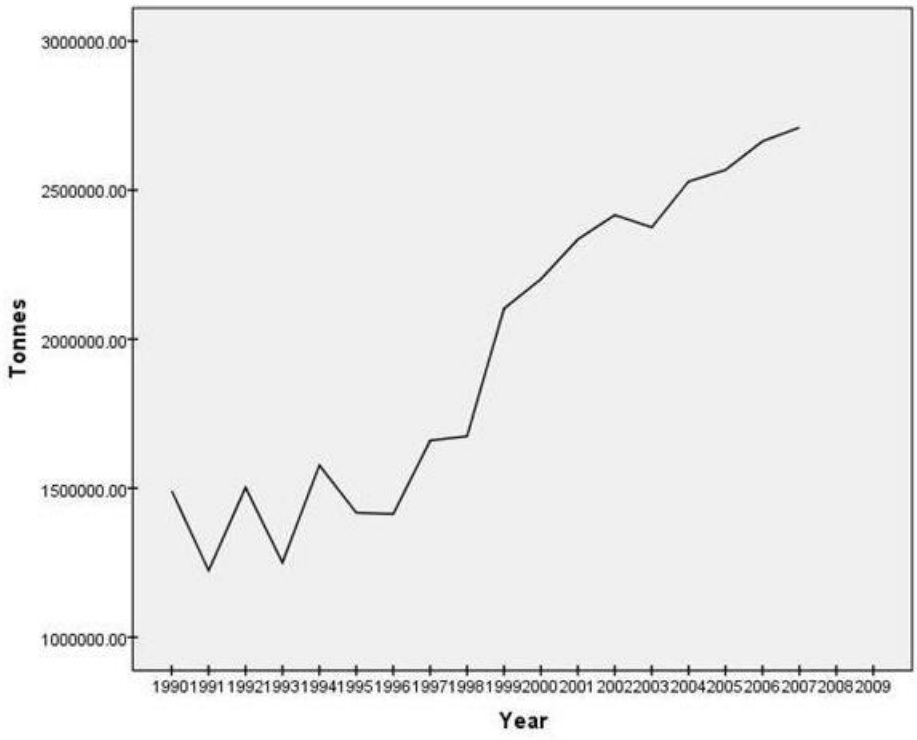

Figure 20. Laotian rice paddy production 1990-2007 (tonnes)
Source: United Nations 2011

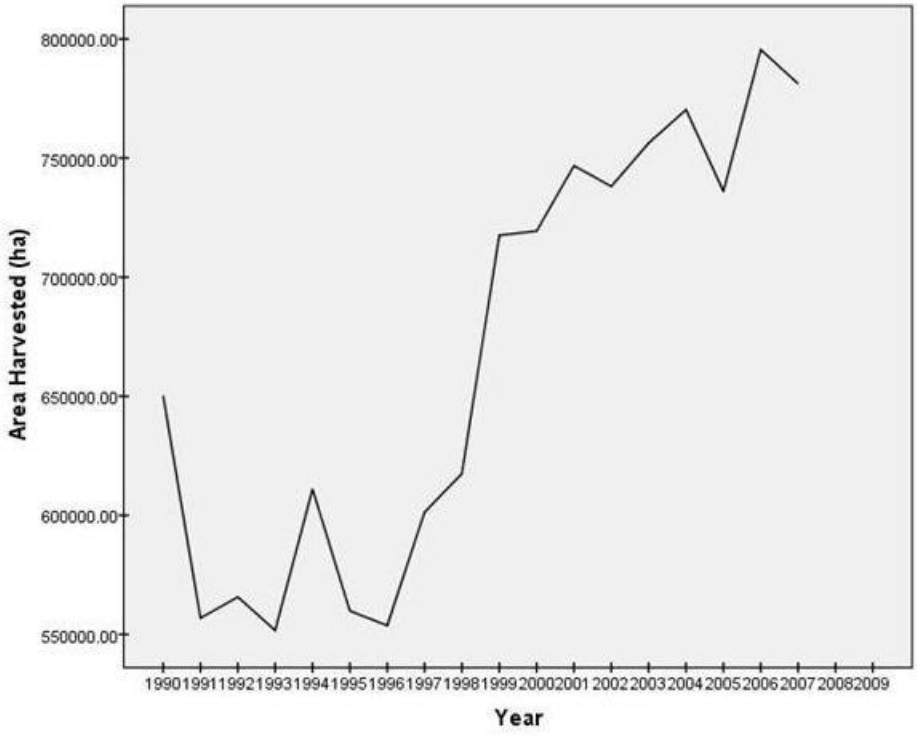

Figure 21. Laotian rice paddy area harvested 1990-2007
Source: United Nations 2011

While critics cite major losses of agricultural land at the local, village level, the national level statistics again paint a different story. Figure 22 shows the amount of agricultural land available in the country. It appears that in contrast to the critic's reports of mass losses of agricultrual land, there has been increases, at least on a national level. This discrepency is interersting as it highlights potential problems in terms of reporting agricultural losses, as well as who and what defines agricultural land. Some of this gain may be due to the usage of electricity from hydropower projects in supporting more advanced agricultural technology, thereby increasing yields. Increases in agricultural land area avaliable may be attributed to land gained that previously had not been avaliable due to seasonal flooding, now controlled by the dam projects. Land may also be gained through the clearing of forests for project related construction.

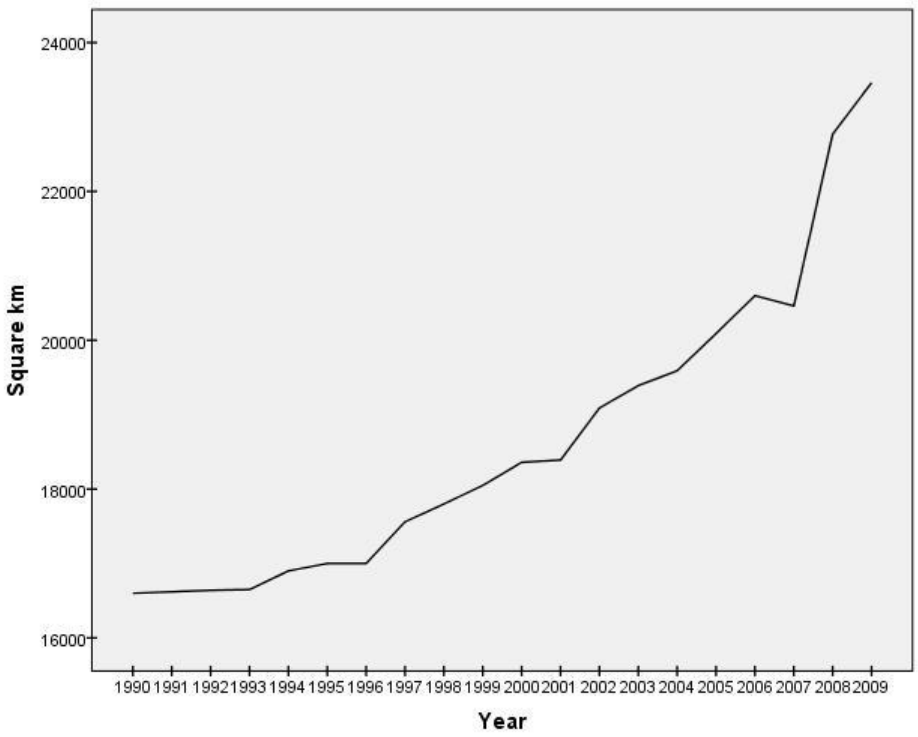

Figure 22. Agricultural Land available in Laos
Source: World Bank 2011b

Another explanation for the difference between critics and supporters is in what constitutes agricultural land loss. Critics have cited losses relating to various aspects of agriculture such as loss of grazing land for livestock, as an example, at least 45,000 ha were reported to be lost during the creation of the Nam Theun 2 reservoir (EDF 2005a, 4). National level statistics however define agricultural land as the share of land area that is arable, under permanent crops, and under permanent pasture (World Bank 2011b). Temporary agricultural land such as seasonal pastoral land and river bank land that may be affected by seasonal flooding are to the best knowledge not included in this statistic.

As stated previously, hydropower development is part of Laos' national poverty eradication strategy, providing funds for improving the quality of life in general for the people of the nation. Improvements in public health are one of the key aspects of poverty eradication, and are reflected by statements of their importance by multiple parties involved (ADB 2010a, 2010b, Barney 2007, World Bank, 1998, 2010b, Winn and Baardsen 2010). These improvements are reflected in such proxies as life expectancy, decreases in infant mortality rate, and health care expenditures per capita. The question remains how much of this is due to the influence of hydropower. Figure 23 shows increases in life expectancy in the past two decades, while Table 5 shows decreases in infant mortality rate. Figure 24 shows increases in health care expenditures per capita.

Money for improvements in these variables is stated to have come from official development assistance as well as hydropower revenue (ADB 2009, 39). At local levels, this is in the form of the building of new health centers, increased health center staff,

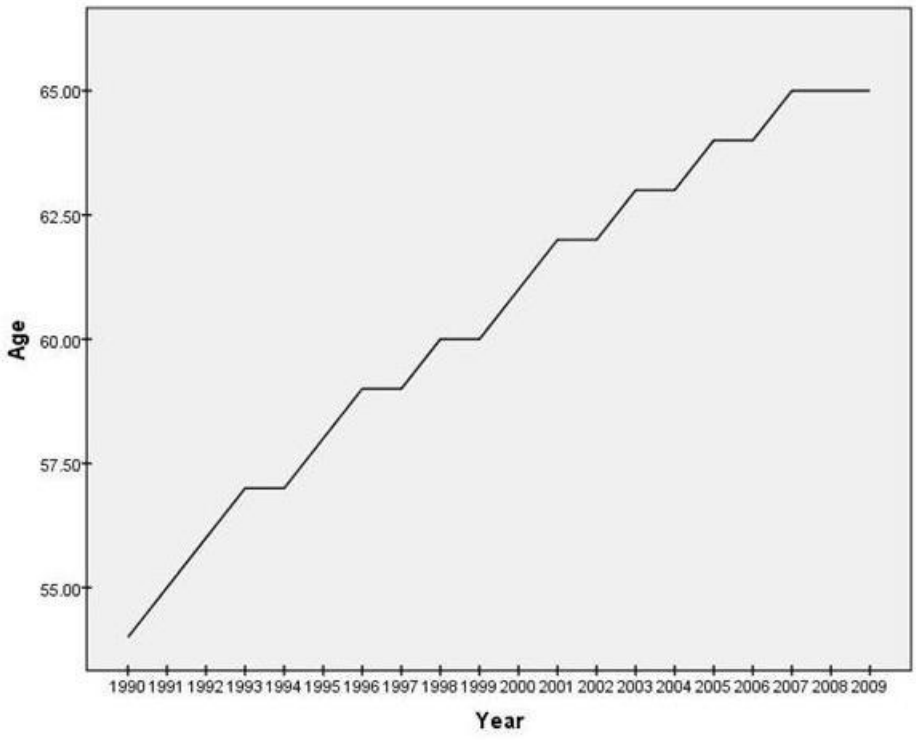

Figure 23. Laotian life expectancy 1990-2009
Source: World Bank 2011b

Table 5.
Infant mortality rate - Laos

	Year		
	1990	2000	2009
Deaths per 1000 people	108	64	46

Source: World Health Organization 2011

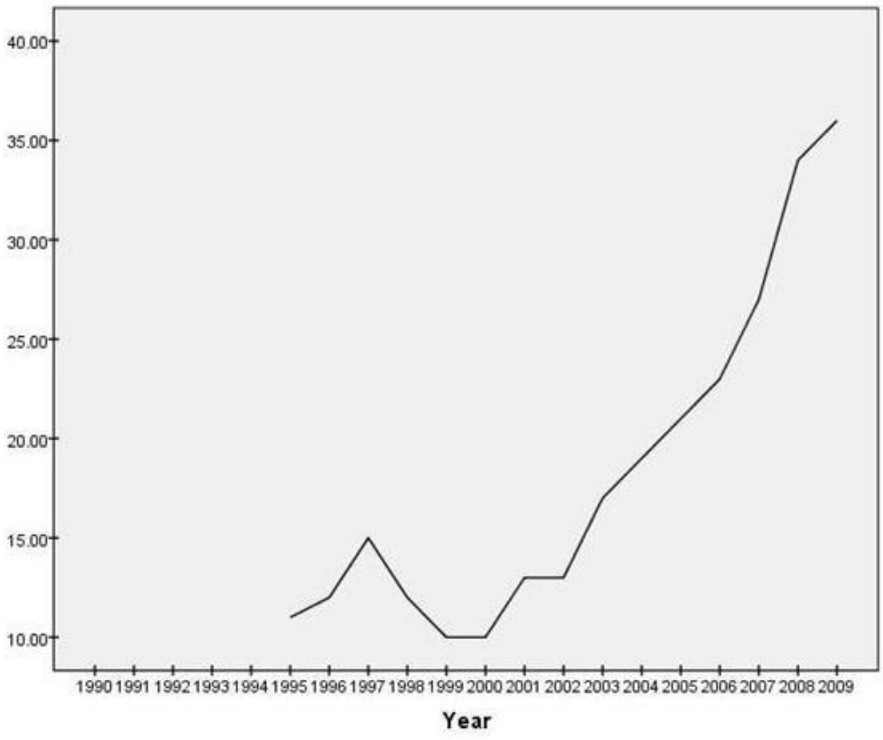

Figure 24. Laotian health expenditures per capita (Current U.S. $)
Source: World Health Organization 2011

medical supplies, medicine cabinets and sanitation facilities in local villages. At the national level improving access to public health programs, education programs, and improving the equity, efficiency and sustainability of health financing are the primary goals of improving the health status of the population of Laos (ADB 2009, Barney 2007, FIVAS 2007, NTPC 2008, Winn and Baardsen 2010, World Bank 2009, 2010b). Yet due to a lack of solid evidence of hydropower revenue being used in this manner, uncertainty is cast whether the increases seen in hydropower development can actually be effective in the accomplishment of socio-economic development goals.

Resettlement, Mitigation, and Compensation Consequences

Large scale hydropower projects by their nature entail massive physical changes to the environment ranging from decreases in biodiversity, inundation of land, and changed hydrology of rivers and streams (ADB 2002, Graf 1999, 2005). These physical

changes often result in the need for resettlement and the mitigation of the effects of dam building, both physical and economical. Given the increase in the number of dam projects as well as the increase in their size and capacity, it is prudent to examine how development patterns have affected the aspects of resettlement, mitigation, and compensation. Both critics and proponents of hydropower development have noted that the larger the magnitude of people displaced, the scale of social impacts increases, the more compensation is needed, resulting in less likelihood of livelihood restoration (ADB 2002, 2004b, EDF 2004, 2005a, 2005b, IRN 2008b, 2009).

In general, policy and procedures related to resettlement and mitigation have evolved since the beginning of large scale hydropower development in the 1970's. This is most evident in the creation of established policies related to resettlement, as well as the establishment of requirements and guidelines concerning the mitigation of negative effects of hydropower development. The National Policy on Resettlement and Compensation (Lao PDR 2003a), the Decree on Resettlement and Compensation (Lao PDR 2003b) and the National Policy on the Environmental and Social Sustainability of Hydropower (Lao PDR 2006b) were created to establish such standards and guidelines. Both the national policy and the decree define resettlement as referring to all measures taken by project proponents to mitigate any and all adverse social impacts of a project on affected persons. This includes compensation for lost assets and incomes and the provision of other entitlements, income restoration assistance and relocation, as needed (Lao PDR 2003a, 3). Compensation is defined as payments in cash or in-kind for an asset to be acquired or affected by a project at replacement cost. Entitlements are a range of measures comprising compensation, income rehabilitation assistance, transfer assistance,

income substitution, and relocation which are due to affected people, depending on the type and degree of loss (Lao PDR 2003a, 1). Relocation is simply defined as the physical shifting of an affected person from their pre-project place of residence (Lao PDR 2003a, 3).

Through compensation and mitigation projects, developers and the Lao government have attempted to mitigate the negative effects of large scale hydropower development. Compensation of the loss of agricultural land and improving food security at a local level in recent projects such as Nam Theun 2 has been done through the provision of new land, rehabilitation of small-scale irrigation systems, assistance in transitioning from slash-and-burn agriculture, instruction in the use of fertilizers, as well as limited food assistance (ADB 2010b, World Bank 2009, 2010b).

Organizations such as the Asian Development Bank and World Bank cite success in resettlement and mitigation measures in relation to several projects such as Theun-Hinboun and Nam Theun 2. Several summary reports by the Asian Development Bank and World Bank detail individual successes linked to the resettlement and mitigation processes developed and enacted in the construction of the Nam Theun 2 project. The World Bank believes that the resettlement process in the Nam Theun 2 project was a success, due to the new initiatives that were pioneered in the process that enabled social change and livelihood transformations (World Bank 2010b). Both the organizations see resettlement and mitigation related to increased hydropower development as side opportunities to enact livelihood transformations, rather than simple livelihood restorations. By the act of relocation and resettlement as a result of hydropower

development, this will spur changes that will allow livelihood transformations which are painted as improvements over the past situation (ADB 2010a, World Bank 2010b).

Livelihood restoration comprises a key part of resettlement that is recognized by both sides of hydropower development as well as being particularly challenging in any context (ADB 2009, EDF 2004, 2005b, IRN 2004, 2008b, World Bank 2010b). While both sides understand that money alone will not reduce poverty, restoration following the construction of hydropower projects is seen very differently whether one supports or opposes large scale hydropower development (ADB 2009, IRN 2008b, World Bank 2009, 2010b).

In the Nam Theun 2 relocation and mitigation efforts, the focus upon livelihood transformation rather than livelihood restoration is apparent in the emphasis upon several pillars of development including: agriculture and rice stock, community forestry, reservoir and fisheries, and off-farm income. It is expected that each of these pillars will make a substantial contribution to the livelihoods of resettled communities (World Bank 2010b, 17). The agricultural pillar for example involves improving yields from agricultural land, as well as introducing the concept of participatory land use planning, which is meant to help create a shared understanding of land use rights and responsibilities (World Bank 2010b, 19). This involves education of local peoples of methods, concepts, and technologies that before the project had been foreign to them. The other pillars also represent livelihood transformation by introducing concepts such as open markets, property and fishery rights, and skill building in non-agricultural livelihoods. This transformation has raised concerns at the village level about access to agricultural land and forests, loss of tradition and community identity, as well as having

sufficient land for the next generation of villagers (IRN 2008b, World Bank 2010b, 34). Villagers still feel ties to the land but according to proponent reports, they report satisfaction with infrastructure improvements and their quality of life suggesting that villagers make cost/benefit analyses given the context of their situation (Winn and Baardsen 2010, World Bank 2010b).

Critics however, have voiced their displeasure with several components of compensation in various dam projects including: lack of compensation for aspects of food security such as the loss of fishing nets and boats; the lack of "land for land" compensation as required by the National Policy on Resettlement and Compensation (Lao PDR 2003a, 4); small (1-2ha) plots of land that were considered poor quality for rice growth and other agricultural growth; an improper focus upon infrastructure support rather than livelihood restoration; and a lack of direct compensation for agricultural and food losses (FIVAS 2007, IRN 2004, 2008a, 2008b).

Additional criticism is focused on the scope of eligibility for mitigation and compensation. In an assessment of compliance with Laotian law in the Theun-Hinboun Expansion Project, critics of hydropower development focus on what they see as a loophole for developers by taking advantage of a semantic difference between "resettlement" and "relocation" (IRN 2008b, 2009). IRN states that the Theun-Hinboun Power Company , the operator and developer of the project, calls the resettlement that was required "relocation", somehow implying that resettlement standards set by the National Policy on Resettlement and Compensation do not apply, which would allow the company to avoid the expenses of complying with official policy and law (IRN 2009, 5).

The assessment of the Theun-Hinboun expansion touches upon a key issue in the development of hydropower development resettlement plans and mitigation strategies, that of the definition of affected persons. The National Policy on Resettlement and Compensation states that all persons residing, cultivating, or making a living within an area to be acquired for a project as of the formally recognized cut-off date should be considered project affected persons, thus entitled to measures of compensation and mitigation (Lao PDR 2003a, 3). Where disagreement lies is in the spatial definition of an "affected person". While official government policy states that affected persons are those who reside and conduct activities within a project zone, critics point out that hydropower development has spatial effects that stretch out beyond the immediate project zone, most often in downstream effects. An example of this disconnect is found in the development of the NT2 project. Official numbers of affected persons according to project developers ranged from 5700 people requiring resettlement (EDF 2004, 8) and a further 40,000 people being affected by the project. Independent critical reviews however cite that between 100,000 and 150,000 people would experience some degree of livelihood disruption due to the project both in the immediate project area and downstream. The Nam Theun Power Company had not explained its rationale behind the lower estimate of affected persons (EDF 2004, 6). Yet according to policy, persons who were downstream would technically not qualify for mitigation and compensation due to their spatial location in relation to the project site. The concession agreement between developers and the Lao government in regards to the construction of Nam Theun 2 also set certain requirements for compensation. Villagers who lost less than 10% of their productive assets were entitled to cash compensation, while those who lost more than 10% were

entitled to replacement land (IRN 2008b, 43). Further discrepancies in official numbers to those of critics are found in multiple hydropower development projects across the time span of focus (IRN 2008b, 2010).

Given the increasing number of planned projects, which more than likely will require some form of resettlement, mitigation, and compensation, it is concerning that these differences on the definition of resettlement, and spatial eligibility for mitigation and compensation are still present. As stated previously, with larger magnitudes of people affected by hydropower development, the mitigation of detrimental socio-economic impacts becomes increasingly difficult. Certain people can be considered winners and losers as a result of mitigation and compensation policies. Whether one is a winner or loser depends much on how losses are defined and one's geographic location in relation to a hydropower project. Even winners may end up being losers as a result of poor planning and insufficient measures.

Geopolitical Consequences of Hydropower Development

Perhaps the most significant issue at present that concerns both geopolitics and hydropower development in Laos is the development of the Mekong River. Again the past geopolitical situation has had a major influence. Three decades of conflict has resulted in the Lower Mekong being in relatively pristine condition physically (Bakker 1999, 213). Presently, the Mekong has been the subject of a new focus on hydropower development in the region (Hirsch 2010). At the regional level, hydropower is the most planned sector with long-term development plans for the region (ADB 2004b). Ranging from major development in Yunnan Province, China to the investigation of several dams

on the Mekong mainstream, the Mekong is seen as the next major source of power and influence in Southeast Asia (IRN 2008b).

Yet there seems to be recognition that mainstream development of hydropower may not be as attractive as it first seemed. The Mekong River Commission formed in 1995, the successor to the Mekong Committee, has recognized that there existed a need for coordination and careful assessment of any kind of development on the Mekong, not just hydropower. The commission has stated that the river represents more than just a flow of water with hydropower potential. The river is a resource that is utilized at multiple scales from local livelihoods to national scale development schemes. While the river is "undeveloped" from an engineering and energy potential perspective, this does not mean that the river is not utilized. Agriculture and fisheries are still significant activities that contribute to the character of the basin as a whole (Bakker 1999, Bird and Voradeth 2008). As such the Mekong River Commission has advocated re-evaluating projects planned for the Mekong River by all riparian nations in light of the evolution of political, economic, and environmental circumstances (Bird and Voradeth 2008, 4). The commission has also recommended that member nations share data and information on potential run-of-the-river mainstream dams. Laos as a member of the commission has complied in 2008, providing information on eight potential dams (Bird and Voradeth 2008, 4).

Presently, while Laos has complied with recommendations and suggestions made by the Mekong River Commission, Laos recently has stated that it will not comply with a halt of dam development on the mainstream Mekong River, despite protests from international environmental groups and even fellow members of the Mekong

Commission (Associated Press 2011a, United Press International 2010). The issue at hand concerns the $3.8 billion (U.S.) Xayaburi dam planned by Laos on the mainstream Mekong River. This dam is the first of 11 projects (9 in Laos, 2 in Cambodia) that are proposed along the river (United Press International 2011a, 2011c). 95% of the dam's 1260 MW production capacity would be slated for export to Thailand. Using the common argument of economic need and utilizing the dam for its economic benefits as justification, the Lao government has stated that the dam would be the "first environmentally friendly project on the Mekong," and "would not have any significant impact on the Mekong mainstream" (Associated Press 2011a, United Press International 2011a).

This dam project has resulted in numerous voices of opposition, even from a traditional political ally such as Vietnam, resulting in a rare dispute between two communist allies. For Vietnam, there exists major concern over the disruption of rice production and aquaculture on the Mekong and in the Mekong Delta. Thailand on the other hand, despite numerous letters and protests has remained silent on the issue quite possibly due to the fact that they are the intended customer for the project (Associated Press 2011a, United Press International 2011b).

While projects such as these require approval on certain elements as by all four members as stipulated by the 1995 Mekong Agreement (Mekong River Commission 1995), Laos reportedly began construction on the project without approval from the commission and in defiance of international environmental groups (Associated Press 2011b). Additionally any decision that is made by the commission is non-binding, which results in more of a symbolic gesture by the Mekong River Commission rather than a true

political one. The commission itself has even expressed concern over the project, citing the potential environmental damage as well as a lack of information about the project. In light of the resistance posed by the other commission members, Laos surprisingly fell in line with the other members and agreed to defer a decision on the construction of the Xayaburi project. A meeting on the issue is expected later in 2011, with Vietnam, Thailand, and Cambodia all agreeing that more studies are needed in order to make a satisfactory decision on the construction of the project (Associated Press 2011c).

Interestingly the dispute over this dam has even resulted in other foreign powers chiming in. The U.S. State Department, while acknowledging the potential represented by mainstream dams in the form of economic stimulation and flood control, stated that there must be an awareness of the socio-economic and environmental impacts dams can have over the long term, and advocating better science and more informed stakeholders (United Press International 2011d). The Senate Committee on Foreign Relations Sub-committee on East Asian and Pacific affairs even called for a delay on any mainstream dam until adequate planning and multilateral coordination could be guaranteed (United Press International 2011c).

This one proposed dam on the Mekong River has resulted in igniting a storm of debate not only among regional allies but even foreign parties with little or no direct interests in the project. The geopolitical situation in the region is clearly tied to regional development with the Mekong River at its center. While Laos had planned this project at a state level in terms of costs and benefits, the resulting political conflict has seen the project jump from the state to the national and even international scale in terms of involvement and discussion. As Bakker (1999) has so succinctly stated, with issues of

water gaining greater importance in regional geopolitics, regional cooperation over water resources will be central in defining wider relationships between riparian nations. It remains to be seen what the future may hold in terms of further development and conflict along the Mekong River.

Geopolitically, the development of Laotian hydropower has only recently had significant effects upon its geopolitical status. Given the case of the Xayaburi hydropower project and the situation it has caused, the Mekong region will be an area of geopolitical interest especially with further hydropower development.

Conclusion

Overall, Laotian hydropower development shows a pattern of increasing development in multiple forms. From the simple number of projects, to capacity, location, and generation, all have shown steady increases since 1998. The physical geography of Laos on its own merit offers substantial hydropower development capability, with a large amount of hydropower potential still untapped. Favorable investment environments created by government policy, regional electricity demand, as well as increased planning standards have helped to contribute to this boom. Increased planning standards at least on paper have helped to portray the image that Laotian hydropower development entails more positive effects than negative. The regional geopolitical situation has also spurred hydropower development, with increasing cooperation between nations of the Greater Mekong Sub-region following the end of the Cold War. All of these key factors have some influence upon hydropower development patterns

Hydropower development patterns however also have had impacts upon additional key factors related to hydropower development. The common justification of hydropower development for the reduction of poverty and improvement of socio-economic status at times seems justified, yet in the example of health, the effect of hydropower is less clear. While critics have focused upon the loss of land related to hydropower development as evidenced by the local accounts, superficially at the national level this is not the case. The increased pace and scale of hydropower development also has affected process and policy related to resettlement and mitigation. It should acknowledged by the critics that some gains have been made since initial projects such as Nam Ngum 1 in various aspects such as compensation and. new institutional frameworks related to mitigation and compensation. Yet the lack of resources to enforce and enable compliance is still striking. Again, clear winners and losers will result from the development of the Laotian hydropower sector. Hydropower development clearly can be profitable, but whether these profits are used and distributed as intended is a different story.

CHAPTER V

FUTURE PROSEPECTS OF HYDROPOWER DEVELOPMENT IN LAOS

Introduction

The development of hydropower in the last two decades has shown two different pictures, the first of stagnation and the second of rapid, large scale development. As evidenced by the numbers shown in Chapter IV, development plans are continuing at a rapid pace. This is in line with the Lao government's goal of exiting 'least developed country status' by 2020. As previous analysis has shown, Laos is committed to hydropower development for the immediate future. As Table 1 in Chapter IV indicated, 62 hydropower projects are currently in the planning stage, having memorandums' of understanding signed for project development agreements and feasibility studies. Several factors identified utilizing the PESL framework have the ability to sharply influence future development patterns. This chapter briefly examines these factors in relation to the analysis of past and present development and discusses the role they have in influencing future development patterns. Beginning with electricity demand and the power market, the impact of future resettlement and compensation strategies, and the geopolitical situation will also be discussed.

Domestic Demand for Electricity

Domestic demand for electricity will be a central factor in the future prospects of Laotian hydropower development. Official power development plans by Electricité du Laos have planned for major increases in domestic electricity demand. Their plans are

focused upon the preparation of sufficient power supplies to meet anticipated demand (EdL 2008, III-4). The 2008 official Electricité du Laos power development plan anticipates increases in domestic demand from the 4 Laotian power networks (North, Central 1, Central 2, South) as well as the ability to meet domestic demand until 2016 under current plans (EdL 2008, A-2). The Electricité du Laos plan forecasts demand until 2020, which is the date that the Lao government has set for achieving its goal of a 90% rural household electrification rate as part of its poverty reduction strategies (ADB 2009, EdL 2008, II-1, Maunsell 2004). Figure 25 details domestic energy demand by region and in total until 2020 in terms of gigawatts (Gw) per hour.

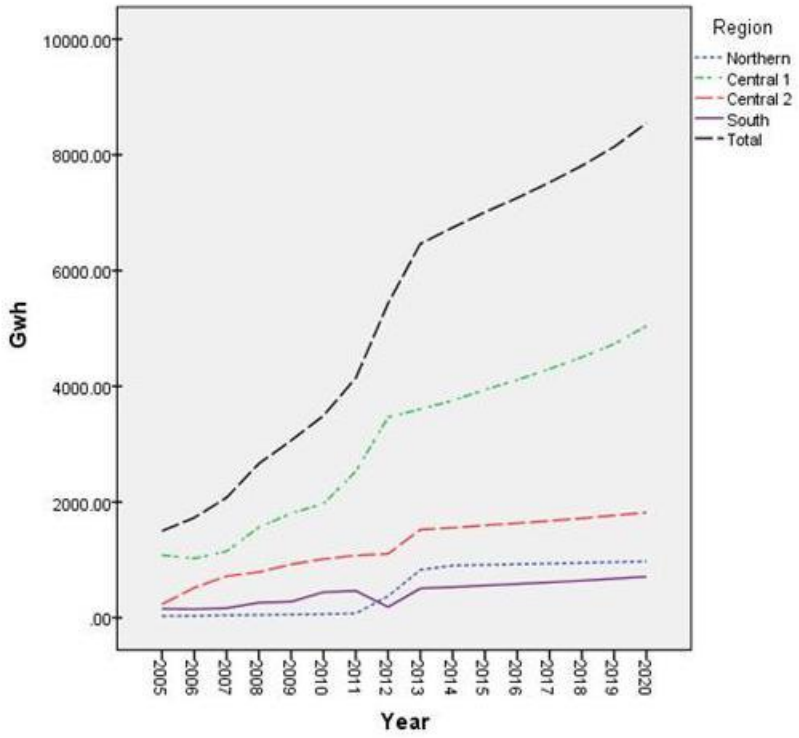

Figure 25. Electricité du Laos power development plan domestic energy forecast 2005-2020
Source: EdL 2008

As shown by Figure 25, major demand is anticipated to come from the two central regions. These regions are the location of the largest consumers in terms of electricity consumption in the form of major industrial projects such as copper and gold mining, steel processing, and cement factories (EdL 2008, II-4). Additional electricity demand will result from the rural electrification projects that aim to electrify 90% of households by 2020.

Building from baselines established in 2006, the Electricité du Laos plan shows an average growth rate of 14% was present in terms of domestic energy demand from 1999 to 2006 (EdL 2008, I-5). Forecasted domestic demand shows an increase of 13% per year until 2020, with 4.56% as residential demand and 6.97% industrial demand (EdL 2008, A-2).

While the Electricité du Laos plan offers a pure domestic assessment of future hydropower potential and plans, a power system development plan was created in 2004 by Maunsell (2004), an independent consultant that was hired by several organizations including the Lao government and World Bank, to create a comprehensive report on present and future energy development in Laos. The Maunsell report which draws upon Electricité du Laos' power development plan takes into consideration external factors more comprehensively. Most notably it attempts to forecast future energy demands of potential Laotian power customers in an attempt to guide future development on a cost-effective path.

The Maunsell plan offers a more grounded study, with certain growth tempered and offers base and best case scenarios concerning both domestic electrification rates and

export prospects. Table 6 compares the forecasts for domestic demand between the Electricité du Laos plan, and the Manusell plan.

Table 6.
Laotian energy demand forecasts 2005-2020

	Year			
	2005	2010	2015	2020
EdL Plan	1499.9	3493.2	7009.5	8549
Maunsell Plan	1731.3	2695	3559.8	4664.2

Source(s): EdL 2008, Mansuell 2004
Units are in GWh

The discrepancies between the two plans are a result of several factors in Maunsell's computations. The Maunsell plan took into account future power grid integration, off-grid electrification, and power load diversity in terms of residential, commercial, or industrial, which would result in a lower demand from the national power grids (Maunsell 2004, 37).

Domestic energy demand is a factor that will need to be considered in the future development of the Laotian hydropower sector. As the country continues to grow in both population and industry, the need of more electricity will rise. Continued hydropower development is one method that is part of meeting this demand, and is part of the overall electricity development plans. The rate of hydropower development however will vary depending on which development plan Laos continues to follow. Domestic energy sector development will be tempered by amounts of capital available as well as the focus upon the export market.

External Demand and Market

The energy demands of the Laos' perspective customers will continue to have a large role in the pace and scale of future development. The Maunsell development plan

developed base and optimal scenarios based on load data of its neighbors, primarily Thailand and Vietnam. There is however an important caveat that the plan notes in terms of export development, in that there is no systematic basis for optimizing the sequence and timing of export projects compared to the development of the domestic system (Maunsell 2004, 14). While the geographic location of Laos in the Greater Mekong Sub-region has provided it key advantages in the development of its export power market, Laos is at the mercy of prices with respect to the power trade. Neighboring countries do have alternative sources of supply in the form of oil, gas, and coal fired plants that in some cases may be cheaper to either buy or develop compared to purchasing hydropower from Laos (Maunsell 2004, 84). While not specifically mentioned by critics, this is one factor that has the ability to contribute to questionable financial returns which may force reevaluation of a project (IRN 2008b). Despite this, the Maunsell plan offers approximate estimates of regional power demands and their effect upon the development of the Laotian hydropower sector. Electricity trading already has taken place and will continue on several levels within the region. Figure 26 shows current amounts of electricity exported by Laos and imported by Thailand and Vietnam in the past 20 years. Data on Vietnam before 2006 however is unavailable and exact countries of origin statistics unfortunately were not available.

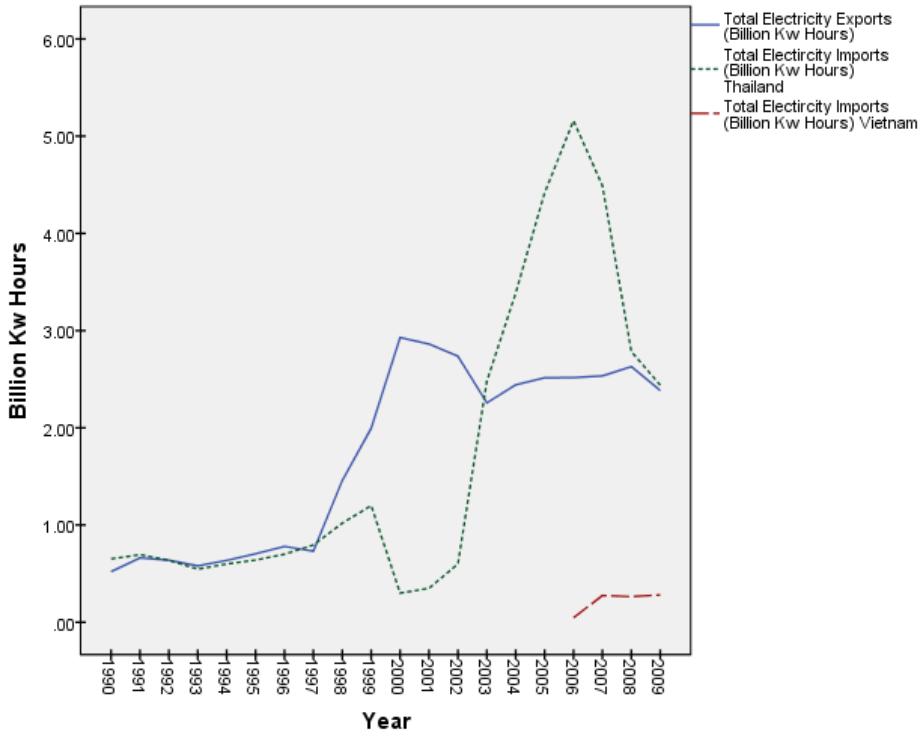

Figure 26. Laotian electricity export totals, Thai and Vietnamese import totals
Source: U.S. Energy Information Administration 2011

Thai Electricity Situation

Thailand represents an important potential customer for future Laotian hydropower sales. Existing linkages between the Laotian and Thai power grids reduces the need for the construction of new power lines between the two countries. Additionally Laos and Thailand already engage in small-scale power trading.

Energy has been a key factor in Thailand's economic growth and success, which has depended upon external sources for nearly 60% of its commercial energy needs (Maunsell 2004, 53). Thai electricity demand has grown, with the annual per capita electricity consumption since 1985 increasing from 400 kWh per year in 1985 to 1400 kWh per year as of the time of the Maunsell report in 2004 (Maunsell 2004, 56). Thai

electricity consumption in the past two decades overall shows consistent increases, with the exception of the period around 1997 as illustrated by Figure 27.

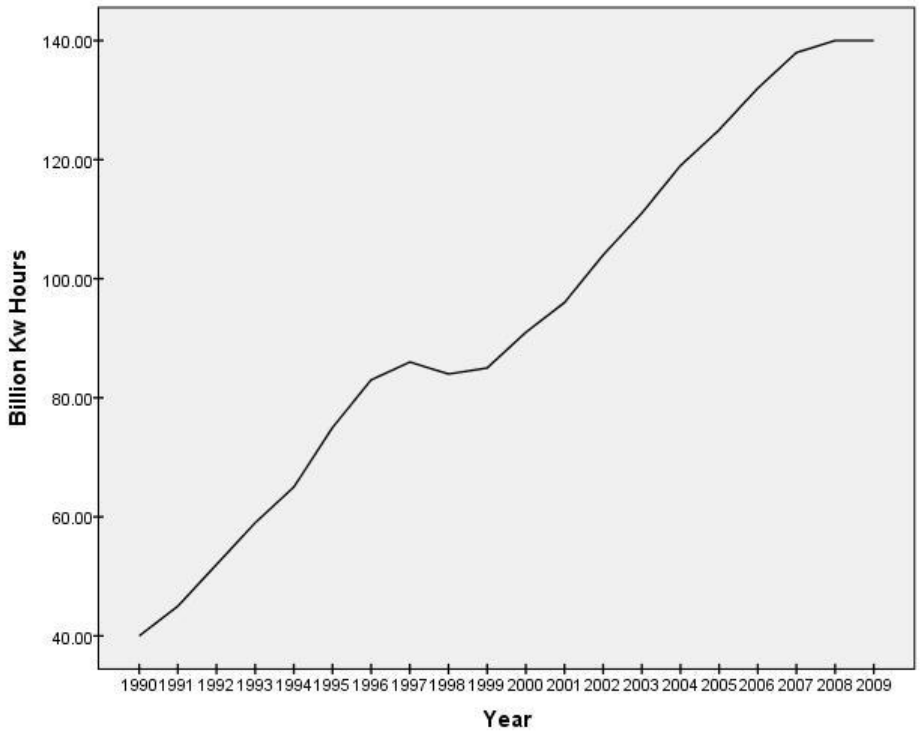

Figure 27. Thai energy consumption – 1990-2009
Source: World Bank 2011b

While the Asian Economic Crisis of 1997 illustrated the sensitivity of the electricity market in relation to economic growth, Thailand's electricity demand rebounded quickly and has continued to rise. It remains to be seen how electricity demand will be affected by the current global economic situation.

On the basis of economic health, Thailand presents a relatively stable market for Lao hydropower exports; however there are other critical factors in determining the prospects for the export market to Thailand. Thailand has been building electricity trading relationships with other countries in the region and entered into discussions for the creation of frameworks for such imports (World Bank 2006). Laos also faces domestic competition from within Thailand in the form of potential gas, coal, and oil

fired power plants. In some circumstances this may be more economically friendly to the Thai government in terms of import and construction costs versus hydropower purchases from Laos (Maunsell 2004, 64). Future Lao export market planning would be advised to consider Thailand's energy alternatives more carefully when analyzing future export hydropower projects for the Thai market, in that while Laos has adequate supply, the Thai demand despite the economic health, may decrease severely.

Several factors still point in favor of a strong Thai market for Laotian hydropower. First, due to strong environmental opposition, the construction of large scale hydropower projects in Thailand has been for the most part halted, despite an abundance of hydropower potential. This will result in declines from the domestic Thai hydropower industry. In 2003 domestic hydropower contributed only 6.3% to the total capacity of the Thai power system; by 2016 it is predicted to fall to 2.2% (Maunsell 2004, 62). Purchases from Laos could be used to offset this loss in the national power system. The second aspect that works in Laos' favor concerning the Thai market is geographic location. The location of Lao projects along the north-eastern and eastern Thai border provide excellent areas for further connection to the Thai power grid with minimal distance and investment, offsetting geographic in-balances within Thailand concerning energy production potential.

Vietnamese Electricity Situation

Vietnam is in some instances similar to Thailand, but acute differences are present in the context of being a power customer of Laos. In contrast to Thailand, Vietnam has an abundant supply of potential domestic energy sources ranging from coal, oil, gas, uranium, and hydropower that compared to Thailand, either do not need to be imported or

are more easily extractable (Maunsell 2004, 64). Yet similar to Thailand, Vietnam has experienced a period of increased electricity demand, however in the case of Vietnam electricity sales increased 70% faster than GDP growth with electricity consumption growing 16.6% per year from 1990 to 1995 (Maunsell 2004, 65). Figure 27 shows Vietnamese electricity consumption from 1990 to 2009. As the figure illustrates, Vietnam has also shown steady increased in electricity consumption. The Asian Economic Crisis did not affect Vietnam as severely compared to the other nations in the region, resulting in continued growth in electricity consumption.

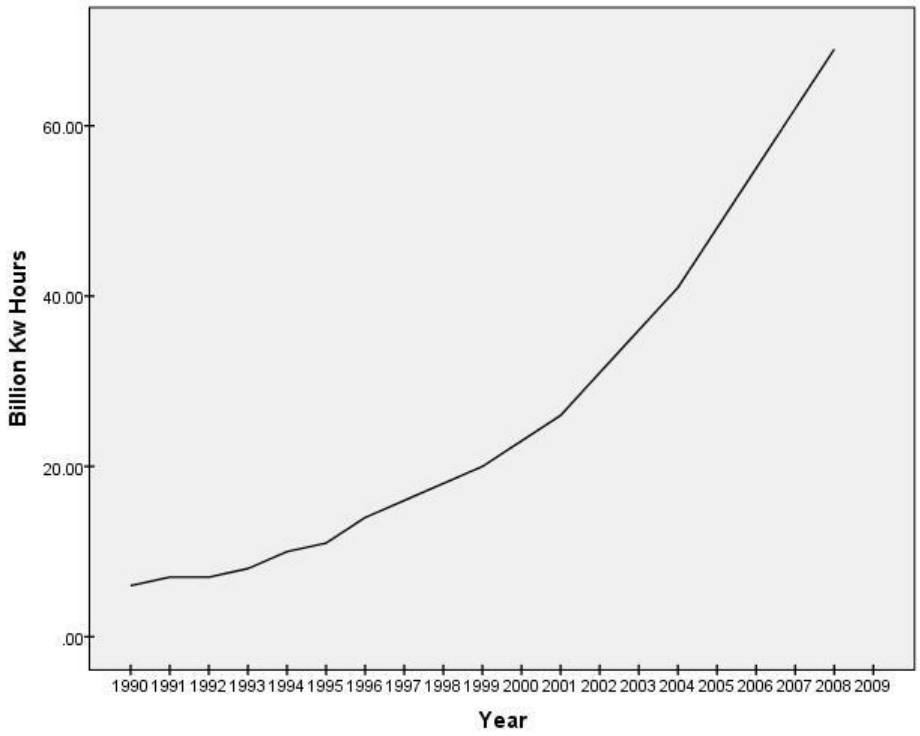

Figure 28. Vietnamese electricity consumption – 1990-2009
Source: World Bank 2011b

While imports do not currently factor heavily into the Vietnamese power system, imports are expected to increase from 2% in 2010 to 8.9% by 2020, suggesting that Laotian hydropower may be used to fulfill that need (Maunsell 2004, 69). Figure 26 previously showed Vietnamese import amounts from 2006 which saw a significant

increase from 46 million Kwh in 2006 to 275 million Kwh in 2007. Import totals for 2008 and 2009 remained around 270 to 280 million Kwh (U.S. Energy Information Agency 2011).

Electricity demand in Vietnam takes a regional character due to several factors including the shape of the country, the geographic distribution of energy resources, and past geopolitical history. Consumption and demand rates are significantly higher in the north and south regions compared to the central. This is in part explained by the presence of Ho Chi Minh City and Hanoi in the south and north respectively. The central region is also less economically developed compared to the other two regions, resulting in a lower consumption and demand rate. The major concern for the health of exports to Vietnam will rest upon the development of Vietnam's domestic energy resources. Northern Vietnam's system is dominated by hydropower but significant reserves of coal are present. Southern Vietnam has hydro production capacity, but is increasingly reliant upon gas fired plants to meet energy needs in the region, while central Vietnam lacks significant energy resources. Future demand will rest upon whether more coal fired plants are developed in northern Vietnam and whether gas fired plants are further developed in the south. If gas and coal supplies are found to be insufficient and expensive to exploit, hydropower from Laos may be seen as having the economic advantage versus domestic energy development (Maunsell 2004, 68). Despite the abundant domestic energy supplies present in the country, Vietnam has still signed memorandums of understanding with Laos for the purchase of hydropower as well as developing several projects within Laos (EdL 2010a, EdL 2011, IRN 2008b.)

Several other potential markets for Laotian hydropower were also identified by the power system development plan, including Cambodia, Myanmar, and Yunnan Province, China, however these markets are constrained, due to a lack of power demand as well as both Myanmar and China representing potential competitors for the Thai hydropower market (Maunsell 2004).

As stated above, potential customers of Laos have alternative options, resulting in the situation not being one of simple supply and demand. Laos will continue to be a price taker unless the power situation changes in the form of depletion or the creation of regional frameworks for the power trade. While future memorandums of understanding for the construction of hydropower dams are fairly numerous, there may be little demand due to various external factors such as alternative energy options and the role of prices. In terms of domestic development, the Lao government will continue following the Electricité du Laos forecasts, which show major growth in the domestic energy demand.

As far as the external market, the government still sees hydropower as the only real viable source of income for national goals due to the potential and viability of the export market. This is evident in the pace of dam construction within Laos. Yet this focus on hydropower is susceptible to macroeconomic conditions which have the potential to derail even the best developed plans such as the case of the 1997 Asian Financial Crisis. Future development may face new hurdles with any major regional or global economic stress.

Mitigation and Compensation

Mitigation and compensation debates may also affect the pace and development of new hydropower projects in Laos. As mentioned in Chapter IV, policies, laws, and

standards have been created in order to pacify critics of hydropower development. These critics have raised attention to the negative socio-economic effects that the construction of large scale hydropower projects can have, as well as the lack of adequate compensation for losses and resettlement. Proponents of hydropower development continue to state that mitigation and compensation measures are working and have made a positive effect. Reports by the World Bank on the resettlement undertaken in the Nam Theun 2 project state that the resettlement and compensation package given to villages affected by the Nam Theun 2 project has been effective (World Bank 2010b). The World Bank reports that the package included housing, water supply and electricity, agricultural land, and community infrastructure, including schools, warehouses, and fertilizer factories (World Bank 2010b, 10). Overall success was reported by multiple agencies including; the World Bank, Asian Development Bank, and the Nam Theun Power Company, the developers of the project. Success was measured in several ways, most notably in the form of increased rice cultivation in resettlement sites with average yield around 1.2 tonnes, compared to pre-project numbers of 0.8 tonnes (World Bank 2010b, 18). Other instances of success included increased household incomes, with a yearly income per capita around $250 U.S. dollars versus less than $150 dollars pre-project, as well as more physical assets such as a television or motorbike (World Bank 2010b, 28).

Asian Development Bank reports include quotes from villagers who have received compensation who say "they are better off than ever before," and that they "miss the old village….but my memories of that place, the hunger and lack of modern things, that's not too pleasant" (ADB 2010b, Winn and Baardsen 2010). These instances of successful mitigation and compensation measures lend to support proponents' views that

the development of hydropower will continue to be beneficial given proper support, lending credence to the claims of projects such as Nam Theun 2 being model projects.

Critics however continue to question the "model project" claims that proponents make about Theun-Hinboun and Nam Theun 2. They also continue to question claims made about the standards of future projects despite statements to the contrary by proponents (EDF 2005b, IRN 2008a, 2008b). Several examples of the failure of mitigation and compensation measures are commonly found in critical arguments against the continued funding of Laotian hydropower. Barney (2007) in his field work at a village affected by the construction of the Theun-Hinboun project found that despite initial agricultural support through the awarding of diesel water pumps and the construction of irrigation channels, this support was not adequate to replace agricultural losses suffered by the villagers. Reasons for this failure included a lack of money for fuel, lack of completion of irrigation channels, and decreasing harvests with increasing input costs (Barney 2007, 25). The Theun-Hinboun Power Company, the primary developer and operator of the project, blamed the failure on the villagers and their lack of cooperation and initiative (Barney 2007, 27). The company was also the primary party responsible for implementing mitigation and compensation measures. Other examples of what critics state as failures of mitigation and compensation include: lack of potable water supplies in the Nam Luek project, despite promises of a new water supply by project authorities; undue emphasis upon new methods of agriculture such as irrigate dry season rice production, and a lack of adequate options for replacement housing in the Theun-Hinboun expansion project (FIVAS 2007, IRN 2004, 2009).

Given these examples, hydropower critics advocate ceasing financial support for large scale hydropower projects unless mitigation and compensation policies, procedures, and standards are followed and met (EDF 2005b, IRN 2008b, 2009). Much of this criticism is directed at public financing organizations such as the Asian Development Bank and World Bank, both major financial supporters of Laotian hydropower projects (ADB 2010b, World Bank 2009, 2010b). If these institutions were to withhold funding unless mitigation and compensation standards were met, this could severely impact the pace of future hydropower development in the country given the large amounts of capital given for hydropower development. Yet the current track record of projects built with support from these organizations indicates that this more than likely will not happen, resulting in the continuation of support.

Highly related to the role mitigation and compensation will have is the continued role of private investment (IRN 2008b, 14). The shift to private investment versus multilateral funding is a trend that will continue into the future in the financing of large scale hydropower projects. This is concerning for future mitigation and resettlement policy as private investors in general have less stringent standards concerning safeguards and mitigation policy compared to institutions such as the World Bank and the ADB (Hirsch 2010, Imhof 2006). While private investors wish to display an image of concern in order to avoid criticism which may impact the approval and construction of potential projects, it is clear that projects having less parties involved will have more freedom in planning, application, and implementation of safeguards.

The rise of private investment in the Laotian hydropower sector has also resulted in the questioning of the continued influence of institutions such as the World Bank and

ADB in terms of mitigation and safeguards. Hirsch (2010) argues that multilateral funding institutions will have continued influence due to the funding of transmission lines and involvement in past projects. Critics believe the future will see the influence of these institutions decline even more due to having no real enforcement powers, as well as being unwilling to exercise the limited recourse options at their disposal such as suspending loan and grant disbursements (EDF 2005b, IRN 2008a).

Geopolitics

As stated in the previous chapter, hydropower development patterns in the Lao PDR may be significantly affected by regional geopolitical dynamics. Hydropower development can have significant geopolitical ramifications that must be taken into account when discussing future large scale transboundary hydropower projects. The geographic location of Laos in the Greater Mekong Sub-region will continue to result in hydropower development and development of the Laotian power system taking on an increasingly regional dimension (Maunsell 2004, 38). The power system development plan by Maunsell has stated that greater cooperation between the GMS countries has increased in the last 10 years and will need to continue to increase if the hydropower sector in Laos is to flourish. Additionally it notes that Lao national plans must be in sync with regional plans concerning hydropower development. Uncertainty is still present however over the pace of integration into the GMS power grids as well as the extent of the involvement of the private sector (Maunsel 2004, 24).

The further development of mainstream Mekong River hydropower dams may prove to be one of the largest sources of potential geopolitical conflict in the region. As the case of the Xayaburi Dam from Chapter IV illustrates, future development on the

Mekong River is beginning to face more opposition. Yet this opposition is now in the form of national governments, other than the traditional local and NGO opponents of hydropower development. At the end of 2011, a decision on the Xayaburi Dam by the Mekong River Commission has been postponed again due to continued concerns by Vietnam and Cambodia about the potential impacts upon fisheries and livelihoods of their citizens (BBC 2011). Further analysis is planned on the potential impact of the Xayaburi Dam by a Japanese firm that has been contracted by the Mekong River Commission (BBC 2011b). Yet given the amount of debate and discussion concerning just one project, it remains to be seen how much more conflict will be spurred by more debate on future projects.

While Cambodia has planned Mekong River dams as well, they have not acted in the manner Laos has in past and present. Laos has pushed ahead with plans for mainstream development with little to no public discussion, reflecting a strong reaction by Laotian leaders at any outside interference in hydropower development (Hirsch 2010, 316). A number of future projects have been planned for the Mekong mainstream by Laos. Figure 28 shows the location of several planned Mekong mainstream dams.

The role China has geopolitically must also be mentioned when discussing mainstream Mekong development. China to this point has been the only nation to build hydropower dams on the mainstream Mekong with at least eight further dams planned. Chinese dams however are being blamed for decreased water levels downstream threatening food security and ecological heath (BBC 2011a). China has rejected these claims, blaming the decreased water levels on dry weather, noting that the entire

Figure 29. Mainstream dams on the Mekong River
Source: BBC 2011

basin has been affected, stating that, "the water level decline of the Mekong River has nothing to do with the hydropower development" (BBC 2011a). While dialogue and information sharing with China was noted as positive, it remains to be seen if it remains constant. This situation reflects how the development of transboundary waters may stir potential disagreements, and could provoke geopolitical conflict. While not to the stage of a "water war" as potentially hypothesized by Furlong (2006), Gleditsch et al (2006), and Toset et al (2000), the situation is still worth keeping vigilance upon. As Bakker

(1999) believes, good water management strategies between nations can diffuse potential water and ecological conflicts (Bakker 1999, 221).

Conclusion

Future Laotian hydropower development will be influenced by several key factors. Increasing domestic demand will result in a need to supply the country with more electricity. Hydropower is certainly one avenue available to supply this demand, but competition from the focus on the external market may result in alternative means to meet this demand. The external market will continue to be an influence upon future hydropower development, given the strength of the Thai market, and the possibilities that exist in Vietnam. Increasing consumption levels will require meeting the demand for electricity, again Laotian hydropower may be the solution. Yet external factors such alternative energy options in the form of oil, gas, and coal, as well as potential economic downturns may result in another bust period for Laotian hydropower development.

Continued focus upon mitigation and compensation issues by critics of hydropower may also have influence to future development by forcing a reconsideration or re-analysis of projects, however as the track record seems to indicate; public financing will continue to support hydropower. An increasing level of private financing with more lax standards will also result in more projects with continued concerns over mitigation and compensation issues. Lastly the regional geopolitical situation will continue to be worth examining in relation to the future of Laotian hydropower development. With future plans for mainstream development of the Mekong River, and given the debates and disagreements on the potential effects, development may see a slowing if not a complete halt.

CHAPTER VI

CONCLUSION

Introduction

The past two decades have seen both booms and busts in terms of Laotian hydropower development. Laos as a least-developed country has attempted to utilize its geographic advantage of being a region rich in hydropower potential, and its proximity to potential customers to earn much-needed revenue for development. Throughout this study, the PESL framework has assisted in identifying several key factors in relation to Laotian hydropower have been found. While this information is very important, it must also be noted that this study was constricted by several limitations that leave room for future research opportunities.

Primary Findings

Development patterns in terms of quantity of projects, capacity, electricity generation, and revenue clearly have shown periods of growth and decline for the last 20 years. Both the capacity of projects and amount of electricity generated by hydropower has increased as well as the total production capacity of Laos. Capacity and the number of projects will continue to rise throughout the next decade. Every province of Laos has at least one or more hydropower project planned or already in operation for the time period of the study.

Remaining highly questionable is whether hydropower revenue is actually having a tangible effect upon socio-economic development and poverty reduction as stated by hydropower proponents. The analysis of the socio-economic consequences of hydropower development was inconclusive at best. Nationally, agricultural losses were not present, in either rice production or land loss, however as stated this may be due to government misrepresentation or different criterion of what constitutes land loss and food production. Improvements were also seen in such proxies as life expectancy and health spending, but without accurate and comprehensive revenue spending data, the relationship between hydropower and these variables is speculative at best, despite the positive statements by hydropower proponents.

Large scale hydropower development will continue to be justified on the basis of economic contribution and geographic viability. The revenue estimate of the contribution to the GDP is one such economic factor that will be used to support the planning and construction of future projects. Yet this is troublesome, as according to estimates in the study, export electricity revenue is actually contributing less and less economically. Given the decreasing contribution of export revenues, the decisions made to further expand and increase hydropower project construction and capacity can be considered questionable by the Lao government.

Hydropower projects will continue to find support from international actors such as the Asian Development Bank and World Bank who see hydropower as a positive force for change and transformation in the region. These organizations will continue to focus on the role hydropower plays for the development of Laos in terms of poverty reduction and increases in socio-economic standards. Critics however, recognize that the

government has limited capacity and management to deal with the regulation and management, of both the hydropower construction process as well as the management of the large amounts of money involved. The lack of strong institutions, monitoring, and accountability for the mitigation and compensation of hydropower development's negative effects will continue be a point of contention between supporters and critics of hydropower development in Laos.

A major dilemma remains however, in that if there is a lack of resources then there is no development, however if there is no development, then no resources can be exploited, hence a "chicken and egg" debate of which needs to come first. The problem currently is finding the best balance in terms of policy making between the requirements placed upon developers and the Lao government in order to gain funding for these projects, developing said projects within time requirements, and the need to maintain sustainable yet profitable resource bases for the future.

The creation of new policies and laws has served to create an environment that appeals to large scale investments for hydropower. The Law on the Promotion of Foreign investment as a primary example encourages investment in hydropower via offering financial incentives and guarantees in regions that are most suited for hydropower development. Additional policies and laws relating to socio-economic consequences and mitigation and resettlement issues create the image that the Lao government recognizes the negative impacts hydropower can have, and is working to solve these issues. This ensures that public funding, while declining, is still available as a funding option for such projects.

The relationship of hydropower and geopolitics is another point of continued interest in the Laotian context. The historical geopolitical situation has helped to explain a severe lack of development pre-1990. Yet the geopolitical situation has also presented opportunities and obstacles to future Laotian hydropower development. With increasing regional rapprochement, bi-lateral investment, and the strengthening of regional ties, prospects for cooperation in developing projects and the creation of new export markets are strong. Yet as illustrated by the case of the Xayaburi dam on the mainstream Mekong River, hydropower can also have an effect on geopolitics. Vietnam's disagreement with Laos on that project on the basis of negative environmental change and threats to food security is indicative of the controversial nature of large scale hydropower development. Regional development will continue to rely on geopolitical stability. Geopolitical conflict arising from the development of the Mekong River and its hydropower resources may derail future initiatives regionally, and while not at the stage of a "water war," the situation warrants continued attention.

Future prospects for the continued development of large scale hydropower projects in Laos will continue to be driven by both export market and domestic demand. Increasing domestic demand as well as government goals of achieving a 90% household electrification rate will result in Laos seeking more electricity. What remains unknown is whether the electrification goal is feasible, given the required amounts of funding and improvements in the electricity distribution system that are needed. Continued purchases from independent power production projects are also another factor that is worth attention. Fewer projects are being constructed for domestic consumption, while more

potential hydropower sites are being scouted for export projects, resulting in increased purchases of electricity from independent sources.

The situation of Laos' export prospects is not a simple supply and demand problem. The possibility of volatile export markets as well as the possibility of competition from its neighbors will continue to make the focus upon hydropower a high risk proposition for Laos. Thailand and Vietnam present stable and strong economic and political conditions for the export of hydropower, however caveats exist. Both Thailand and Vietnam will continue to have alternative energy production options such as coal, gas and oil fired plants for the production of electricity. While these prospects are based upon predictions and estimates that appear strong on paper, history must be considered when discussing the future. As the Asian Economic Crisis in 1997 demonstrated, economic shocks can severely impact electricity demand, and in turn hydropower development. A weakened export market given the amount of investment and development already under taken by Laos in the hydropower sector, would entail severe negative consequences for the Lao economy and leave the country on the hook for the multiple costs of hydropower development.

Study Limitations

Several limitations presented themselves at times during this study that hindered analysis. Most notably, a lack of comprehensive statistics relating to hydropower revenue income and spending limited the analysis of the effects of hydropower on socio-economic variables. Due to the lack of firm revenue spending data, the use of proxies was required in an attempt to validate the positions taken by supporters and critics. Related to this was the problem of data access which limited analysis at several points. Official statistics

directly from Laos concerning revenue and socio-economic variables were either non-existent, restricted, had to be found through tertiary sources such as the World Bank and United Nations, or estimated as in the case of the hydropower revenue totals. Additionally, import and export amounts of electricity for countries in the region were compiled as one amount. Firmer conclusions could have been garnered if these amounts were delineated by country, ex: total amount of Lao electricity exports to Thailand, Vietnam, etc. Validity of several statistics such as agricultural land available and amount of rice produced are examples of statistics for which reports may be inaccurate, due to differences in definition of agricultural loss or who constitutes a rice producer.

Another major limitation was in the lack of diversity for sources of information. Much of the information relating to the negative aspects of hydropower development was only found in reports by NGO's who are noted critics of hydropower. Similarly, much of the information on the positive effects was from developers, project financers, and other proponents of hydropower development whose biases are inherent in their positions. Mass media news articles and academic journal articles helped to supplement the analysis, but more independent studies by neutral parties would have benefited the analysis.

Lastly the study was constrained by a lack of Lao language comprehension and the absence of a fieldwork component. Several documents and web-sites concerning the Laotian hydropower sector were only available in the Lao language, and several translations were questionable due to being financed by the Lao government. A field-work component would have also benefited the analysis by learning what government

officials and villagers' perspectives currently are, however this would prove beyond the logistical limitations of the research project.

Future Research Prospects

Future research, besides concentrating on the points mentioned above should focus on developing more complete statistics in relation to hydropower revenue. Revenue data would help to validate either supporters or critics' positions on the actual impact of large scale hydropower development. More studies and access to project sites by academics that are independent of either project supporters or anti-hydropower NGO's could also help to shed further light on the local level impacts of Laotian hydropower development. Similar to what Singh (2009) accomplished, a more open study of not only hydropower's effects at local levels but how hydropower is perceived at local levels would help shed understanding on why at times there seems to be no local scale voice on hydropower development. Research examining the application of solutions at multiple scales in terms of mitigating the negative effects of hydropower development would be beneficial in determining whether solutions devised at the local level or national level are more appropriate.

A major factor that deserves further attention is the impact of hydropower revenue. While revenue was shown to increase at the close of the century, in the last ten years, electricity export revenue has decline to the point where its contribution to the national economy could be considered minimal rather than substantial. The export revenue estimate in the study serves as a baseline to examine the pattern of revenue, but without firm data, there will continue to be much speculation on the actual impacts of hydropower revenue.

The shift from public to private support for hydropower will also continue to merit attention. As stated previously in Chapters IV and V, private investors will generally have more lax standards in terms of environmental impacts, and mitigation and compensation issues. The large numbers of projects that are either under construction or are planned for the future are evident of this trend. Many projects that are selected are sub-optimal in terms of these standards and do not sufficiently consider the actual costs of development. While certain large scale projects such as Theun-Hinboun and Nam Theun 2 have had significant support from international lending agencies, many of the future projects for Laos are increasingly privately funded, constructed and operated. This trend will continue to fuel concerns over the future of environmental and social standards in hydropower development.

The focus on Laos may have produced contextual situations and constraints that are unique to Laos. Studies on the development process in other regions such as South America where hydropower is also being developed would provide a helpful comparison to determine generalities common to the hydropower development process. Comparisons to the development history in industrialized nations would also serve the purpose of determining contextual features unique to hydropower development in LDC's.

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