An Analysis of China's Investment in the Hydropower Sector in the Greater Mekong Sub-Region

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KTH Royal Institute of Technology
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An analysis of China's investment in the hydropower sector in the Greater Mekong Sub-Region

Frauke Urban, Johan Nordensvärd, Deepika Khatri, Yu Wang

Abstract

The Mekong River's richness in natural resources offers large benefits to its populations; nevertheless it also raises the interest of foreign investors. Recently, Chinese firms, banks and government bodies have increasingly invested in large hydropower projects in the Greater Mekong Sub-Region. Due to China's rapid economic growth, its rapid industrialisation and its limited domestic natural resources, the Chinese government has issued the 'Going Out Strategy' which promotes investments in overseas natural resources like water and energy resources. In search for climate-friendly low carbon energy, cheap electricity and access to a growing market, Chinese institutions turn to Southeast Asia where Chinese institutions are currently involved in more than 50 on-going large hydropower projects in Cambodia, Laos, Myanmar and Vietnam as contractors, investors, regulators and financiers. These Chinese institutions have influence on environmental and social practices as well as on diplomatic and trade relations in the host countries. Currently, there are major gaps in understanding in more detail who is engaged, why, how and with what impacts. This paper therefore aims to assess the motives, actors, beneficiaries and the direct and indirect impacts of China's investments in large hydropower projects in the Greater Mekong Sub-Region. The authors use the 'Rising Powers Framework' to assess these issues, which is an adapted version of the Asian Drivers Framework.

Key words:

China; Mekong; hydropower; natural resources; investments

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1. Introduction

During the last 30 years, China has experienced high economic growth and population growth. At the same time, it has become known as the 'factory of the world'. This puts pressure on scarce domestic natural resources which are essential for powering China's growing economy. These developments have to be viewed in the context of China's growing status as a global production and manufacturing hub. The expanding Chinese economy is creating increasing demands for power to be exported from the 'resource-rich but infrastructure-poor Western China to resource-poor but development-frenzied Eastern China' (McNally, 2009:291). This raises questions about the sustainability of China's development. The government therefore issued the 'Going Out Strategy' during the 10th Five Year Plan (2001-2005) which promotes investments in overseas natural resources like energy and water resources. Consequently, China is increasingly engaging with low income countries (LICs) to ensure access to natural resources and cost-effective production and labour. In search of cheap electricity and access to a growing hydropower market, China turns to the Greater Mekong Sub-Region.

The potential for tapping this natural resource and harnessing it to generate energy was recognised as early as the 1950s, but tense relations between riparian states hampered plans of hydropower development. The end of the Cambodian conflict and an extension of peace dividends between Cold-War opponents in the 1990s shifted the emphasis to regional economic cooperation and environmental security (Bakker, 1999). Chinese institutions are currently involved in almost 50 on-going large hydropower projects of more than 50MW in Cambodia, Laos, Myanmar and Vietnam as contractors, investors, regulators and financiers. China is also engaged in about five hydropower projects in Thailand, however of less than 50MW capacity.

This paper aims to provide a comprehensive analysis of the actors, motives and the impacts of China's investments in the hydropower sector in the Greater Mekong Sub-Region. There is a growing body of literature available in this field; however there is a lack of comprehensive studies about China's engagement in this region, the motives and dynamics behind it and the impacts. Many earlier publications do not go beyond regionally specific studies (e.g. Dore and Yu, 2004; Hayashi et al., 2008; Magee, 2006) or disciplinary limited studies (e.g. Goh, 2004; Hayashi et al., 2008; Hwang et al., 2007; Tilt et al, 2009; Yu, 2003). This paper aims to take a more holistic approach by combining several disciplinary perspectives and assessing economic, environmental, energy, social and developmental causes and implications which have often been neglected by earlier studies and assessing the larger-scale causes behind who is driving China's overseas dam development and in which capacity, why are they doing this, what do they gain from it and what the direct and indirect implications for China, low income countries and others are. Many earlier studies are limited in their analysis of these issues and do not offer an interdisciplinary and holistic analysis. Many earlier studies further focus on a few selected hydropower projects or a small geographic area rather than assessing larger-scale patterns and international trends which are symptomatic for

China's engagement in the Greater Mekong Sub-Region, Southeast Asia and beyond. In line with this reasoning, this paper adds value to the existing knowledge in this field by assessing the larger-scale and interdisciplinary motives, actors, beneficiaries and the direct and indirect impacts of China's investment in the hydropower sector in the Greater Mekong Sub-Region. This paper aims to assess particularly the indirect impacts for which very little analysis is available. For assessing these issues, the authors use an adapted version of the 'Rising Powers Framework', which is an adapted version of the Asian Drivers framework developed by Humphrey and Messner (2005), Humphrey and Messner (2006), Schmitz (2006), Kaplinsky and Messner (2008) and their Asian Drivers colleagues. The adapted framework is used to assess the specific channel of investment for hydropower projects. Section 2 elaborates China's economic growth and its energy implications; section 3 presents the analytical Rising Powers Framework; section 4 presents the results of the analysis drawing on Chinese investments in large hydropower in the Greater Mekong Sub-Region; section 5 discusses the findings and concludes the paper.

2. China's economic growth and its energy implications

China makes an unprecedented case when it comes to its rapid development over the last three decades, its booming economy and its economic reforms from a centrally planned economy to a market economy with Chinese characteristics. The Chinese economy transformed from an agrarian economy into an industrial and service economy during the last three decades, shifting from support for Maoist inspired revolution to prioritising 'economic modernisation and to maximising access to foreign markets, technology and capital' (Mohan and Power, 2008:30). Since then, China has witnessed an average annual GDP growth of about 9% through its 'state-orchestrated market' approach (Ampiah and Naidu, 2008:330). Chinese Gross National Income (GNI) per capita, measured in Purchasing Power Parity (PPP), has increased 24-fold between 1980 and 2008, which had a strong positive effect on income levels and prosperity, particularly in the urban areas (World Bank, 2010). Today, China is a global player in the economy, politics and environment. However, the high economic growth, rapid modernisation and industrialisation have taken their toll on the Chinese environment and sustainability. China faces significant environmental challenges such as climate change, resource scarcity, water pollution, soil pollution and air pollution (Watts, 2010).

China's rapidly growing economy, the high amount of embodied carbon emissions due to its exports and its strong dependence on coal have brought China into the position of a major polluter. Watson and Wang found that 23% of Chinese CO_2 emissions are due to its strong export market and fuelled mainly by exports to the US and EU (Watson and Wang, 2007). "Fuelling the dragon" has become a major challenge as China's growing economy and its large population can only be sustained using enormous energy resources. China is endowed with cheap, though mostly low-quality coal which comes from indigenous supplies. China also imports higher quality coal from other developing countries, such as South Africa, and oil from various developing countries in Africa, Asia and Latin America. China's energy mix consisted of 87% fossil fuels in 2009, of which

coal accounted for 67%, oil for 17% and gas for 3% (IEA, 2012). Finally, China invests heavily in large hydropower projects in the Greater Mekong Sub-Region and imports cheap hydroelectricity generated by the Mekong River to its booming megacities. Over the last 10 years, Chinese investments in the Greater Mekong Sub-Region have tripled (NBS, 2011). While China mainly invests in natural resources in these countries, it also encourages imports of Chinese manufactured goods. The Chinese practice is often to bundle aid, trade and investment by providing for example both investments and concessional loans for dam-building and linking this to the export of electricity coupled with the import of Chinese manufactured goods.

The Mekong and energy generation

The Mekong River presents an immensely valuable resource for China and East Asia. It is the eighth largest river in the world, with a basin covering 800,000 square kilometres of mainland East Asia. Flowing through Yunnan province in Southern China, it passes through Laos, Thailand, Cambodia and Vietnam and forms part of the border between Myanmar and China and Myanmar and Laos (Goh, 2004). Emerging in the Tibetan plateau, it covers a distance of 4,500 km before finally entering the South China Sea through Vietnam. According to Bakker (1999), in terms of average runoff, the Mekong can be ranked as the tenth largest in the world while it is the twelfth largest in terms of length.

Bakker (1999) further highlights that the Lower Mekong basin represents 77% of the total catchment and contributes approximately 80% of the river's flow, which primarily originates in Laos. The significance of the Mekong as a source of livelihood for the estimated 50 million people living in the basin is thus evident, with the river supporting the largest freshwater fishery in the region, providing drinking water and a source of irrigation for rice cultivation and serving as a mode of transportation. It is one of the most important rivers in the world precisely because of the large watershed population, sediment discharge, flow volume, channel length and fisheries richness (Magee, 2006).

The Upper Mekong in China —or Lancang Jiang in Chinese— on the other hand contributes 16% of the Mekong's total discharge, but in real terms it has a far more crucial impact. The river contributes 100% of the flow at the Laos border and 60% as far downstream as Vientiane, 20% at Pakse in southern Laos, 15-20% in Vietnam and 16% at Phnom Penh (Goh, 2004). In addition, it serves as a vital aspect of maintaining the crucial minimum dry season water flow along most of the mainstream of the Mekong in Laos and Thailand—even in Cambodia, where the Lancang contributes almost 45% of the average flow in April (Goh, 2004). In terms of power generation, Magee (2006:29) adds that 'the Lancang's annual hydropower generating capacity within Yunnan is estimated to be more than 100 TWh'. To put this figure in perspective, 80 TWh per year would be enough to power the regions of Guangzhou, Shenzhen, Dongguan and Kunming combined. The significance of the Mekong River in generating hydropower is thus very high. Table 1 indicates the hydropower potential in the Greater Mekong Sub-Region.

Country	Hydropower resources	Technically and

	(MW)	economically exploitable resources (MW)
China (Yunnan)	104,386	101,094
Myanmar	41,780	39,720
Laos	30,000	25,000
Vietnam	30,000	12,000
Thailand	10,620	9,130
Cambodia	10,000	8,600

Table 1: Estimated hydropower potential in the Greater Mekong Sub-Region. Source: Chinese Statistical Yearbooks, National Bureau of Statistics, 2011.

3. The Rising Power Framework

The framework we use for evaluating China's investments in hydropower in the Greater Mekong Sub-Region is the 'Rising Powers Framework', which is an adapted version of the Asian Drivers Framework developed by Humphrey and Messner (2005), Humphrey and Messner (2006), Schmitz (2006), Kaplinsky and Messner (2008). The Asian Drivers Framework was developed to help understand the rise of Asian 'tiger economies' such as Korea, Singapore, Taiwan and later China. The Asian Drivers Framework focussed on impacts of economic channels of interaction, such as trade, aid, investments, as well as non-economic channels such as global governance, individuals/migrants and the environment (Kaplinsky, 2008). It also assessed direct and indirect impacts as well as competitive and complementary dimensions of these impacts for the Asian 'tiger economies'. The competitive and complementary aspect responded mainly to issues around international economic competitiveness. The framework was aimed at assessing the impacts of these emerging economies and their impacts on other countries, including developed and developing countries.

While acknowledging the substantial contribution that the Asian Drivers team has made to this field of research, this project attempted to rework and adapt the framework according to the needs of this project. This project added further dimensions to the Asian Drivers Framework, namely the motives, actors and beneficiaries engaged in Chinese overseas dam-building. The motives, actors and beneficiaries have been largely neglected by most studies on the Asian Drivers, emerging economies and hydropower developments. In addition, rather than discussing competitive and complementary impacts the framework was updated to discuss positive and negative impacts of China's engagement in LICs. The Asian Drivers Framework was therefore reworked into the 'Rising Powers Framework'. This framework has been adapted and tested throughout the ESRC-funded Rising Powers project. The framework assesses the motives, actors, channels of interaction and the impacts of Chinese involvement in LICs. In the Rising Powers project, we started out to disaggregate China's engagement in LICs by focussing on the channels of interaction such as aid, trade, foreign direct investment (FDI), governance, innovation, policy, environment and migrants; and to assess the motives, actors, beneficiaries and the direct and indirect impacts. We further assessed whether the impacts are positive or negative. Throughout the project, we noticed that

most of the existing research has been on direct impacts rather than indirect impacts, as the latter are more complex and less clear to analyse. We also noticed there was a gap in assessing environmental and social impacts such as migration, innovation and policy processes, as most primary research has been conducted on trade and aid. The environment and migrants are impacts or vectors of other channels, rather than channels themselves. As a consequence of these considerations, we used the Asian Drivers Framework as a starting point, but have since then amended it into the Rising Powers Framework which takes these issues into account. The framework has been tested throughout the project for two case studies: China's engagement in the African oil sector (Urban et al., 2011) and China's investments in the hydropower sector in the Greater Mekong Sub-region (see this paper). The Rising Powers Framework is displayed in table 2.

Channel	**Motives**	**Actors**	**Beneficiaries**	**Impacts**			
				Positive		Negative	
				Direct	Indirect	Direct	Indirect
Trade							
Investment (FDI)							
Aid							
Innovation							
Politics							

Table 2: Rising Powers Framework for assessing China's engagement in Low Income Countries and its impacts

For this particular paper, we only focus on the channel 'investment' to get an in-depth analysis of China's role in this field. The amended framework for this paper is therefore shown in table 3.

Channel	**Motives**	**Actors**	**Beneficiaries**	**Impacts**			
				Positive		Negative	
				Direct	Indirect	Direct	Indirect
Investment (FDI)							

Table 3: Motives, actors, beneficiaries and impacts for Chinese investments into hydropower in the Greater Mekong Sub-Region

The information used for populating and analysing the Rising Powers Framework for this specific case study is based on literature review from academic journal papers published in well respected peer-reviewed journals such as World Development, China Quarterly, Energy Policy, Energy, Journal of Environmental Management and Political Geography. Other sources of information are book chapters and scientific reports about China's engagement in the hydropower sector in the Greater Mekong Sub-Region. Key literature comes from the following sources: Bakker, 1999; Bosshard, 2009; Chang et al., 2009;

Dore and Yu, 2004; Gaung, 2011; Goh, 2004; Hayashi et al., 2008. Heinrich Böll Stiftung, 2008; Hwang et al., 2007; International Rivers 2008 / 2009 / 2010 / 2011; Jönsson, 2009; Magee, 2006; McDonald et al., 2009; McNally et al, 2009; Tilt et al, 2009; Yu, 2003. In addition, we use the extensive Chinese dam database of International Rivers (2011).

Rather than focussing on one case study from one country, we use a broader international scale of assessment which enables us to analyse the overarching and recurring actors, motives, impacts and processes behind China's engagement in the Greater Mekong Sub-Region. There may be variations for specific countries and/or projects; however it has been found that most actors' engagement on the Chinese side and most of their motives and impacts are consistent even when various countries and projects are compared.
We argue there are four main motives for China's investments in large hydropower projects in the Greater Mekong Sub-Region:

Motive: Need for access to hydropower resources from the Greater Mekong Sub-Region

1 due to limited domestic resources and to increase energy security, fuel economic growth and development.
2 to spare China's own rivers and avoid resettlement.
3 to foster regional cooperation and create interdependencies among neighbouring countries.
4 to use low carbon energy for climate change mitigation.

4. Investments in hydropower in the Greater Mekong Sub-Region

As highlighted above, China's rapid economic growth and high population have driven it to look beyond its borders for alternative sources of energy to fuel its high rate of industrialisation and maintain national energy security. In the age of climate change, low carbon sources of electricity are in high demand. In this respect, hydroelectricity is attracting large investments from countries like China, which has also been criticised for being a major emitter of greenhouse gases.

Over the last two decades, Chinese dam expansions have progressed, first at the domestic level and, since the government's 'Going Out' strategy, also overseas. This is reflected in supporting data which states that China has the highest number of dams in the world, not merely domestically but also abroad. According to International Rivers (International Rivers, 2010:1), in 2009, 'Chinese banks and companies [were] involved in constructing some 251 dams in 68 different countries, particularly in Africa and Southeast Asia'. Bosshard (2009:44) adds that 'roughly half of all the world's large dams are within China's borders. With a capacity of more than 170,000 megawatts, it is the world's largest producer of hydropower.'

In this context, the Mekong presents a very valuable resource for China, not simply as a way to generate power, but also to develop diplomatic and economic relationships with its neighbouring countries of Laos, Cambodia, Vietnam, Thailand and Myanmar. The Mekong is thus seen as a natural link between its riparian states and is viewed not just as a naturalised river but one that is 'underutilised and unproductively variable' (Bakker, 1999:219). The aim is to tap the river for energy generation and hence spark regional economic growth and integration. While China has built dams on the Upper Mekong for over a decade, the Lower Mekong has so far largely escaped hydropower development. However, as energy demands increase and the region's economy grows, there is an increasing demand for electricity and a subsequent impact has been seen with increased investments in the Lower Mekong. The economic imperative behind the development of the Mekong River basin is captured in a statement by Khy Tainglim, Cambodia's Minister of Transportation, 'Water is our oil […] and we should use our water to export and get foreign currency to develop the country' (Goh, 2004:7).

In a bid to consolidate economic ties with its neighbours, China is also investing heavily in other countries of South East Asia which are not directly situated on the Mekong River, such as Myanmar which is a tributary country to the Mekong River. Chinese dam-builders currently invest in more than 50 dams in Myanmar alone (International Rivers, 2011). Sinohydro, China's largest dam builder and a State-Owned Enterprise (SOE), has been given the contract to construct a number of dams, such as the Yeywa hydropower station, the Hutgyi hydropower project in Kayin State and another on the upper Thanlwin (Kunlong) River in Shan State in Myanmar (International Rivers, 2011). According to Gaung (2011), in the first seven months of the 2010-2011 fiscal year alone, one third of foreign investment in Myanmar went into the hydropower sector. In Southeast Asia as a whole, Chinese institutions are currently involved as contractors, developers, financiers and regulators in about 280 hydropower projects of large, medium and small size, including about 125 dams, in the Southeast Asian countries of Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand and Vietnam. This is about 45% of all Chinese overseas dams (International Rivers, 2011). Table 4 below shows, yet unpublished, data of Chinese dams along the Mekong River and its tributaries as well as the project costs, the financiers, the developers, the builders and other contractors. The table shows there are currently 50 large dams built by Chinese dam-builders in the Greater Mekong Sub-Region. The table only includes large-scale developments of 50MW or more, hence the five Chinese hydropower projects in Thailand are not listed in this table. The table further only includes dams that are completed, under construction or at a feasibility study stage, not dams that have only been proposed. The table shows that the developments in Cambodia, Laos and Vietnam involve a small number of well-known key players such as Sinohydro and EximBank, whereas the developments in Myanmar include a large number of smaller less well-known players such as Guangdong New Technology Import and Export Company, Yunnan Machinery Export Import Company, China Hydropower Engineering Consulting and others. As many of these hydropower deals are of sensitive nature, some information is yet unknown and many of these dams remain non-researched.

Country	Project	Project cost	Financier	Developer	Builder	Other contractors
Myanmar	Bu-ywa Hydropower Plant, 60MW, under construction	$20 million	Department of Irrigation	Unknown	Unknown	Guangdong New Technology Import and Export Company
	Chibwe Dam, 2000MW, under construction	Unknown	Unknown	Unknown	Unknown	China Power Investment Corporation, Myanmar-Asia World Company
	Chigwe Nge, 99MW, under construction	Unknown	Unknown	Unknown	Unknown	Unknown
	Htamanthi Dam, 1200MW, under construction	Unknown	Unknown	Unknown	National Hydropower Co., Ltd, Ministry of Water and Electricity	Unknown
	Khaunlanphu Dam, 1700MW, under construction	Unknown	China Power Investment Company	Unknown	Unknown	Yunnan Machinery Export Import Company
	Kun Chaung Dam, 60MW, under construction	Unknown	Unknown	Unknown	China Heavy Machinery Corporation	Unknown
	Kun Dam, 84MW, under construction	Unknown	Alstom	Unknown	Unknown	Unknown
	Kyaing Tong (Kengtawng) Dam, 54MW, under construction	$20 million	Unknown	Unknown	CNEEC, Zhejiang Orient Holdings Group Limited	Yunnan Machinery Export Import Company
	Kyauk Naga Dam, 75MW, under construction	Unknown	Unknown	Unknown	Unknown	Unknown
	Kyee-ohn kyee-wa Dam, 60MW, under construction	$20 million	Department of Irrigation	Unknown	Unknown	Guangdong New Technology Import and Export Company
	Laiza Dam, 1560MW, under construction	Unknown	China Power Investment Co.	Unknown	Unknown	Yunnan Machinery Export Import

						Company
	Lakin Dam, 1400MW, under construction	Unknown	China Power Investment Co.	Unknown	Unknown	Yunnan Machinery Export Import Company
	Man Tung (Mantawng or Manton) Dam, 6300-7000MW, Feasibility Study	Unknown	Unknown	Sinohydro, HydroChina, Union of Myanmar's Ministry of Electric	Sinohydro, Three Gorges Corporation and China Southern Power Grid	Unknown
	Mawlaik hydropower, 500MW, under construction	Unknown	Unknown	China Guodian, Burma's Electric Power Ministry No 1, and Tun Thwin Mining	Unknown	Unknown
	Mone Dam, 75MW, under construction	Unknown	Unknown	Unknown	Sinohydro	Unknown
	Myitsone Dam + 6 others, 13360MW, under construction	At least $300 million (value of Sinohydro contracts)	Unknown	Asia World Company, China Power Investment Corporation, Yunnan International Power Investment Company of China	China Investment Power	Sinohydro (Concrete - aggregate processing) Bureau 11, a (downstream civil works $150 million contract - 48 months), Sinohydro has over $300 million in contracts from Myitsone
	Nao Pha Dam, 900-1000MW, under construction	Unknown	Unknown	China Hydropower Engineering Consulting Group (HydroChina), Union of Myanmar's Ministry of Electric Power No. 1	China Hydropower Engineering Consulting	Unknown
	Pashe, 1600MW, under construction	Unknown	China Power Investment Co.	Unknown	Unknown	Yunnan Machinery Export Import Company
	Paunglaung Dam, 280MW, under completed	Unknown	Unknown	Lower Paunglaung Dam, Yunnan Machinery Export Import	Sinohydro	Yunnan Machinery Export Import Company,

				Company, Sinohydro, Ningbo Huyong Electric Power Material Co., Kunming Hydroelectric Investigation Design & Research Institute		Sinohydro
	Phizaw, 1500MW, under construction	Unknown	China Power Investment Co.	Unknown	Unknown	Yunnan Machinery Export Import Company
	Shweli 1, 600MW, under construction	$150 million	Yunnnan Joint Development Corporation [Yunnan Power Grid Corporation, Yunnan Machinery Export Import Company, Yunnan Huaneng Lancang River Hydropower Company], China Power Investment Co.	Unknown	Builder	Yunnan Machinery Export Import Company
	Shweli 3, 360MW, under construction	$150 million	Yunnnan Joint Development Corporation, China Power Investment Co.	Unknown	Builder	Yunnan Machinery Export Import Company
	Tarpein 1, 240MW, completed	$250 million	Unknown	Datang Group	Ministry of Electric Power, conglomerate of Chinese companies, China Datang Corporation	Sinohydro
	Tarpein 2, 168MW, completed	Unknown	Unknown	Datang Group	Ministry of Electric Power, conglomerate of Chinese companies, China Datang	Sinohydro

					Corporation	
	Tasang Dam, 7100MW, under construction	$9,000 million	Unknown	Unknown	China Southern	China Southern
	Thaukyegat 1, 150MW, under constraction	Unknown	Unknown	Unknown	Unknown	Unknown
	Thaukyegat 2, 120MW, under constraction	Unknown	Unknown	Unknown	Unknown	Unknown
	Upper Paunglaung Dam, 140MW, under construction	Unknown	China Exim Bank	Yunnan Machinery Export Import Company and MEP	Sinohydro	Yunnan Machinery Export Import Company, Sinohydro
	Upper Thanlwin, 2400MW, under construction	Unknown	Hanergy, Goldwater Investment Group	Unknown	Unknown	Unknown
	Yeywa Dam, 790MW, completed	$600 million	China Exim Bank ($200 million preferential interest rate loan), China International Trust and Investment Co. (CITIC), China Power Investment Co.	Ministry of Electric Power, CITIC, Sinohydro	China Gezhouba Group Co., China National Electric Equipment Co., Hunan Savoo Oversea Water & Electric Engineering Co., China National Heavy Machinery Co. (CHMC), Sinohydro and COLENCO	Central China Power Grid Co., CHMC, COLENCO, and State Grid Co., have provided support for the construction of transmission lines
Cambodia	Da Dai Hydropower Project, 246MW, under construction	$1,800 million	Unknown	Unknown	Gezhouba	Unknown
	Kamchay Dam, 193MW, completed	$280 million	China Exim Bank	Sinohydro	Sinohydro	Unknown
	Lower Stung Russey Chrum hydropower project (Steung	$412 million	China Exim Bank, INFINITY Insurance, People's Insurance	Unknown	China Huadian Group (Hong Kong branch)	Singapore branch of international law firm Herbert Smith

	Russei Chrum Kraon), 338MW, under construction		Company of China			
	Lower Stung Russey Hydropower Dam, 235MW, under construction	Unknown	Unknown	Unknown	China Yunnan Corporation for International Techno-Economic Cooperation	Unknown
	Sambor hydropower project, 7110MW, under construction	Unknown	Unknown	China Guodian	China Guodian	Unknown
	Stung Atay Dam, 120MW, under construction	Unknown	Unknown	Unknown	China Guodian	Unknown
	Stung Tatay hydropower project, 246MW, under construction	Unknown	Unknown	Unknown	China National Heavy Machinery Corporation	Unknown
Laos	Nam Beng, 50MW, under construction	Unknown	Unknown	Unknown	Unknown	China Electrical Equipment Corp
	Nam Feuang, 60MW, under construction	Unknown	Unknown	Unknown	Unknown	Yunnan Provincial Power Investment
	Nam Khan 2, 130MW, under construction	$430 million	Sinohydro	Sinohydro	Sinohydro	Electricite de Laos
	Nam Khan 3, 95MW, under construction	$430 million	Sinohydro	Sinohydro	Sinohydro	Electricite de Laos
	Nam Leuk, 60MW, completed	Unknown	ADB, Japanese Government	Unknown	Unknown	China International Electric and Water Corporation
	Nam Lik 1,2, 100MW, under construction	Unknown	Unknown	Unknown	China International Water and Electric Corporation	Unknown
	Nam Ngum 5, 120MW, under	Unknown	Bank of China, Sinohydro,	Sinohydro	Sinohydro	Unknown

	construction		Electricite du Laos			
	Nam Ou 2, 640MW, under construction	$750 million	Sinohydro and Lao Government	Sinohydro	Sinohydro	Sinohydro
	Nam Ou 8, 680MW, under construction	Unknown	Sinohydro and Lao Government	Sinohydro	Sinohydro	Sinohydro
	Nam Tha, 263MW, under construction	Unknown	Unknown	Unknown	China Southern Power Grid Corporation	Unknown
	Nam Tha 1, 168MW, under construction	Unknown	Unknown	Unknown	China Southern Power Grid Corporation	Unknown
	Xepone 3, 70-100MW, under construction	Unknown	China National Machinery & Equipment Import & Export Corporation (CMEC)	Unknown	Unknown	Unknown
	Xeset 2, 76MW, completed	Unknown	China Exim Bank	Unknown	Norinco Construction Company of China; Northwest Hydro Consulting Engineerc (CMECC)	Unknown
Vietnam	Cua Dat Hydroelectric Dam, 97MW, completed	$100 million	Sinosure	Unknown	China National Heavy Machinery Corporation; Dong Fang Electrical Machinery Company	Unknown
	Song Bung 4, 156MW, under construction	$261 million	ADB	Unknown	Sinohydro	Mott Macdonald Electricity Construction Advisory Joint Stock
	Tuyenquang Hydropower Project, 314MW, completed	Unknown	ENV	Unknown	Unknown	Yunnan Machinery Export Import Import Company, Northwest Hydro Consulting Engineers (CHECC)

Table 4: Chinese dams of more than 50MW in the Greater Mekong Sub-Region (completed, under construction and feasibility study status). Source: International Rivers, 2011 (latest updates of database: late May 2011).

4.1 Motives for the Chinese investments in dams along the Mekong River

This section applies the Rising Powers framework by assessing the motives of Chinese investments in dams in the Greater Mekong Sub-Region.

Motive 1: To increase energy security, fuel economic growth and development

The key driving force behind China's hydropower expansion stems from its high economic growth, its rapid industrialisation, urbanisation, development and its role as the factory of the world. About a quarter of China's production capacity is geared towards meeting the demand for products for OECD countries (Watson and Wang, 2008). To sustain the economic take-off, one of the biggest factors China has to grapple with is energy security. Energy security is crucial as energy is needed for powering economic growth and for providing the financial means to achieve development goals. China is primarily dependent on coal for generating power. Table 5 indicates how energy consumption in China is expected to almost double between 2000 and 2020 and how growth rates for hydropower are assumed to develop over the coming years (Dore and Yu, 2004).

	2000	**2010**	**2015**	**2020**
Total (Mt coal equivalents)	1092.7	1481.1	1727.9	2016.4
Hydro and nuclear (TWh)	227.8	435.1	544.1	682.0
Growth rates: hydro and nuclear	20.8%	29.4%	31.5%	33.8%
Growth rates from 2000 levels: total primary energy supply	-	35.5%	58.1%	84.5%
Growth rates from 2000 levels: hydro and nuclear	-	91%	138.8%	199.4%

Table 5: China's projected supply of primary energy. Source: Dore and Yu, 2004.

According to Pamlin and Baijin (2007:10), one of the key drivers for China's FDI is precisely because of a demand for natural resources. The following data exemplifies this: 'average annual outward FDI flows grew from $450 million in the 1980s to $2.3 billion in the 1990s, and outward FDI stock was estimated at $37 billion by the end of 2003.' From 2000 to 2005, China's FDI grew on average by 65.6% per year. During the same time frame, Chinese companies launched 28 overseas mergers and acquisitions in the mining and energy industries with an average deal value of US$ 280 million (Pamlin and Baijin, 2007). Based on these factors, China's 10th Five-Year Plan (2001-

2005) set an ambitious goal of achieving hydropower development to the tune of 125 million kW, by 2010 this should account for 28% of the country's total electricity demand and going up to 150 million kW by 2015 (Chang et al, 2009)[1]. The Eleventh Five-Year Plan (2005-2010) envisions building hydropower capacity to 300 million kW by 2020 to respond to the energy requirements of the growing economy (ibid).

From these figures, it is evident that given China's limited domestic natural resources, foreign investment in the energy sector is crucial to propel its economic development goals. China's emphasis on the Great Leap Forward and its agricultural development goals combined with rapid industrial development has resulted in its emergence as a major investor in fuelling natural resource extraction. International Rivers reports that Chinese institutions are currently involved in about 50 on-going large hydropower projects in Cambodia, Laos, Myanmar and Vietnam as contractors, investors, regulators and financiers (International Rivers, 2011). This has been accomplished by drawing on a history of dam construction that spans 45,000 large dams within China's borders, built predominantly over the last 50 years (McDonald et al., 2009).
What makes the Greater Mekong Sub-Region special and sets it apart from other world regions is that China can import electricity from these large dams. The imported electricity is increasingly being used to power booming urban areas in China. There is thus a direct link between creating hydroelectric capacity in Laos, Cambodia, Thailand, Vietnam and Myanmar and importing it as clean electricity to support the over-stretched domestic energy market. As a consequence, Laos has named itself the "battery" of Asia and aims to export a large share of its electricity to neighbouring countries like China and Thailand, rather than using it domestically. Nevertheless this is linked to rather high distribution and transmission losses associated with long-distance electricity transport.

Parts of the debate about increasing economic growth are linked to increasing the revenue Chinese SOEs and other corporations make. The 'Going Out Strategy' is geared towards expanding the markets of domestic firms overseas as they have grown out of the domestic market. This plays a role in Chinese overseas dam projects, as the Chinese hydropower capacity has already been exploited substantially, while there is significant untapped hydropower potential along the Lower Mekong River. Expanding overseas means increased revenues for Chinese firms and does not limit them to domestic markets. As aid, trade and investments are often bundled; Chinese investments in hydropower are usually linked to the export of electricity coupled with the import of Chinese manufactured goods and trade deals for Chinese firms.

Motive 2: To spare China's own rivers and avoid re-settlement
A second motive for China's investment in hydropower in the Greater Mekong-Sub

[1] This estimated figure for 2010 has to be compared with the figures provided by the International Energy Agency IEA, which indicates that only 15% of China's total electricity supply came from hydropower in 2008 (IEA, 2010). There are often discrepancies between energy planning and realisation in relation to these energy statistics. In some cases, the Chinese and the IEA's data differ to a certain degree.

Region is to spare China's own rivers and its people from the negative impacts of dams and dam-building. Large hydropower projects can have considerable social and environmental effects. Around the world, dam building has lead to the relocation of millions of people. In some cases, it has been reported that affected people were relocated to areas without appropriate infrastructure and lacking basic amenities such as sanitary facilities, drinking water, electricity and roads like at Tarbela (Pakistan) and Tucuruí (Brazil) (WCD, 2000a and 2000b). In other cases, and most notably in China, people were relocated from rural areas to modern cities where they had improved access to infrastructure and modern amenities, but lost their rural livelihoods. The Chinese Three Georges Dam included the flooding of 13 cities, 140 towns and 1,350 villages and the flooding of numerous sites of cultural, historic and religious heritage. At the Three Gorges Dam 1.3 million inhabitants were relocated, many of them from rural areas to the cities (DTK, 2002; International Rivers, 2008a). It has been reported that many subsistence farmers and fishermen were relocated to urban areas, or they received tiny slots of barren land as compensation. As a result, many people were worse off after the resettlement than before due to loss of livelihoods, rises in unemployment, decreased income and not sufficient land for subsistence farming. Scientific studies suggest that the resettlement process and the loss of cultural and social roots at the Three Gorges Dam resulted in mental stress and in an increase of depression among the resettled population (Hwang et al., 2007). Other key social problems regarding relocations are the following: compensation payments are often too low for a decent living, relocation of the local population often results in loss of livelihoods such as fisheries or subsistence farming and compensation payments are not equally well distributed which means that some people do not receive any compensation at all or only years after their relocation. There is also an issue with higher than expected construction costs due to bribery, excessive bureaucracy and corrupt local elites, such as has been suggested for the Three Georges Dam (International Rivers 2008). There are reports that at least 349 local officials were found guilty of corruption at the Three Georges Dam (International Rivers 2008; Hwang et al, 2007). More detailed discussions about the social ramifications follow in the impacts section below.

There are high environmental implications associated with large hydropower projects, of both positive and negative nature. The main environmental benefit is the production of low carbon electricity which is a competitive alternative to fossil fuels. Another main reason for the construction of hydropower plants is often flood control, although evidence from the Three Gorges Dam shows that the possibilities for flood control are limited (Hayashi et al., 2008). Increased possibilities for irrigation and agricultural productivity are reported to be one of the main environmental benefits of large hydropower projects (Goh, 2004; Dore and Xiaogang, 2004).
Observed negative environmental impacts include increased erosion, increased sedimentation rates, increased frequency of landslides, changes in water flows, destruction of flora and fauna, ecosystem changes, geomorphologic changes, decreases in water quality partly due to increased inflows of pesticides and industrial waste waters, increased eutrophication and most importantly changes in fish and shrimp productivity. A

very serious environmental impact is reported to be reservoir-induced seismicity which is likely to trigger earthquakes. This is assumed to be problematic for the Three Gorges Dam which is built on two major tectonic fault lines (International Rivers, 2008a, International Rivers, 2009b, DTK, 2002). More detailed discussions about the environmental ramifications follow in the impacts section below.

Considering these high social and environmental impacts, it seems understandable that China is interested in investing in large hydropower projects outside of its own national boundaries. Investing in large hydropower projects in Cambodia, Laos, Myanmar, Vietnam and Thailand enables Chinese corporations such as Sinohydro to make profits, to import cheap low carbon electricity to China's booming cities, and at the same time to spare Chinese rivers and its populations from considerable adverse effects.

After the experience of the Three Georges Dam, some large hydropower projects have been stopped in China due to domestic and international opposition. A case in point is the planned hydropower development in the Tiger Leaping Gorge, which is one of China's most scenic and famous gorges. The dam building was halted due to economic, cultural, social and environmental considerations. The dam building would have meant that large numbers of people would have lost their land and had to be resettled, a scenic tourist attraction would have disappeared which would have had high economic impacts and cultural and natural heritage would have been destroyed – similar to the Three Georges Dam. Nevertheless the Chinese government put these plans on hold and suggested it had to learn from its mistakes made during the construction of other hydropower dams (International Rivers, 2008b). Since the Tiger Leaping George was recently awarded UNESCO World Cultural Heritage Status, dam plans were further put on hold. Instead, China rather invests in overseas dams, such as in the Greater Mekong Sub-Region. This serves the dual benefit of transporting cheap hydroelectricity from the Greater Mekong Sub-Region to China and of causing negative social and environmental impacts overseas rather than at home.

Motive 3: To foster regional cooperation among neighbouring countries

A fourth motive for China's investment in hydropower in the Greater Mekong-Sub Region is the promotion of regional cooperation with its neighbouring countries. There are three key trans-national bodies which have been created to foster regional cooperation among the countries in the Greater Mekong Sub-Region, of which China is a member. These three bodies are the Greater Mekong Sub-Region Cooperation Program (GMS Program), the ASEAN-Mekong Basin Development Cooperation (AMBDC) and the Mekong River Commission (MRC).

The GMS Program was created with assistance from the Asian Development Bank in 1992 and has the aim of promoting sub-regional economic cooperation. It particularly aims to promote economic relations among China, Cambodia, Laos, Myanmar, Thailand and Vietnam in the areas of agriculture, energy, environment, human resource development, investment, telecommunications, tourism, transport infrastructure, and transport and trade facilitation (ADB, 2011).

The AMBDC was established in Kuala Lumpur in 1996. It aims to promote development cooperation for the Mekong basin countries. Its key development priorities are basic infrastructure, investment and trade, agriculture, natural resource development, industry, human resources and science and technology. 10 ASEAN countries are involved as well as China, Japan, and Korea (ASEAN, 2009).
China is also a cooperating partner of the Mekong River Commission. The original countries of the Mekong River Commission, which was established in 1995, are Cambodia, Laos, Thailand and Vietnam. China and Myanmar joined the Mekong River Commission later. The key goal of the MRC is to achieve sustainable development and poverty alleviation for the Mekong Basin and to enable peaceful cooperation of its riparian countries (MRC, 2011).
These examples highlight the great value that China attaches to regional cooperation among its neighbouring countries in the Greater Mekong Sub-Region.

The motives behind China's aim for regional economic cooperation can be linked to its trade ties, its diplomatic links, the interdependency this creates for Chinese imports and exports to China, and the influence Chinese institutions have on political, environmental and social practices. This creates **1** long term diplomatic relations and increased bi-lateral cooperation at the national level and **2** increased influence at other governance levels such as at the multilateral and international level.

Similar to its African counterparts, Southeast Asian countries have benefitted from China's approach to 'economic rights' and 'rights of subsistence' as the priorities of developing nations. By practising a policy of non-interference in Southeast Asian politics and a 'no strings attached' policy in the dispensation of aid, China presents itself as an alternative to the West which gives aid based on non-negotiable demands. Thus, while this provides Southeast Asian countries with a certain measure of leverage in dealing with the West, it raises a number of ethical considerations. This includes China's support of authoritarian regimes like the government in Myanmar. Nevertheless, China's overseas policies are viewed as a welcome change from those imposed by Western countries (Aguilar and Goldstein, 2009:1557), and are helping China to gain diplomatic support to defend its international interests. This is not only mutually beneficial in terms of aid, but also in terms of investments and trade, as China is one of the largest trade and investments partners of the countries in the Greater Mekong Sub-Region. Due to its close economic and diplomatic ties with Southeast Asia, China in turn is increasing its influence in forums like the World Trade Organisation (WTO), G20, the UN Security Council and the United Nation's Framework Convention on Climate Change (UNFCCC).

Motive 4: To use low carbon energy for climate change mitigation
In addition to securing its energy needs, hydropower also presents an opportunity to tap into what is viewed as low carbon energy. China has one of the world's largest hydropower resources and currently generates about 17% of its total electricity supply

from hydropower (IEA, 2012)[2]. Massive hydropower dams such as the Three George's Dam make a substantial contribution to China's low carbon energy and its move towards sustainable development and a low carbon economy to mitigate climate change. China is a forerunner in developing large hydropower projects and it is often suggested that other countries should follow its example for mitigating climate change. It also has to be considered that while China's economic growth is rapid; its per capita energy resources are relatively small. According to China Economic Net (2004, cited in Pamlin and Baijin, 2007:25):

> [T]he per capita area of arable land in [China] is only one fifth of the world average, the level of per capita water resources is one fourth of the world average, and that of forest is one seventh of the world average. The per capita reserves of key mineral resources that support the growth of the national economy like petroleum, natural gas and coal in China are only 11%, 45% and 79% of the world average[3].

In this context, extracting natural resources and gaining access to energy resources is not only crucial, but its sustainable acquisition is of importance. The development of hydropower as a renewable energy source thus also addresses environmental concerns of rising CO_2 emissions, rising air pollution and fossil fuel resource depletion while providing low carbon energy to support the economic boom (Chang et al., 2009).
One might wonder why China would be interested in investing in low carbon energy overseas rather than within its own borders. One reason is that the electricity from the hydropower dams in the Greater Mekong Sub-Region is being exported to China. This in turn has positive impacts on China's carbon emissions from electricity consumption. Due to international pressure at the climate change negotiations of the UNFCCC, China has ambitious Nationally Appropriate Mitigation Actions (NAMAs) in place to reduce its carbon intensity by 40-45% by 2020 in comparison to 2005 (carbon reduction in relation to GDP) (UNFCCC, 2010). The 12th Five Year Plan for the period 2011-2015 has strengthened these targets. Even though the hydroelectric imports from the Greater Mekong Sub-Region are small in comparison to the total electricity consumption in China, they play an important role for enabling China to reduce its emissions externally. These imports could be interpreted as serving similar means as the carbon offsetting of the Clean Development Mechanism CDM that developed countries engage with in developing countries – nevertheless without the official carbon trading stamp.

4.2 Actors, beneficiaries and impacts

[2] This figure for 2009 has to be compared with the figures provided by Chang et al. (2009), which indicate that about 28% of China's total electricity supply is expected to come from hydropower in 2010 (IEA, 2010). There are often discrepancies between energy planning and realisation in relation to these energy statistics. In some cases, the Chinese and the IEA's data differ to a certain degree.
[3] These figures are calculated by dividing the total amount of natural resources available in each country and globally by the number of people per country and globally.

This section applies the Rising Powers framework by assessing the actors, beneficiaries and the direct and indirect impacts of Chinese investments in dams in the Greater Mekong Sub-Region.

Actors: The number of Chinese actors involved in tapping into overseas hydropower development presents an increasingly complex picture. SOEs in China are becoming major players in extracting resources in riparian states along the Mekong like Cambodia, Laos and Vietnam. For instance, the Chinese Export–Import Bank and other Chinese financial institutions, state-owned enterprises, and private firms were involved in at least 93 major dam projects overseas in 2009 (McDonald et al., 2009). As McNally et al. (2009:290) highlight, this involvement cuts across many levels: 'national level power companies and their provincial subsidiaries, regional power grids, supra-regional yet sub-Ministerial basin (watershed) commissions, governmental units and legally-grounded citizen groups'. Adding to the complexity of this grid are linkages between resource providers in Western China and Eastern China where the majority of load centres are located. Key actors include SOEs like the China National Water Resources and Hydropower Engineering corporation (Sinohydro), China Gezhouba Group Corporation (Gezhouba) and the China Southern Power Grid (CSG); financiers like China Exim Bank, Sinosure, China Development Bank and Bank of China; regulators like the State-Owned Asset Supervision and Administrative Commission (SASAC), Ministry of Environmental Protection (MEP), Ministry of Commerce (MOFCOM), Ministry of Finance (MoF), Ministry of Foreign Affairs (MoFA), National Development and Reform Commission (NDRC) and others. Table 6 shows the different key actors investing in dams in the Greater Mekong Sub-Region and their roles. Nevertheless, table 4 above indicated that many companies play different roles for different projects. For example, Sinohydro acts as a developer, builder and contractor depending on the project.

State-Owned Enterprises (SOE)	**Private Enterprises**	**Regulators**	**Financiers**
Sinohydro	China Gezhouba Group Corporation (Gezhouba)	State Council	ExIm Bank
China Southern Power Grid Company	Other private firms	State-Owned Assets Supervision and Administration Commission (SASAC)	China Export and Credit insurance Corporation (Sinosure)
China International Water and Electric Corporation	Regional power grid companies and resource providers in Eastern China	Ministry of Commerce (MOFCOM)	Other banks like China Development Bank (CBD)
China National Heavy Machinery Corporation		Ministry of Finance	

Other national power companies and their provincial subsidiaries		Ministry of Foreign Affairs	
Regional power grid companies and resource providers in Eastern China		National Development and Reform Commission (NDRC)	

Table 6: Chinese actors involved in dam-building in the Greater Mekong Sub-Region and their roles. Sources: McNally et al., 2009; McDonald et al., 2009, International Rivers, 2008. Please note that this list is not exhaustive and only names the major players.

To grasp the complexity of the main players involved in hydropower development, it is vital to study the origins of these actors. With regard to the construction of dams, the main actors are five electric power companies that emerged from the former State Power Corporation of China which in turn were established from the former Ministry of Electric Power. While these corporations have been designated as privatised stock companies and listed in the stock exchange, the central government of China continues to maintain a supervising interest in their activities (McNally et al, 2009).

The largest hydropower dam building company in China is the SOE Sinohydro Corporation which is subject to the rules and regulations of SASAC (International Rivers, 2008). Sinohydro was involved in an estimated 42 overseas dam projects in 2009 and in addition to construction, also invests in projects. For instance, it is providing 27% of the project capital for the Nam Ngum dam in Laos (McDonald et al, 2009).

Another major player is the China Southern Power Grid company, a provincial-level SOE, which was set up in 2002 to reform the power system. The Sambor Dam on the mainstream of the Mekong River in Cambodia is one of the projects in its portfolio (McDonald et al, 2009). Others like China International Water and Electric Corporation, which is involved in Malaysia, Albania, Burma, Laos and Pakistan, and China National Heavy Machinery Corporation, which has a number of projects in Myanmar, Cambodia, and Vietnam, add to the complex web of actors participating in China's drive to dam rivers (International Rivers, 2011).

In addition to the above mentioned construction companies, financial institutions like China Exim Bank and China Export and Credit Insurance Corporation (Sinosure) also have a significant interest in hydropower development and are involved in the majority of China's overseas investments (Heinrich Böll Stiftung, 2008). ExIm Bank for example is involved in the construction of the Kamchay Dam on the Mekong River in Cambodia, and serves as the official export credit agency of the Chinese government. Data reveals that in 2005, China Exim Bank approved loans to the value of RMB 158.6 billion (approximately US$ 20 billion) (Pamlin and Baijin, 2007). Supporting its activities, Sinosure promotes Chinese foreign investments through the issuance of export credit insurance. An estimated 60% of its medium and long-term loan activity is for China Exim Bank transactions (McDonald et al, 2009). In addition to these large stakeholders, a

number of non-state enterprises like China Gezhouba Group Corporation (Gezhouba) participate in hydropower development and are involved in building and financing projects in over 30 countries in Asia and Africa, such as the Yeywa Dam in central Myanmar (McDonald et al, 2009).
As highlighted above, the sheer number of players at every level of jurisdiction raises questions about accountability, transparency and sustainability in addressing the impact of these developments on the lives and livelihoods of affected people and the environment.

Beneficiaries: Reasons for concern are increasing disparities in the benefits accrued from hydropower. For instance, electricity generated in Western China and along the Mekong River is exported to urban and industrial load centres in coastal and Eastern regions to support economic activity (McNally et al, 2009). Rural electrification thus often remains on the back seat. In Laos, for example, only 8% of rural households were connected to the electricity grid in the early 2000s, compared to over 60% in the capital Vientiane. Lack of electricity in rural areas contributes to poverty and with more than half of the population living below poverty line, rural poverty in Laos is twice that in urban areas. There is currently little evidence that investments in hydropower in Laos will increase access to electricity for Laos' poor (Yu, 2003). In terms of regional disparity in power trade, a growing concern is that some countries will bear the costs of generating energy, but the benefits will accrue elsewhere, mainly for the benefit of large corporations.

Direct positive impacts: China is the world's largest hydropower developer. Chinese dam-builders tend to invest in countries and regions where the World Bank, the Asian Development Bank and other multilateral organisations have often stopped hydropower developments, such as in Myanmar, Borneo and Sudan. It thereby offers opportunities for bringing infrastructure, resources and investments to poor and deprived countries. This further has positive effects for local employment opportunities. It also offers possibilities for increasing access to electricity in these countries. The governments of Mekong countries such as Laos view hydropower development as a tool to alleviate poverty, achieve the Millennium Development Goals and accelerate economic growth. Jönsson (2009:202) adds that Laos is looking to become the 'battery of the region by increasing its production capacity to 30,000 MW from the current capacity of 670 MW.' Laos aims to build several new large hydropower plants planned over the coming years with investors from Laos, China, Thailand, France (Jönsson, 2009). Nevertheless distribution and sustainability of the benefits is an issue which bears responsibilities for host countries and Chinese dam-builders.
In addition, the overseas engagement in hydropower creates jobs for Chinese engineers, construction workers and other employees and it enables to create revenue for Chinese hydropower companies and investors outside of the crammed domestic market. This contributes to China's economic growth and employment opportunities.

Indirect positive impacts: Hydropower is climate-friendly low carbon energy which uses abundant water resources for producing electricity and powering economic growth. It has a large abatement potential when it comes to greenhouse gas emissions and is a powerful option to mitigate global climate change. Therefore, hydropower is being hailed by many as one of the answers to China's growing energy demand while simultaneously keeping greenhouse gas emissions low. Hydropower offers an opportunity to reduce China's high dependence on coal and other fossil fuels and thereby mitigate climate change, reduce air pollution, safeguard finite fossil fuel resources and enable sustainable development.

Yet, large hydropower has also been criticised on a number of counts. The reasoning that large hydropower is being particularly climate-friendly is being questioned on the basis that deeper water and slower flowing speeds will result in an increase in methane and CO_2 emissions (Chang et al, 2009), particularly from large reservoirs. Some argue that reservoirs are major sources of greenhouse gas emissions, mainly methane and nitrous oxide due to bacterial decomposition of organic material underwater and greenhouse emissions from the production phase of hydropower dams (Fearnside, 2002. Rosa et al, 2004, Ruiz-Suarez et al., 2003).

However, most studies agree that hydropower plants produces less greenhouse gas emissions during their lifetime than fossil fuel plants, namely at least 10 times less and that greenhouse gas emissions from hydropower are comparable to those of other renewable energy technology. China has also huge amounts of small hydropower plants which contribute only marginally to greenhouse gas emissions and provide a way of increasing agricultural productivity and enabling rural electrification for China's rural areas.

Other indirect positive effects are increased cooperation between China and the countries of the Greater Mekong Sub-Region, which results in enhanced economic and political opportunities. Increased investments on the Chinese side often comes alongside increased trade and aid flows, which are crucial for poor countries such as Myanmar, Laos and Cambodia, while increased trade flows are particularly relevant for Vietnam and Thailand.

Direct negative impacts: In addition to the environmental impact, hydropower development on the Mekong also has a number of direct social ramifications. According to Adams (2000:vi), the social impacts of dams can be defined as 'impacts on the lives of individual people or groups or categories of people, or forms of social organisation.' Tilt et al. (2009:250) add that:

> Social impact assessment is the process of analyzing (predicting, evaluating and reflecting) and managing the intended and unintended consequences on the human environment of planned interventions (policies, programs, plans, projects) and any social change processes invoked by these interventions so as to bring about a more sustainable and equitable biophysical and human environment.

The main debates revolve around whether positive outcomes in terms of economic development outweigh the costs, the spatial distribution of the benefits and the impact on vulnerable groups like indigenous people, women and reservoir evacuees (Adams, 2000). This presents a complex web of analysis as impacts are both positive and negative and even within communities, significant disparities occur along gender lines, which often go unseen in impact assessments of large dams. With regard to the immediate social impacts of large scale dam construction, the main issues are as follows: inappropriate resettlement, alterations in the lifestyle of people, the lowering of the standard of living, disregard for local people's rights, identity and culture, and taking land and other natural resource tenure away from local people (Yu, 2003). The trauma of resettlement is one of the biggest issues communities have to grapple with. Loss of landholdings, insufficient compensation and cultural costs compounded with resettlement efforts that lower the standard of living of communities is one of the immediate impacts (Adams, 2000).

Indirect negative impacts: Large hydropower development plans of the regionally prevailing China however have to be viewed in the context of its downstream impact on riparian states. Points of contention have been raised with regard to demands to protect fisheries, agriculture and shipping (McNally et al., 2009). Further, changes in aquatic life because of inundation and its subsequent impact on fisheries have not been sufficiently studied (Chang et al, 2009). In the Lower Mekong, fisheries are a vital livelihoods source for an estimated 12 million rural households (Dore and Yu, 2004). According to current estimates,

> 2 million tonnes are harvested each year from the Lancang/Mekong fishery – 1.75 million tonnes from the 'capture fisheries' valued at USD 1.45 billion, plus another 250,000 tonnes from aquaculture (Dore and Yu, 2004:23)

Goh (2004) adds that changes in the ecosystem such as higher water levels in the dry season and lower water levels in the wet season in Laos and Cambodia's flooded mangrove forests will significantly lower the spawning ground for migratory fish. This in turn will affect productivity in wild-capture fisheries and affect the lifestyle of people in the region for whom fish makes up 80% of animal protein in their diet (Goh, 2004). One example where studies have been conducted to understand potential impacts of dams on the Lancang is the Tonle Sap Great Lake in Cambodia, a vital ecological system supporting fisheries in the region, and rice cultivation in southern Vietnam (Dore and Xiaogang). Another case in point is the proposed construction of the Don Shaong Hydropower project on the Lower Mekong River, which would block the main channel for fish migrating for Cambodia, Laos, and Thailand (Jönsson, 2009).

Another environmental issue that stems from water impoundment is the increased risk of landslides and earthquakes caused by the sheer weight of water and its possible seepage into fault lines. An example is the Manwan dam where a landslide of 150,000 cubic metres of soil occurred during its construction. Further, the Xiaowan dam is also proposed close to a designated earthquake prone zone (Goh, 2004). Another result of

water inundation can be severe changes in aquatic life because of eutrophication, a process where excessive plant growth occurs due to an increase in nutrients (Chang et al., 2009).

Sedimentation, nutrient deposit and flow regulation are other aspects which affect the ecological biodiversity and consequently the livelihoods of people living in this region. During the wet season, floods deposit nutrients in flood plains where rice cultivation takes place, which is crucial for soil fertility. In fact, 80% of Cambodia's rice cultivation is dependent on this flooding (Goh, 2004). The construction of dams on the Lancang will lower seasonal flows downstream and give rise to the need for artificial fertilisation. Additionally, higher dry seasonal flow will affect truck gardening, a form of supplementary agriculture practiced in the Mekong. Dry season flows may increase downstream by up to 90% at Chiang Saen, 80% in Luang Prabang, 70% in Vientiane and more than 1600 km from the cascade, 40% at Mukdahan (Dore and Xiaogang, 2004). Other negative impacts could result from the trapping of large amounts of sediment by these dams causing downstream erosion (Goh, 2004).

The Manwan dam on the upper Mekong is such a case. Tilt et al. (2009) have conducted an analysis of the impact of this dam on the rural economy, transportation, housing, health and gender of rural areas near the Manwan. Findings reveal that prior to dam construction in 1991, per-capita farmland ranged from 0.067–0.129 ha, with an average holding of 0.118 ha per capita. Post the 1996 construction of Manwan dam, this fell to an average holding of 0.08 ha. In addition, inundation resulted in a decline in the yield of rice and corresponding shift to other dryland crops such as maize and sugar cane. Livestock and animal husbandry were also affected by the flooding of forage lands. Studies also show that there has been a decline in economic productivity in these areas (Tilt et al., 2009).

> According to surveys conducted by the Statistics Bureau of Yunnan Province on the rural economy of the province, per-capita income of Manwan resettlers in 1991 (before the valley was flooded) was 6.7% higher than the provincial average. By 1997, (after the valley was flooded), findings from our general survey on the livelihood of resettlers indicated that per-capita income in the reservoir region was only 46.7% of the provincial average (Tilt et al., 2009: 254).

Meeting heating and cooking needs in resettled villages like Hongyan, has also proven challenging with the task falling to women to walk three to four kilometres in search of firewood. With the reallocation of land and dispensation of compensation primarily given to the male head of the household, women have been further marginalised. This is also reflected in skewed gender ratios in schools (Tilt et al., 2009).

To address these concerns and criticism from the international community, China passed an Environmental Impact Assessment (EIA) Law. According to this, companies proposing projects have to conduct an environmental impact assessment prior to project construction, which will then have to be approved at the appropriate environment bureau (McDonald et al., 2009). Yet, the potential of EIA to address the above mentioned issues is limited by having 'no requirement that EIA's be completed for policy or legislation [and]

no provision for requiring that unavoidable impacts be mitigated by project developers' (ibid). Transboundary Environment Assessment (EA) protocols and the UN Convention on the Law of the Non-Navigational Uses of International Watercourses have not had an impact as yet on fostering cooperation or dialogue between riparian states to address these environmental ramifications of hydropower development (Dore and Xiaogang, 2004). A major factor behind this is that not only is China the uppermost riparian state, but it is also the most politically powerful, has the fastest economic growth and remains relatively unfettered by the Mekong River Commission. Power relations between riparian states thus have a significant role to play in key decision making.

5. Discussion and Conclusion

To summarise, Chinese institutions are currently involved in about 50 on-going large hydropower projects of more than 50MW in Cambodia, Laos, Myanmar and Vietnam, as well as in five smaller hydropower projects in Thailand, as contractors, investors, regulators and financiers (International Rivers, 2011). This paper aimed to close some of the current knowledge gaps by assessing in more detail who is engaged in Chinese large hydropower projects along the Mekong River, why, how and with what impacts. The paper therefore assessed the motives, actors, beneficiaries and the direct and indirect impacts of China's investments in large hydropower projects in the Greater Mekong Sub-Region using the 'Rising Powers Framework'. In conclusion, this paper has elaborated how Chinese institutions invest in large hydropower projects in Southeast Asia due to four key motives:

1. Due to limited domestic resources and to increase energy security, fuel economic growth and development.
2. To spare China's own rivers and avoid resettlement.
3. To foster regional cooperation among neighbouring countries.
4. To use low carbon energy for climate change mitigation.

China's growing hydropower investments are in part motivated by its energy needs for being able to remain the 'factory of the world' as well as to build visible signs of economic cooperation between China and other developing countries in South East Asia. In this respect, the development of the Mekong is serving as a tool for regional power relations and the development of an infrastructural network between China and its neighbours. Energy security and strategic interests are thus the prime motivations for this investment. In addition, the globalisation of the hydropower industry is being embraced both for creating overseas jobs and for providing the infrastructure for larger resource extraction projects (Bosshard, 2009). China is currently building 19 of the world's 24 largest hydropower stations, and power generation equipment is now China's second-largest export earner after electrical appliances (Bosshard, 2009).

While the development of water resources for long-term economic development is also a motivation for the countries of South East Asia to construct dams, it is important to view this in the context of the existing power disparities between China and countries along

the Lower Mekong. In Cambodia, for example, China is a donor, investor in infrastructure projects like roads and bridges as well as a trading partner (Goh, 2004). Dams are often part of aid packages that China is providing to foreign governments, a method that has been adopted by countries like Japan or Korea in the past. This creates complications for affected countries in expressing concerns over the ecological and social impacts of the construction of dams along the Mekong River. Despite these adverse effects, hydropower can be environmentally beneficial as it mitigates high amounts of greenhouse gas emissions and is thereby a climate-friendly form of energy. This can replace significant amounts of coal and thereby contribute to a better climate, reduced air pollution and reduced fossil fuel resource depletion. This could contribute to sustainable development in China, whereas its sustainability in the electricity-exporting countries could be questioned due to significant environmental and social impacts of dams and unequal distribution of benefits.

On another note, Chinese companies are conducting feasibility studies for dams and simultaneously serving as financiers, builders and regulators of hydropower projects resulting in a blurring of lines between these spaces. The sheer number of public and private actors involved in the hydropower industry also raises transparency and accountability issues due to the multiplicity of players involved. While the Chinese government has provided guidelines to protect the interests of local employees and maintain environmental standards, often these guidelines are only partly effective as Chinese enterprises operate at a distance from the government, particularly when these norms are in conflict with private interests (Bosshard, 2009). Often the implementation of these social and environmental guidelines depends as much on the host country as the Chinese institutions involved.

However, over the past few years, China's environmental laws have been strengthened with the introduction of improved EIAs which call for public participation and the approval of the Ministry of Environmental Protection (International Rivers, 2008). In addition, laws have also been instituted on the displacement of people, thus including provisions for livelihood resettlement at a level similar to or greater than that of the displaced people. While this law currently pertains to dams within China's borders, it can be used as a guideline for overseas projects as well. With respect to overseas projects, Nine Principles Governing the Activities of Foreign Investment Firms were issued in 2006 by China's State Council which calls for mutual respect, complying with local laws and protecting environmental resources (International Rivers, 2008). However, Sinohydro, China's largest dam building SOE, does not have an environmental policy while China Southern Power Grid, another major hydropower company, has only a very general policy document. The question that persists is whether the new national laws will be applied to overseas projects in the future and will thereby ease some of the ramifications for people dependent on the Mekong and its environment.

Finally, China offers opportunities for access to energy, infrastructure and investments for poor countries such as Myanmar, Cambodia and Laos. It often operates in areas that

have been abandoned by the World Bank and other multilateral organisations. It thereby offers an opportunity for poor and deprived countries that goes beyond what Western donors can offer them – however this comes with both positive and negative implications. While investments in hydropower in the Greater Mekong Sub-Region offer opportunities for sustainable development in China due to access to cheap low carbon electricity, domestic environmental protection, economic growth and increased firm competitiveness, the environmental, social and economic implications of Chinese hydropower investments are far more varied for the countries of the Greater Mekong Sub-Region.

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