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ECONOMIC EVALUATION OF HYDROPOWER PROJECTS IN THE LOWER MEKONG BASIN

INTRODUCTION

This brief summarises the key findings of an Economic Evaluation of Hydropower Projects in the Lower Mekong Basin (LMB) recently carried out by Natural Resources and Environmental Management Research and Training Center (NREM), Mae Fah Luang University, Chiang Rai, Thailand (Intralawan, Wood, and Frankel 2017). There are eleven dams planned for the Lower Mekong mainstream (see Figure 1). Xayaburi and Don Sahong are under construction, and a third, Pak Beng Dam, is expected to begin construction in 2017.

Commonly cited economic benefits of Lower Mekong mainstream dams include electricity for export, primarily to Thailand and Vietnam, and revenue for Lao PDR to develop the country and raise living standards. However, our study finds that project justifications seem to have ignored or underestimated the economic costs of environmental and social impacts such as capture fisheries loss and reduction in sediment/ nutrients and overestimated the economic benefits from hydropower. By changing and updating some of the economic assumptions and values, we find that the overall economic impact of planned Mekong hydropower projects would be negative.

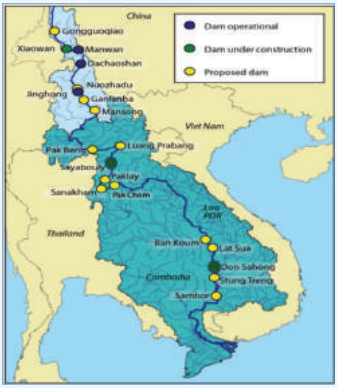

Figure 1. Location of constructed/ planned hydropower projects in the Mekong Basin

KEY MESSAGES

The overall economic impact of planned Mekong hydropower projects would be negative.

The negative economic impact is mainly due to the economic value of capture fisheries loss being much larger than benefits from hydropower.

Social mitigation costs and loss of sediment/nutrients also have a significant economic impact.

The economic impact on Lao PDR and Thailand is forecast to be positive, with Thailand being the main beneficiary. Vietnam and Cambodia are forecast to suffer large negative economic impacts.

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http://bit.ly/2obdY7f

METHODS AND ASSUMPTIONS

Our study (hereafter referred to as NREM Update) evaluates the 'eleven dams scenario' which comprises the 11 Lower Mekong mainstream dams (nine in Lao PDR, and two in Cambodia) plus 30 dams planned for the tributaries; the total capital investment is approximately US$50 billion (see Table 1).

This scenario was chosen because it is consistent – and allows comparison – with Mekong River Commission's (MRC) "Assessment of Basin-wide Development Scenarios – Basin Development Programme, Phase 2" (hereafter referred to as BDP2) (Mekong River Commission 2011).

NREM Update evaluates the costs and benefits of planned hydropower projects in terms of Net Present Value (NPV) for a 50-year period, using 2016 prices, and applies a ten per cent discount rate which is typically used to evaluate major infrastructure projects and is the same rate applied in BDP2.

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NET PRESENT VALUE

NPV is the current value of money that will flow from a project over time minus the initial investment. The implementation of a project costs money upfront (construction) and in future (operation and maintenance costs). Also, bank loans have to be repaid and interest paid, usually spread over many years. Revenue (sales) is generated after completion of project construction. Money changes in value over time, so NPV can be used to convert costs and revenues, over the project life, into today's money.

	CAPACITY (MW)	CAPITAL INVESTMENT ($ MILLION)
Pak Beng	855	2,400
Luang Prabang	1,410	2,800
Xayaburi	1,285	3,700
Pak Lay	1,320	2,400
Sanakham	660	1,530
Pak Chom	1,080	2,700
Ban Khoum	1,870	4,400
Lat Sua	650	2,100
Don Sahong	240	720
Stung Treng	980	2,000
Sambor	2,600	4,900
Total mainstream	12,950	29,650
Tributary projects	10,100	20,600
Grand Total	23,050	50,250

Table 1: Lower Mekong Hydropower Projects – eleven dams scenario

The key assumptions used in the economic calculations are shown in Table 2. Further details are provided in the full report.

	NREM UPDATE (Economic values and assumptions)
HYDROPOWER CAPACITY	23,000 MW
CAPITAL INVESTMENT	$ 50 billion
OPERATING COST	1.5% capital investment/year
ELECTRICITY PRICE	$ 0.07/KWh
RESERVOIR FISHERIES	+ 64,000 tons/year @ $ 2.5/kg
AQUACULTURE	+ 73,000 tons/year @ $ 2.5/kg
CAPTURE FISHERIES	- 725,000 tons/year @ $ 3.5/kg
SOCIAL IMPACT COST	5% capital investment
ENVIRONMENTAL COST	3% capital investment
SEDIMENT LOSS	$ 450 million/year
COUNTRY BENEFIT SPLIT	host country 30% - developer 70%

Table 2: Economic values and assumptions applied in NREM update

RESULTS

KEY DIFFERENCES BETWEEN BDP2 AND NREM UPDATE

The BDP2 estimated that the net economic benefit of the eleven dams scenario would be US$33.4 billion. However, the NREM Update estimates that the overall economic impact will be negative, the NPV is approximately minus US$7.3 billion. Table 3 below shows the differences in the overall results of economic calculations between BDP2 and NREM Update.

	BDP2 NPV ($ MILLION)	NREM UPDATE NPV ($ MILLION)
Hydropower	32,800	6,600
Reservoir fisheries	200	800
Aquaculture	1,300	900
Capture fisheries	-1,900	-13,000
Wetlands	100	200
Social/Cultural	0	-1,600
Sediment/Nutrients	0	-2,300
Others	900	1,100
Total	33,400	-7,300

Table 3: Summary of NPV calculations for 11-dams scenario

1. **HYDROPOWER**
NREM calculation of hydropower benefits is much lower than the BDP2 figures, mainly due to BDP2 using low capital investment data, high electricity price and a different electricity trading model.

2. **CAPTURE FISHERIES**
NREM estimates of the NPV of the fisheries are much higher mainly because it assumed a fish value of US$3.5/kg compared to BDP2 which assumed $0.8/kg. The price used in NREM Update is less than recent MRC estimates which reported US$4.8/kg (Nam , et al. 2015).

3. **SOCIAL/CULTURAL IMPACTS**
BDP2 did not take into account the mitigation costs of social and cultural impacts, whereas NREM Update assumes mitigation costs to be equivalent to 5% of capital investment.

4. **SEDIMENT/NUTRIENTS**
BDP2 did not take into account economic losses associated with loss of sediments and nutrients. Drawing on data from the Mekong Delta Study (MDS) (Ministry of Natural Resources and Environment; Government of Vietnam 2015), NREM Update calculated economic costs associated with loss in sediments and nutrients. NREM figures are conservative – the MDS forecasts that decreased sediment and nutrients could reduce long-term rice production in Vietnam by 2.4 million tons/year, which is equivalent to an economic loss of approximately US$8 billion.

DISTRIBUTION OF COSTS AND BENEFITS BY COUNTRY

The distribution of costs and benefits between individual Lower Mekong Basin countries is difficult to estimate as other countries (e.g. China, France, Korea, Malaysia and Norway) are involved in project funding and operations.

BDP2 concluded that all Lower Mekong countries would benefit, with Lao PDR, where most of the dams will be built, being the largest beneficiary. NREM Update finds that while Lao PDR and Thailand still benefit, the benefit is much lower than estimated in BDP2. Cambodia and Vietnam would suffer large negative economic impacts (see Figure 2)

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CONCLUSIONS

1. **The overall economic impact of planned Mekong hydropower projects would be negative.** Using updated data and assumptions for project economics, NREM Update estimates that the NPV will be minus US$7.3 billion. This is mainly due to the economic value of capture fisheries loss being much larger than benefits from hydropower; and also the inclusion of economic costs associated with mitigating social impacts and loss of sediments and nutrients.

2. **Thailand is the main beneficiary of the planned hydropower projects and the net economic impact for Lao PDR is positive** (but much lower than forecast in BDP2). Cambodia and Vietnam would suffer large negative impacts. This is contrary to BDP2 which concluded that all LMB countries would benefit from hydropower development and that Lao PDR would be the main beneficiary.

3. **The forecast profitability of Xayaburi is modest even assuming no impact on capture fisheries and the environment.** A small percentage loss of capture fisheries caused by Xayaburi would result in a large, negative economic impact. The justification for Don Sahong is even more contentious as it is not essential for the security of Lao PDR electricity supply and the potential capture fisheries loss far exceeds the hydropower benefit. The forecast profitability of Pak Beng is also modest.

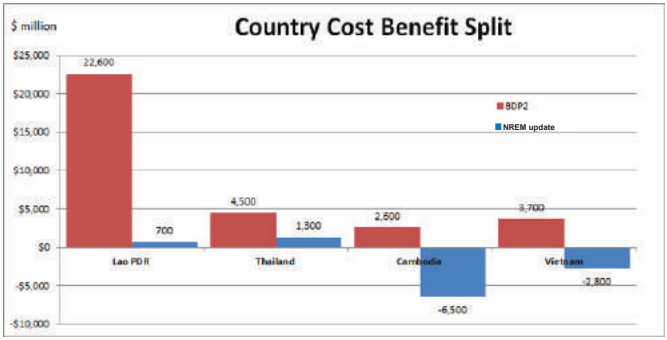

Figure 2. Costs and benefits by country: BDP 2 and NREM Update

4. **The 11 mainstream projects would provide about 8% of forecast LMB power demand (Intelligent Energy Systems Pty Ltd (IES) and Mekong Economics (MKE) 2016).** If the mainstream projects are not pursued, there would be minimal risk for electricity security in the LMB countries and the forecast electricity demand could be supplied by alternative energy sources such as solar and biomass and improved energy efficiency (Intelligent Energy Systems (IES) 2016).

RECOMMENDATIONS

The following recommendations are proposed for further consideration:

1. **Delay construction of other mainstream dams until Xayaburi is completed and the effectiveness of mitigation measures including fish passes and sediment sluice gates has been demonstrated.**
2. **Require hydropower projects to include full-cost accounting of social and environmental conservation mitigation measures in the committed capital investment.**
3. **Re-assess the net economic impacts and forecast benefits to Lao PDR based on a 'likely scenario' for mainstream hydropower projects, which have a high probability of going ahead.**
4. **Develop a new LMB energy strategy taking into account less hydropower income than previously anticipated, updated forecasts for LMB power demand and technology developments for improved energy efficiency & renewable energy.**

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