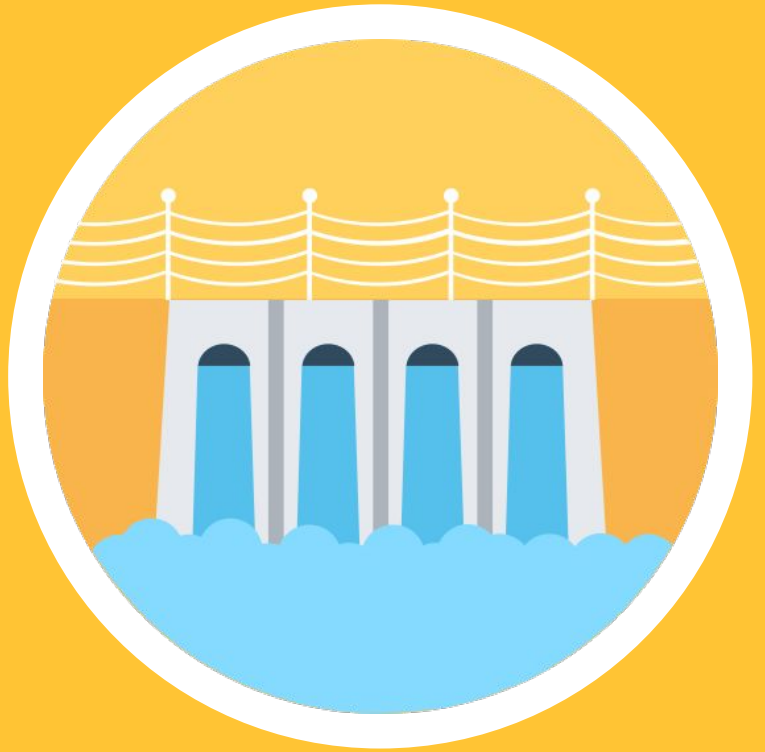
Can Hydropower Drive Sustainable Growth in Laos



Group 6

Agenda

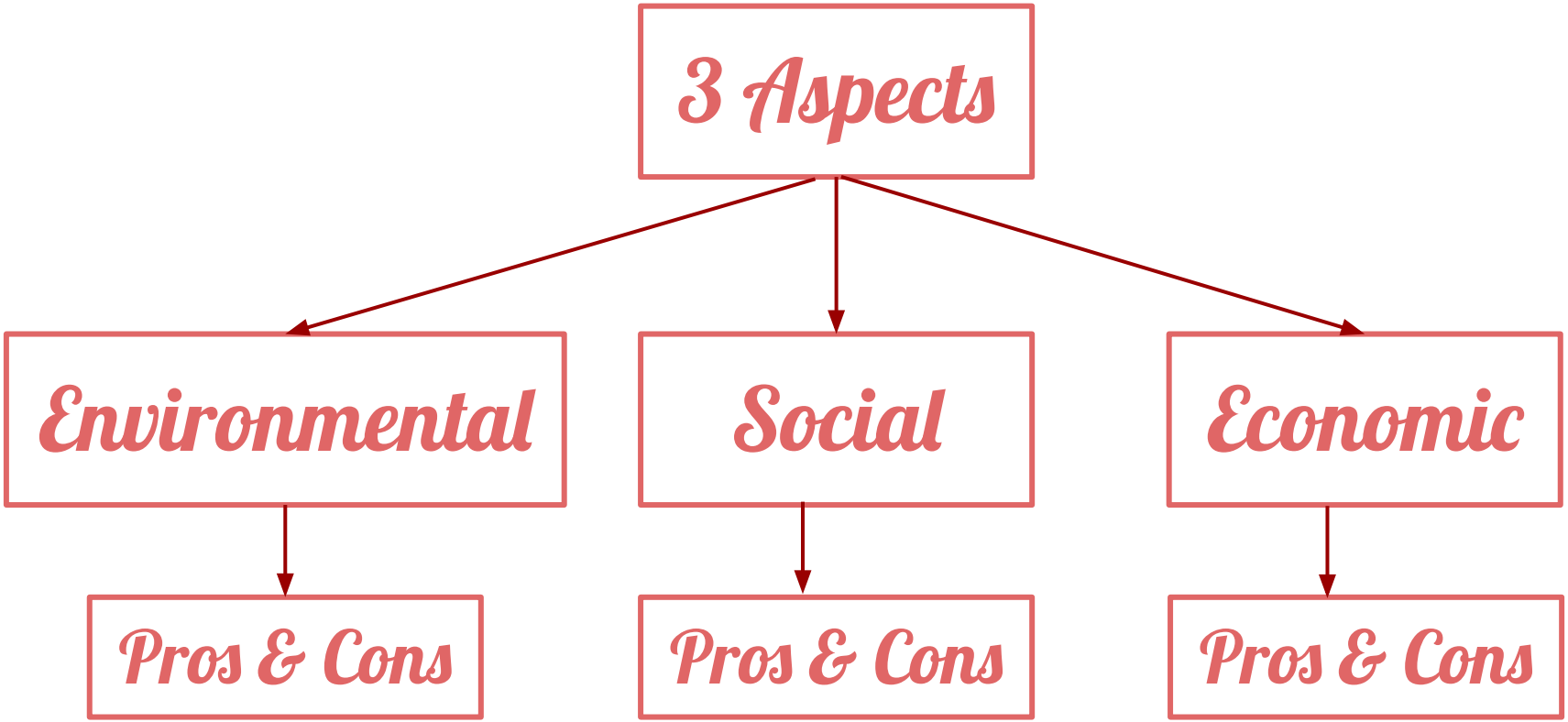
1. Introduction
2. Framework
3. Pros & Cons for 3 aspects
4. Suggestion and Conclusion

Introduction

Laos Hydropower

- Heavy investment in Hydroelectric power in Laos
- Battery of South-East Asia
- Nam Theun 2 was very successful
- Concerns about Xayaburi Dam
- Our goal

Framework


3 Aspects
Environmental
Social
Economic
Pros & Cons
Pros & Cons
Pros & Cons

Environmental Aspect

Pros

Hydropower is a renewable energy

Renewable Energy sources are better for the environment

- One of the lowest air pollution emission in the process of electricity generation

CO2 : Carbon Dioxide
SO2 : Sulfur Dioxide
NO : Nitrogen Oxide
NMVOC :Non-methane volatile organic compound

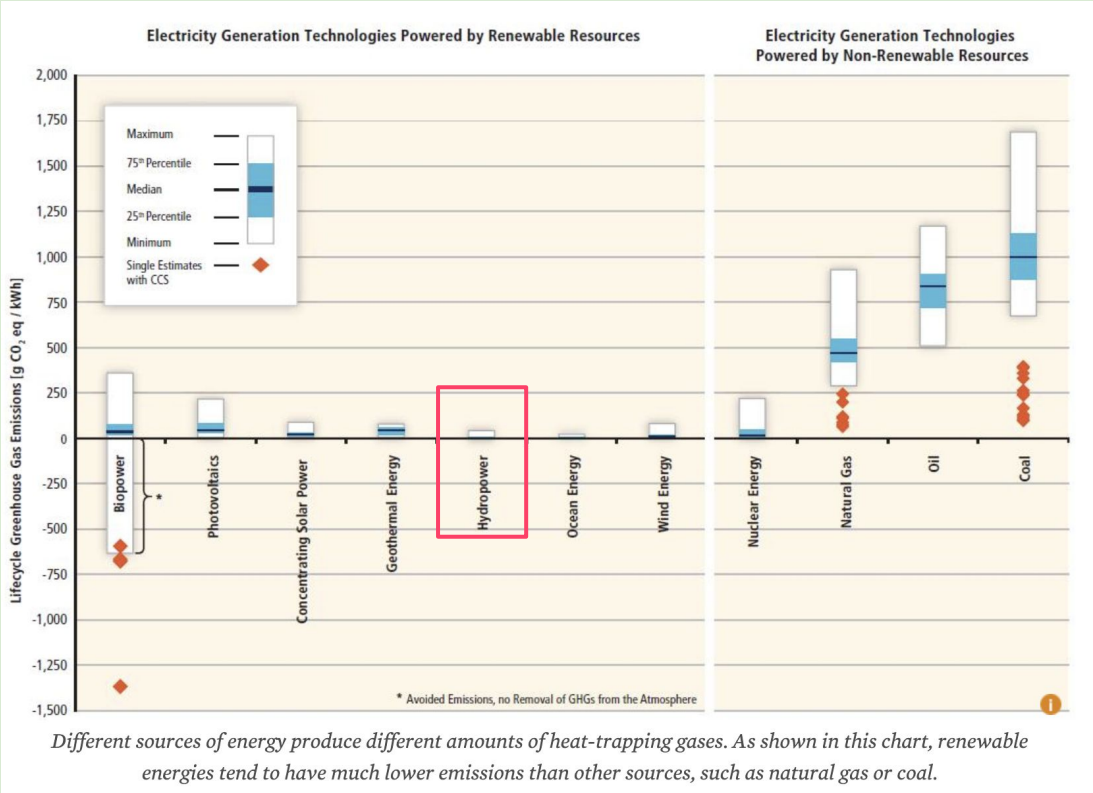
Emissions produced by 1 kWh of electricity based on life cycle analysis

Generation option	Greenhouse gas emissions gm equiv CO_2/kWh	SO_2 emissions milligram /kWh	NO_x emissions milligram /kWh	NMVOC milligram /kWh	Particulate matter milligram /kWh
Hydropower	2-48	5-60	3-42	0	5
Coal – modern plant	790-1 182	700-32 321+	700–5 273+	18-29	30-663+
Nuclear	2–59	3-50	2-100	0	2
Natural Gas (combined cycle)	389–511	4-15 000+[4]	13+-1500	72-164	1-10+
Biomass forestry waste combustion	15–101	12-140	701-1950	0	217-320
Wind	7–124	21-87	14-50	0	5-35
Solar photovoltaic	13–731	24-490	16-340	70	12-190

Source : OECD

Pros

Hydropower is a renewable energy



Different sources of energy produce different amounts of heat-trapping gases. As shown in this chart, renewable energies tend to have much lower emissions than other sources, such as natural gas or coal.

Source : https://www.nrel.gov/analysis/life-cycle-assessment.html

2nd Lowest air pollution emission in the process of electricity generation

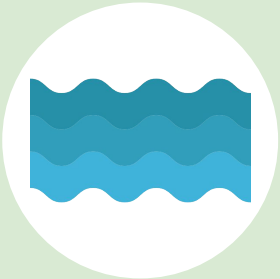
Pros

Reinvestment on environmental management program

- The Environmental Protection Law (1999) and Decree on Environment and Social Impact Assessment No.122 (2010)
- Example : The Nam Theun 2 (NT2) Nakai - Nam Theun National Biodiversity Conservation Area (NBCA)

Cons

Degradation of water quality and flow



Water Flow (Dam)

Holds back sediments

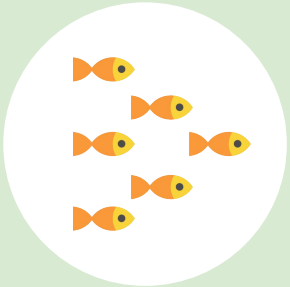
Water Pollution (Reservoir)

Oxygen Stratification
- Reduces overall oxygen content of the stream

Eutrophication
- Chemical nutrients; nitrogen, phosphorus
- Algae explosion
- Water quality suffers

Thermal Pollution
- Top layers closest to the sun
- Drastic temperature change

Cons Harmful to habitats



Fishes are unable to migrate

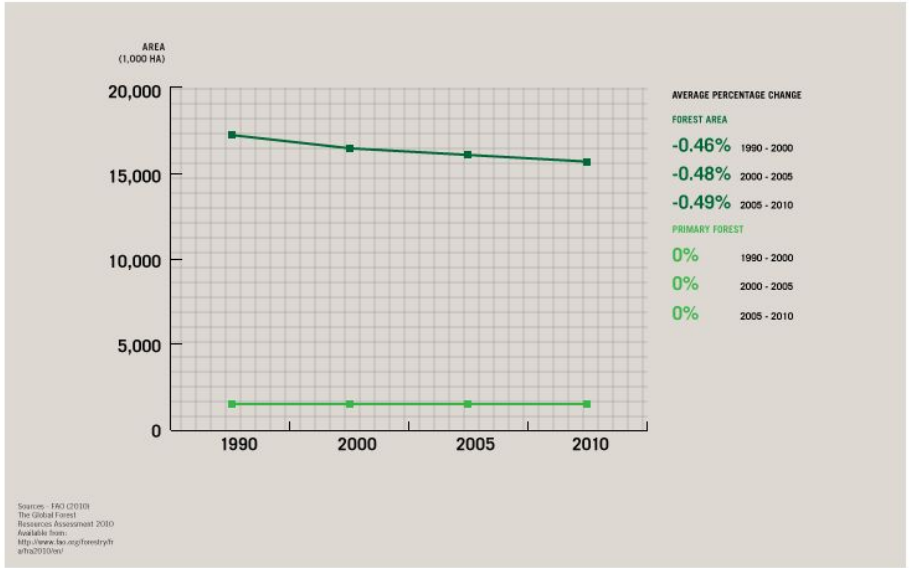
Dam turbines kill fishes

High voltage powerline kills birds

Loss of forest and wetland (road construction)

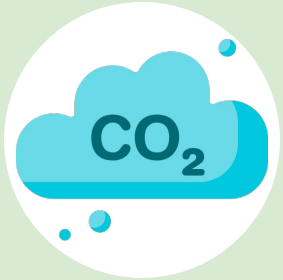
Cons

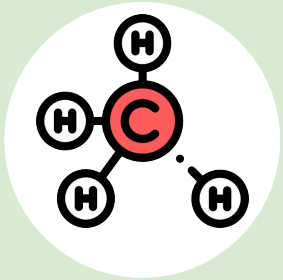
Harmful to habitats



Source: FAO. 2010. Global forest resources assessment 2010. Country Report, Lao PDR. FRA 2010/112. Rome

Cons Emission of greenhouse gases





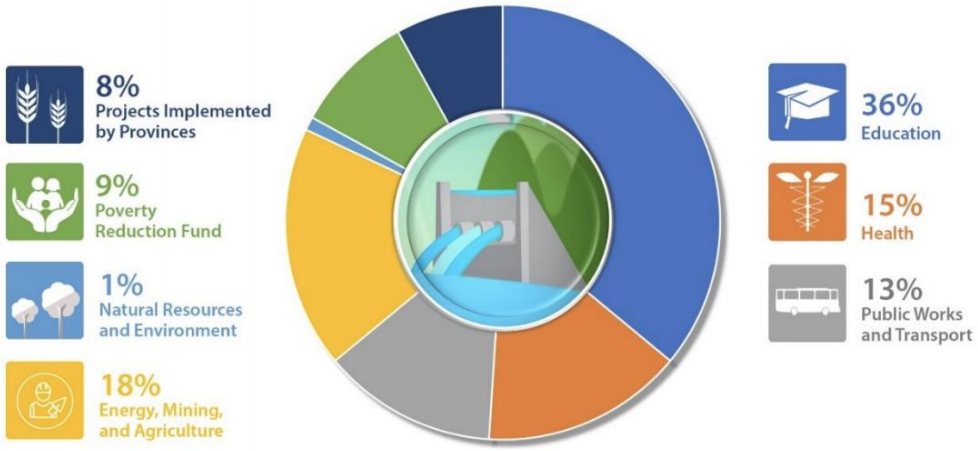
- Carbon dioxide and methane may also form in reservoirs and be emitted into the atmosphere
- Manufacturing the concrete and steel in hydropower dams requires equipment that may produce emissions

Social Aspect

Pros1 -Poverty Reduction and Environmental Management

- The Revenue Management Program (RMP) is a key dimension of the NT2, which assists Laos government implement its priority **poverty reduction and environmental programs** using revenues from NT2

Figure 1: Disbursement of NT2 Revenues to Sectors (2009/10-2014/15)

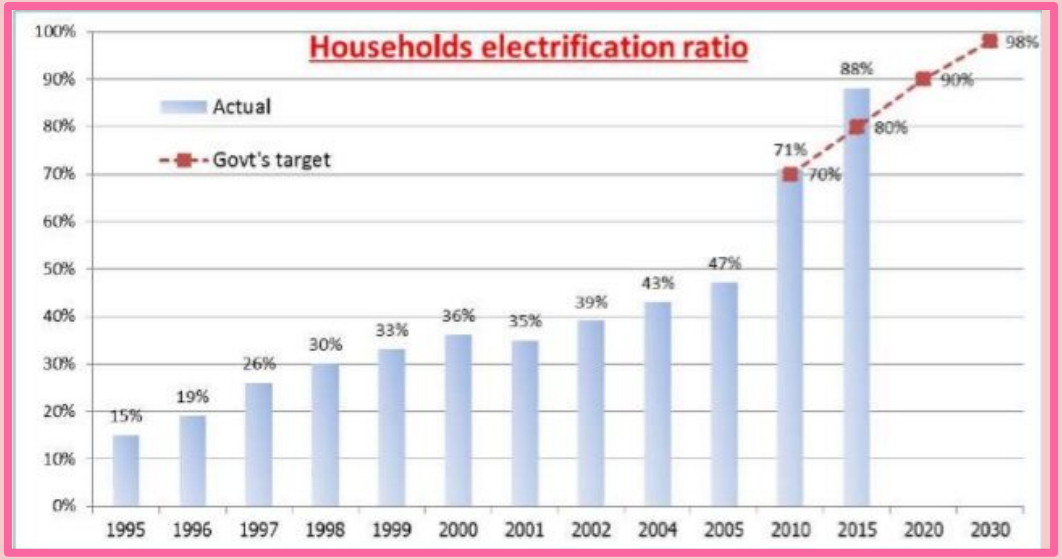


Source: SAO Audits FY 2009/10-2014/15

Source: World Bank. 2017. Lao People's Democratic Republic – Nam Theun 2 Hydropower Project update

Pros2 - Increase Electrification.

- The highest priority of the Government of the Lao People's Democratic Republic (PDR) is to rapidly electrify all households in the country.



Source : https://www.slideshare.net/energyforall/laos-rural-electrification

Cons 1: Migration and Resettlement

- Change the livelihood such as social, cultural, religious ,and economic terms
- Around 40-80 million people are migrant

Cons 2: Agriculture & Fishery

- soil around the dam area is inefficient and lack of nutrient
- the dam affects directly to Mekong fishery

Cons 3: Security & Safe Risk

- Poor security creates safety risk
- For example, Xepain-Xe Nam Noy dam fractured

Cons 4: Health

- Vectors borne disease such as malaria mosquitoes or anopheline mosquitoes

Economic Aspect

Focusing on Nam Theun 2 Power Project

- The project exports 5,354 gigawatt-hours (GWh) of electricity to Thailand, 300 GWh domestically, and **will provide revenue to the Lao PDR through taxes, royalties, and dividends**
- The Project is structured as a **build-own-operate-transfer**, with a concession period of 31 years, of which the operating period is 25 years. In 2033, the project facilities will be transferred to GoL free of charge.
- The project will promote economic growth in the region and is an integral part of the government development framework
- Projects aims:
  - Sustainable economic growth
  - Poverty reduction in Lao PDR
  - Environmental conservation
  - Development through infrastructure investment

Pro: Government Revenues

- Between 2010 and 2017, over **$170 million** in revenues were received by the Lao treasury in income from NT2.
- **$1.9 billion** in foreign exchange earnings for the government over the 25-year operating period. This will bring in about $80 million a year
  - In keeping with the project's legal agreements, all government revenues have and will be allocated to projects and programs contributing to poverty reduction or environmental management
- Starting 2033, government will receive full share of revenues

Source: Asian Development Bank: Lao People's Democratic Republic: GMS Nam Theun 2 Hydroelectric Project https://www.adb.org/projects/37734-013/main#project-pds

Source: World Bank. 2019. Powering the Future: the Nam Theun 2 Project in Lao PDR

Pro: Power Purchase Agreements

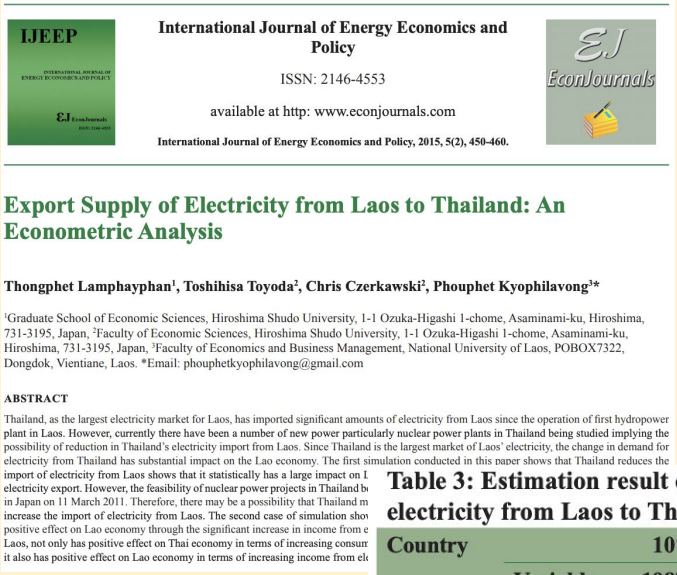
General Prayut Chan-o-cha (Thailand PM) and Mr. Thongloun Sisoulith (Laos PM) witnessed signing of MOU between Electricity Generating Authority of Thailand (EGAT) and Électricité du Laos (EDL) for new PPA of Nam Ngum 1 and Say-sed. 2018.

- **Currently** 4 private hydropower plants in Laos supplying commercial electricity to Thailand
- 2 projects **under construction** that have signed a contract with EGAT, scheduled for commercial operation in 2019.
- EGAT's total purchased capacity (including electricity purchased from the Nam Theun 1 Hydropower Plant Project, which is scheduled for commercial operation in 2022) is 5,934.9 MW

Station	MW	Station	MW
Nam Nhone	3	Nam Ngiep 2	180
Nam Leuk	60	Nam Ngiep 1	290
Nam Lik	100	Theun-Hinboun	550
Nam Ngum 5	120	Nam Ngum 2	615
Houay Ho	152	Nam Theun 2	1075
Nam Ngum 1	155	Xayaburi	1285

Pro: Reliability of Export Volume

Economic Aspect



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Export Supply of Electricity from Laos to Thailand: An Econometric Analysis

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ABSTRACT

Thailand, as the largest electricity market for Laos, has imported significant amounts of electricity from Laos since the operation of first hydropower plant in Laos. However, currently there have been a number of new power particularly nuclear power plants in Thailand being studied implying the possibility of reduction in Thailand's electricity import from Laos. Since Thailand is the largest market of Laos' electricity, the change in demand for electricity from Thailand has substantial impact on the Lao economy. The first simulation conducted in this paper shows that Thailand reduces the import of electricity from Laos shows that it statistically has a large impact on L electricity export. However, the feasibility of nuclear power projects in Thailand b in Japan on 11 March 2011. Therefore, there may be a possibility that Thailand m increase the import of electricity from Laos. The second case of simulation sho positive effect on Lao economy through the significant increase in income from e Laos, not only has positive effect on Thai economy in terms of increasing consur it also has positive effect on Lao economy in terms of increasing income from el

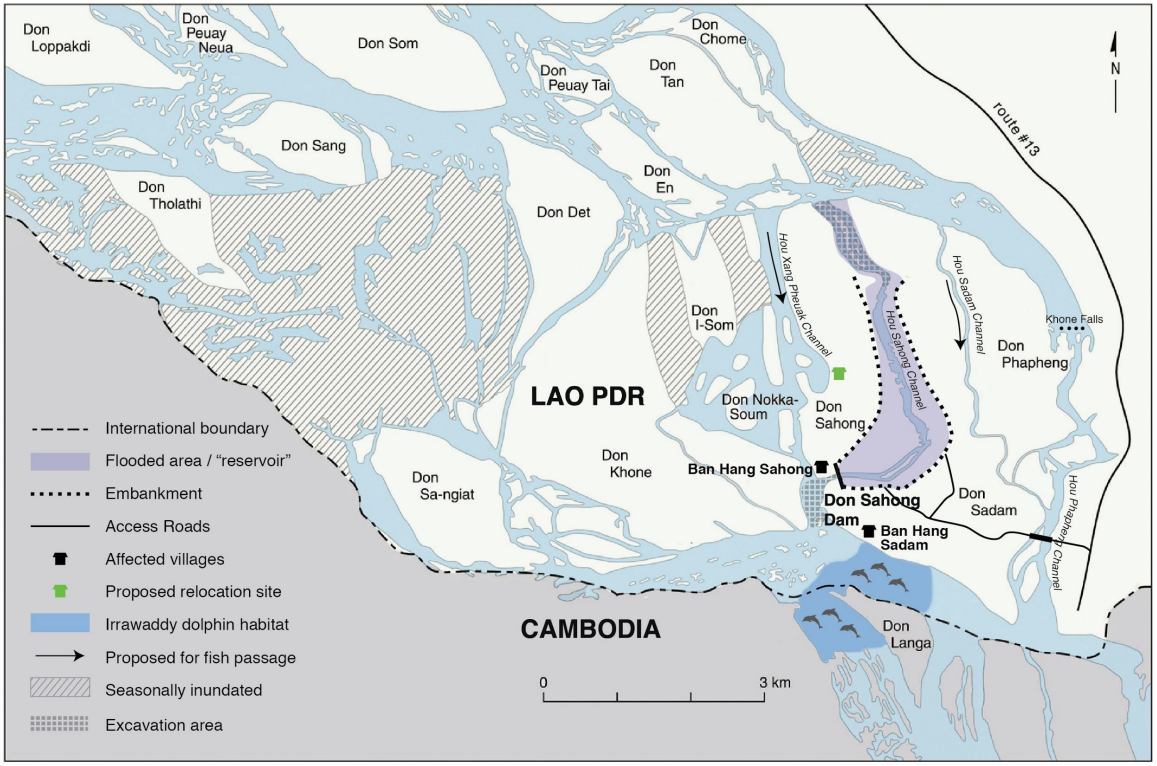
Table 3: Estimation result of decreasing the import of electricity from Laos to Thailand (Unit: Million USD)

Country	10% Decrease in IME_T^L			
	Variable	1987-1996	1997-1999	2000-2010
Laos	CE_L	−0.0962	−0.1008	−0.1008
	EXE_L^T	−2.7613	−2.8930	−2.8933
	GDP_L	−3.5830	−3.7540	−3.7542
	I_L	−1.4709	−1.5411	−1.5412
Thailand	CE_T	−3.1540	−3.3066	−3.3036
	IME_T^L	−2.7613	−2.8930	−2.8933
	GDP_T	−10.2730	−10.7666	−10.7545
	IT	−2.8260	−2.9633	−2.9654

- "significantly increasing demand in Thailand indicated by the extension of MOU for increasing electricity from Laos also implies that Thailand can import more electricity from Laos as much as Laos can supply to Thailand"
- "if Thailand succeeds in construction of nuclear power plants in the country, there is a possibility that Thailand may decrease the import of electricity leading to the negative impact on Laos' electricity export"
- **an increase of import demand from Thailand ->Thailand's consumption and Laos' export of electricity increase their respective GDPs, which also means the investment sector is positively affected**
- "Furthermore, import of electricity from Laos also provides political and fuel diversity to balance Thailand's reliance on gas import from its neighboring country – Myanmar"

Source : https://dergipark.org.tr/download/article-file/361401

Economic Cons: The lost of jobs



<u>Don Sahong Dam Disrupting</u>

- Fish migration
- Fisheries
- Tourism

As the Mekong basin borders Laos and Cambodia, the fisheries in cambodia will also be disrupted.

Source :https://opendevelopmentcambodia.net/tag/hou-sahong-channel/

The irrawaddy dolphin

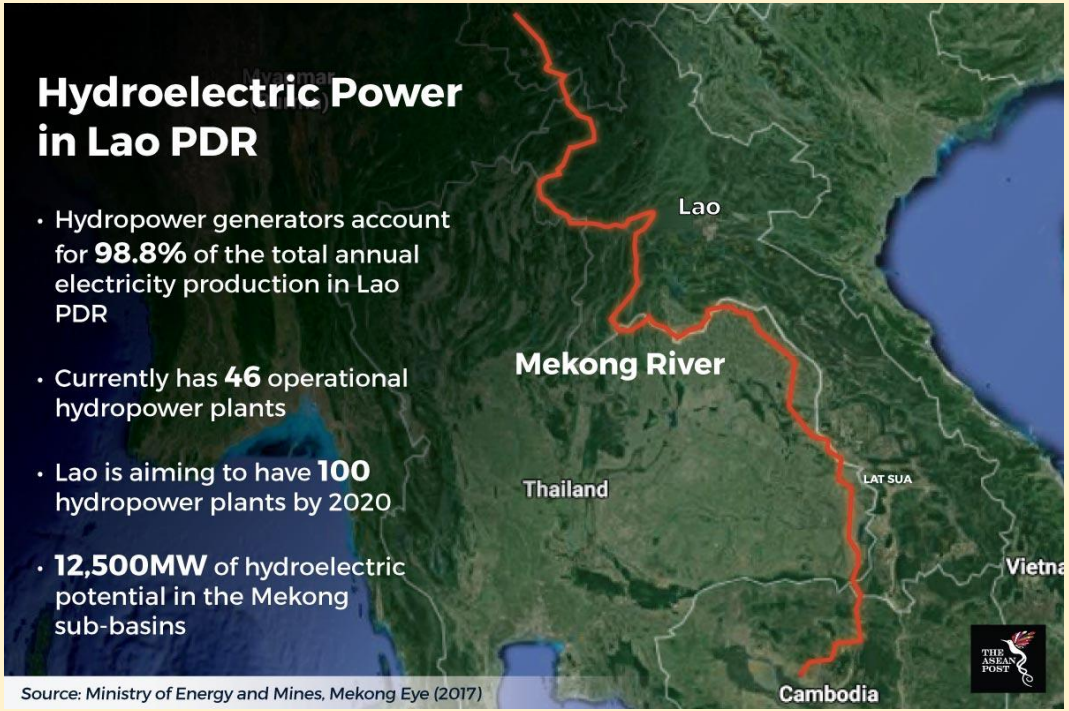
Source : https://www.wwf.org.uk/updates/mekong-river-dolphin-population-rises-first-time-20-year

Economic Cons: The price of hydro power

The World Commission on Dams found that on average, large dams have been at best only marginally economically viable. The average cost overrun of dams is 56%. This means that when a dam is predicted to cost $1 billion, it ends up costing $1.56 billion. In too many cases, the burden of uneconomic dams is shouldered by a nation's citizens, while the project builders walk away with a tidy profit and another project to add to their portfolio. Given that most of the world's large dams are now being built in the world's poorest nations, this is a burden they can ill afford.

Source : https://www.internationalrivers.org/resources/can-huge-dams-solve-our-economic-problems-1825

Economic Cons: Insufficient production of electricity



- Laos is the only country that is more than 90% hydro-dependent.
- Drought-induced blackouts could occured. Diversifying the electricity production could prevent such disaster.

Economic Cons: Insufficient production of electricity

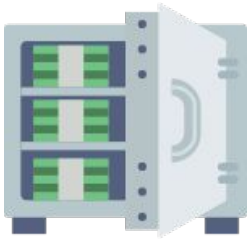
Suggestions & Conclusion

Policy Recommendations

Cost-benefit Analysis of Building Future Dams

Environmental Safeguards

Resettlement Plans



Emergency Funds & Contingency Plans

Meticulous Workers & Construction

Conclusion

- We think that only if the costs can be mitigated by the aforementioned policy recommendations, hydropower can be a sustainable development project for Laos
  - We can see the economic benefits of projects like Nam Theun 2 Dam, which will create substantial revenues, provide newly constructed infrastructure, enhanced education and health service, and better transport systems. This calls for transparency in revenue disruption and corporate social responsibility.
  - In addition, environmental and social aspects like involuntary resettlement, flood regime change, loss of fisheries, and disruption of livelihoods and ecosystems need to be carefully dealt with in projects to come.

Thank You