



***ANALYSIS OF ENVIRONMENTAL AND SOCIAL
COSTS AND RISKS OF HYDROPOWER DAMS,
WITH A CASE STUDY OF SONG TRANH 2
HYDROPOWER PLANT***

Green Innovation and Development Centre (GreenID)

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List of Acronyms

DOIT	Department of Industry and Trade
EIA	Environmental Impact Assessment
Eo	Annual production output
ESHIA	Environmental, Social and Health Impact Assessment
EVN	Electricity Viet Nam
FSL	Full supply water level
GreenID	Green Innovation and Development Centre
GoV	Government of Viet Nam
IFC	International Finance Corporation
kWh	kilo Watt hour
MARD	Ministry of Agriculture and Rural Development
MOI	Ministry of Industry (before merger with the Ministry of trade into MOIT)
MOIT	Ministry of Industry and Trade
MOL	Minimum operating water level
MONRE	Ministry of Natural Resources and Environment
MW	mega Watt
Ndb	Firm capacity
Nlm	Installed capacity
QCVN	Quy Chuẩn Việt Nam (Vietnamese Standards)
SEA	Strategic Environment Assessment
SIA	Social Impact Assessment
TCXDVN	Tiêu Chuẩn Xây Dựng Việt Nam (Vietnamese Construction Standards)
UNDP	United Nations Development Program
USD	United States dollar
VND	Viet Nam dong

Exchange Rate used: USD 1 = VND20,850

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Executive Summary

Hydropower is one of the main electricity sources in Viet Nam. It has low financial costs in operation compared with fossil-fuel-based power generation. Hydropower has been planned by the Government of Viet Nam (GoV) to be developed to its full potential by 2020. It has attracted significant investment from the State and since the mid-2000s from the private sector. While adding low cost generation capacity as Viet Nam's electricity demand is increasing fast, the development of hydropower is also causing negative impacts, and questions about environmental social risks and costs are being raised.

This study aims to analyse environmental and social costs and risks of hydro-electric dams, to inform policy making on the causes and extent of environmental and social costs and risks of hydro-electricity dams in Viet Nam, through general data analysis and in particular a case study of the Song Tranh 2 hydropower plant in Quang Nam province. The study shows the main shortcomings in calculating, managing and mitigating environmental and social costs and risks of hydropower. The costs for resettlement, loss of forest area, biodiversity loss and dam safety are examined in detail and a review of the relevant legislation was done.

Regarding the costs for resettlement, it seems that citizens are generally worse off after resettlement. The GoV has implemented the 'land-for-land' policy in land confiscation practices since the 1990s, including those for hydropower projects. However, in many cases, compensated land provided is less in quantity and worse in quality than the land that was taken. The compensation and support is insufficient for resettled people to conduct the same agricultural practices as on their former land. People have become poorer than before resettlement. Up to 56% of hydropower projects with higher than 30MW capacity were started before 2009, after which more specific regulations were instigated and higher levels of support for livelihood recovery in the resettlement areas for hydropower projects were issued. However, the cost of resettlement land is still not accounted for in the investment of hydropower projects. Those are major expenses that could increase significantly the total investment cost for hydropower projects.

The real costs of forest loss caused by hydropower are much more than those calculated and planned for compensations in Environmental Impact Assessments (EIAs) of hydropower projects. Particularly, the value of ecosystem services of the lost forests has not been taken into account. A large number of resettled people have engaged in deforestation for living as a result of poverty. Only a small number of forest-replanting plans (agreed in EIAs) have been put into practice. This is a consequence of land scarcity and the lack of enforcement by authorities from central to local level. This leads to risks of serious losses of forest and forest biodiversity, more severe floods and droughts in downstream areas due to the reduction of forest coverage, and negative impacts on forest-dependent economic activities.

Negative impacts of hydropower on biodiversity have not been properly mitigated. Almost all hydropower plants were designed without taking into account migration routes for fish or aquatic fauna. Also habitat is lost due to the inundation of land, and because land is needed for dam construction and resettlement. More land will be accessible for poachers and hunters, posing risks to wildlife. The effects of hydropower development on biodiversity are usually underestimated in EIAs. The Law on Biodiversity (2008) does not address hydropower development, and thus fails to protect biodiversity in the case of hydropower development. The low amounts of money reserved for the mitigation of negative impacts on biodiversity makes hydropower projects appear cheaper than they should be, as hydropower increases the chance of biodiversity loss with costs to the environment and society.

The safety of hydropower dams was found to be insufficiently guaranteed. The risk of inducing earthquakes is usually not sufficiently taken into account. Safety measures are often absent and current legislation leaves many possibilities for mismanagement. There are, for example, no

requirements for the technical and financial capability of the builders of dams. Consequently, human lives, material assets and environment in downstream areas are at risk, including potentially serious damage and/or complete losses if dam failures happen.

There are gaps in the legal requirements for EIAs, which partly explain the above weaknesses in calculating and mitigating environmental and social risks of hydropower projects. The legal requirements for EIAs do not include specific details about critical aspects such as the formulation of project alternatives, scoping, data accuracy and sources, assessment of impacts and the formulation of mitigation plans, the cumulative impacts on the supply chain that the specific projects add on top of an existing project or situation. In addition to the gaps in EIA requirements, enforcement is also weak, which is illustrated by for example the fact that the EIA of the Song Tranh 2 dam was approved well *after* approval and initiation of the construction. Consequently, EIA has not been a useful tool to safeguard and mitigate environmental and social costs and risks of hydropower projects.

The arguments are specifically illustrated through the case study of the Song Tranh 2 hydropower project which was assessed in detail. The Song Tranh 2 hydropower project, with an installed capacity of 190MW, is located on the mainstream of the Tranh River in Quang Nam province, which is a part of the Vu Gia – Thu Bon River System in the Central Region of Viet Nam. The reservoir of the dam is 23.01 km² and 1046 households had to be resettled. Since the plant started operating in 2012, many problems occurred such as stimulated earthquakes, issues with the dam management and water leakages. The compensation for lost livelihoods is too little for a good livelihood and no support has been given to find alternative livelihoods. Some people said that the locations of agriculture land compensated are without access to irrigation which makes it impossible to grow crops. As a consequence of facing instability in their livelihoods, many relocated people are now involved in illegal deforestation and forest product harvesting, and they clear land for cultivation. Increasing deforestation and further biodiversity degradation by resettled people contributes to total losses as a result of the project. Many of the problems occurring in Song Tranh 2 are similar to those found in literature.

In conclusion, hydropower is not as cheap as currently estimated because many environmental and social costs involved with hydropower projects are under-estimated and under-invested. These include costs for resettlement and recovering livelihoods, the full-scale compensation for forest loss and the negative impacts on biodiversity directly and indirectly caused by the projects, as well as for dam safety guarantee and risk mitigation. The shortages are caused by gaps in the legal frameworks and weaknesses in their enforcement. They lead to risks of poverty among resettled people, increasing forest loss and negative impacts on biodiversity, which may be damaging to the environment and society.

The study suggests that the following should be undertaken to address the gaps and weaknesses, and contribute to sustainable development of hydropower in Viet Nam: (1) review all environmental and social costs and risks as well as costs of mitigation of negative impacts of new dams; and the full costs of maintenance, monitoring and operation of existing hydropower plants to minimise impacts; (2) set up schemes for resettled people displaced by all hydropower projects; (3) regulate and enforce compulsory Social Impact Assessment (SIA) as part of the approval process, besides Environmental Impact Assessment; (4) enforce regulations on investors' payments for forest loss and biodiversity degradation caused by hydropower; (5) improve the legal framework for hydropower plant investment and reservoir/dam operation/ management, dam safety and safety risk mitigation and their enforcement; (6) monitor the implementation of inter-reservoir operational schemes and review their impacts and possibly adjust; (7) review and incorporate underestimated and underpaid environmental and social costs in the total costs of hydropower investment and operation; (8) strengthen human resource development in MOIT and provincial DOITs in order to improve approval and monitoring of hydropower plants, and of reservoir operation.

PART 1 ANALYSIS OF ENVIRONMENTAL AND SOCIAL COSTS AND RISKS OF HYDROPOWER DAMS

1. Introduction

Hydropower is one of the main electricity sources in Viet Nam. Due to low operational costs when compared with fossil fuel based power generation, hydropower has been planned by the Government of Viet Nam (GoV) to be developed until most potential will be taken up by about 2020. It is attracting investments from the State and since the mid-2000s also from the private sector. Hydropower is helping to meet the rapidly growing electricity demand. However, the development of hydropower in Viet Nam also has negative consequences, including environmental and social risks and costs, which have not counted to their full scale in the final costs of hydropower.

This study aims to “*carry out a deep analysis of environmental and social costs and risks of hydro-electric dams, with a case study of the Song Tranh 2 hydropower plant to inform relevant policy making processes in Viet Nam on the causes and extent of environmental and social costs and risks of hydro-electricity dams in Viet Nam, through general data analysis and in particular a case study of the Song Tranh 2 hydropower plant in Quang Nam province*”.¹

The study highlights the main shortcomings in calculating, managing and mitigating environmental and social costs and risks of hydropower in Viet Nam. It aims to support the legal framework, such as the development of the Law on Environmental Protection in 2013 – 2014.

The main research questions are:

1. *What is the overview of hydro-electricity, reservoir management and dam construction and operation in Viet Nam?*
2. *What are the costs of hydropower in Viet Nam (including environmental and social costs)?*
3. *What are legislation/regulations on minimization of hydropower dam development induced costs and risks in Viet Nam?*
4. *How was Song Tranh 2 Hydro Power Plant managed?*

The term “environmental and social costs” refers to financial expenses that are being paid and/or should be paid and accounted for in the total financial investments and operation of hydropower plants and projects. The failures or shortcomings in paying the full environmental and social costs in hydropower projects put the environment and society at risk, including increasing poverty and forest loss, and negative impacts on biodiversity. This study also considers dam safety management and mitigation of potential risks of hydropower dam failure.

This study uses mainly secondary data, i.e. it reviews and analyzes existing studies and regulations on hydropower in Viet Nam. Inevitably, there are aspects about which there are insufficient studies, particularly on forest losses caused by hydropower development. About those aspects, we report what has been observed so far and suggest further studies. This paper also benefits from field research of the Song Tranh 2 hydropower plant with observations and semi-structured interviews with local people and authorities, which informed the case study in Part 2 but which is also used here in Part 1, the overall study.

The box below, Table 1 and Table 2 provide the basic facts about hydropower and the potential for hydropower development in Viet Nam.

¹ UNDP & GreenID 2013: Micro-Capital Grant Agreement For Non-Credit Related Activities Support for the Research. Analysis of environmental and social costs and risks of hydro-electric dams, with a case study of the Song Tranh 2 hydropower plant

Box: Basic facts about hydropower in Viet Nam

- The average rainfall in Viet Nam is 1,600 mm, ranging from 700 to 4,000 mm per year in different regions.
- There are 2,360 river basins with a length of more than 10km each. Of these, 13 have catchment areas of over 10,000km², including: the Red river; Thai Binh; Bang Giang-Ky Cung; Ma; Ca; Vu Gia - Thu Bon; Ba; Dong Nai; Cuu Long (Mekong); and 4 large tributaries of the Mekong river, i.e. the Da, Lo, Se San and Srepok. Large river basins are trans-provincial. Ten out of those 13 are international rivers. The catchment area outside Vietnamese territory of those ten rivers is 3.3 times larger than in Viet Nam.
- The water volume resulting from precipitation over Vietnamese territory is 310-315 billion m³ per annum. Water coming from other countries is 520-525 billion m³, or about 63% of the total fresh surface water volume of 830-840 billion m³ per annum (Dao T.T. et al. 2011 p5-6).
- By December 2012, there were 118 hydropower plants and projects operational, under construction or planned with an individual capacity of 30MW or above. Together they have a total installed power generation capacity of 24,893 MW. They include:
 - 49 operating hydro power plants with a combined capacity of 11,881 MW;
 - 47 hydro power plants under construction with a combined capacity of 5,462 MW;
 - 22 planned hydropower projects with a combined capacity of 7,411 MW².
- Before 2006, the State, particularly EVN, was the only investor in hydropower development in Viet Nam. In 2006, Decree 30/2006/QD-BCN³ was issued by the Government to regulate investments in independent power projects, including those from the private sector. Since then, more and more hydropower projects invested by private investors have been developed in Viet Nam, although the State remains the biggest investor in this sector. There has not any foreign direct investment in hydropower projects in Viet Nam.

Chapter 2 describes the environmental and social risks considered by investors and owners of hydropower projects and their mitigation measures, and if available, the costs of mitigation. It provides a basis for further analysis of shortages in calculating, managing and mitigating environmental and social risks of hydropower projects, including resettlement, forest loss, negative impacts on biodiversity, and aspects of dam safety in Chapter 3, 4, 5 and 6. The analysis includes reviews of legal frameworks on those issues. Chapter 7 analyses the shortcomings in the requirements on the content of EIAs for hydropower projects, which is one of the direct reasons for the aforementioned problems. The last chapter provides some conclusions and recommendations.

² Vietnam's Master Power Development Plan 5,6 &7 and the authors' review

³ Since 2007, Ministry of Industry and Ministry of Trade merged into the current Ministry of Industry and Trade

Table 1 - Economic – technical potential for hydropower development in Viet Nam

River basin	Capacity (MW)	Electricity (TWh)	Distribution (MWh/km2)	Ratio (%)
Lo – Gam – Chay	1,470	5.81	212	7.0
Da	6,960	26.95	1,400	32.3
Ma	890	3.37	74	4.0
Ca	520	2.09	147	2.5
Vu Gia – Thu Bon	1,120	4.29	475	5.1
Tra Khuc – Huong	480	2.13	531	2.6
Ba	670	2.70	150	3.2
Se San	1,980	9.36	700	11.2
Srepok	700	3.32	143	4.0
Dong Nai	2,870	11.64	436	14.0
10 main river basins	17,660	71.67	423	85.9
Entire territory	20,560	83.42	250	100

Source: Dao T. T., et al., 2011 p44

Table 2 - Changes in power production by major power sources 2010 – 2030 (TWh)

production (TWh)	2010	2020	2030
renewables	4.3	14.9	41.7
hydro	23.8	64.7	64.6
natural gas	38.0	66.0	73.0
LNG	7.3	13.2	27.1
coal	16.5	154.4	392.0
diesel & oil	1.8	0.0	0.0
nuclear	0.0	6.9	70.2
imported	5.6	9.9	26.4
Total	97.3	330.0	695.0

Source: Figure 25 in UN-Viet Nam (2013), based on official Vietnamese sources, including SRV (2011)

2. Environmental and Social Risks Considered in Hydropower

Table 3 lists environmental and social costs and risks as described in the EIAs of hydropower projects, as well mitigation measures to address potentially negative impacts of dams.

Table 3 - Environmental and social risks being written in EIAs with mitigation measures in Song Tranh 2 190-MW hydropower project

Risks	EIA mitigation measures	Mitigation costs Song Tranh 2 (Million VND)
I. Environmental risks		
Changes in geological surface of the area	Construction management	n/a
Air pollution	Construction management	8.77
Noise pollution	Construction management	3.45
Dust pollution	Construction management	n/a
Water pollution	Construction management	n/a
Waste pollution	Waste control and processing	60
Effects on flora system	Prohibiting forest loss, wildlife hunting and fishing by electricity and chemicals	33.6
Effects on wildlife system		
Effects on fish and aquatic beings		
Forest loss	Planning reforestation	1,276.7
Changes in river flow	Ensuring minimum river flow after the dam during the dry season	n/a
Alluvium filling up the reservoir		n/a
Changes in reservoir water quality	Clearing and cleaning the reservoir bed before filling it up with water	17.64
Quality of water discharged from the hydropower plant to river		
Losses of water through dam	Intensifying water proof capacity of the dam foundation	n/a
Erosion and creation on the bank of reservoir	Reforestation and protecting forest around the reservoir	120
Stimulating earthquake caused by the hydropower plant construction	n/a (not commonly considered for any hydropower plant)	n/a
Losses in mineral resources in the reservoir area	Collecting all minerals before filling the reservoir with water	n/a
Water-borne diseases	n/a	n/a
II. Social risks		
Resettlement of local people	Compensations investments in building resettlement areas Support for recovering livelihood of resettled people	488,493.94
Losses in resources and materials	Compensation	
Migration and change in livelihood of local people	Support for recovering livelihood of resettled people	
Burning and explosion	Safety management	5,000
Labour accidents	Labour safety management	n/a
Diseases and insecurity	Healthcare and disease control measures	210
Dam safety	Implementing Vietnamese standards on hydraulic construction works. Installing dam observation system	50

Source: EVN 2006 No1, EVN 2006 No2

Table 3 also gives the estimated mitigation costs for the Song Tranh 2 hydropower plant for most items (this is discussed in further depth in Part 2). The table shows gaps and suggests that the calculation of hydropower costs does not fully incorporate environmental and social costs and risks, and should facilitate further analysis of gaps in calculating environmental and social costs of hydropower in the later parts of this study.

Hydropower in Viet Nam is often calculated to be cheaper than other types of power generation such as coal, gas and oil-fired power plants see for example data in.

Table 4 - Average Generation Costs of Different Power Sources in Viet Nam

Types of power	Fixed investment	Fuel	Operation & Management	Total Costs (US Cent/kWh)
Hydropower	3.5	--	0.2	3.7
Large coal	2.0	4.2	0.8	7.0
Chinese coal	1.2	4.3	1.0	6.5
Combined Cycle Gas	1.2	6.7	0.4	8.3
Gas Turbine	2.6	9.0	0.7	12.3
Diesel	1.6	30.0	1.0	32.6

Source: Dapice D., 2008 p8

The budgets or costs for mitigation measures vary greatly from project to project, depending on factors such as location, the situation of the local environment and society, the willingness of investors, and enforcement by local authorities. The not-counted costs, and not-planned expenditures to mitigate negative social and environmental impacts and risks of hydropower projects also vary.

Table 5 shows the subjective judgement by experts about the main gaps in assessing costs and making expenditures for mitigating all social and environmental impacts and risks in hydropower projects in Viet Nam. A cost-gap is the difference between the amount of expenses that have been planned for mitigating certain impacts in EIAs of hydropower projects and the expenses required for fully mitigating all costs and risks. Ten key cost-gaps have been identified. The experts ranked the biggest cost-gap with number 10 and number 1 is the smallest gap. In case an expert estimated that several gaps are equal in size, the positions were shared.

Weaknesses in assessing social and environmental impacts and risks in hydropower projects are further analyzed in Chapter 3, 4, 5, 6 and 7. Those chapters provide evidence for the broad views expressed by the experts in Table 5 about the ten main cost-gaps. The discussion then leads to the conclusions and recommendations for improvement in Chapter 8.

Table 5 - Summary of expert judgement on gaps in social and environmental cost estimates and expenditures in hydropower projects in Viet Nam

Expert ranking of cost-gap levels: 1=lowest, 10=highest rank / cost level					
	Tran Dinh Sinh	Le Anh Tuan	Dao Trong Tu	Lam Thi Thu Suu	Nguy Thi Khanh
I. COSTS NOT INCLUDED IN EIAs					
Land for resettlement	10	10	10	10	10
Cost of environmental services of forest being chopped for the construction of hydropower plants	10	10	10	10	10
Mitigating negative impacts on biodiversity, particularly preventing wildlife hunting and poaching	10	10	10	10	10
Preventing additional deforestation related to the construction of hydropower plant	10	10	10	10	10
II. COST INCLUDED IN EIAs BUT NOT ENOUGH					
Land compensation for resettled people	5	1	6	1	3
Recovering livelihood for resettled people					
- Support for agriculture and forestry development in resettlement areas	5	2	4	2	3
- Vocational training for resettled people	5	6	4	6	5
- Job creation program for resettled people	5	4	2	6	5
Re-planting forest	2	5	6	4	6
Implementing proper schemes and measures to ensure dam safety	1	3	1	4	1

3. Gaps in Resettlement Costs

3.1 Introduction

This chapter analyzes the cost-gaps regarding resettlement. It reviews the legal framework on compensation and resettlement in hydropower projects and shows that the gaps in practice are the result of shortages in the legal framework.

Hydropower projects take vast land areas and usually lead to the need to move many households to other areas (i.e. resettlement; see also Table 6). Hydropower investors in Viet Nam, however, do not pay much for compensation and resettlement. As this chapter will show, the biggest gaps are in compensating for land taken for the development of hydropower plants and recovering livelihoods of resettled people in resettlement areas. Another gap is the value of resettlement land which is not fully counted as a cost of hydropower projects.

Table 6 - Land taken in some hydropower projects and resettled people

Hydropower	Land taken for hydropower projects (hectare)	Resettled people
Thac Ba	23,400	30,000
Hoa Binh	75,000	89,720
Son La	23,333	91,100
Huoi Quang	4,558	6,459
Ban Chat	8,186	15,738
Lai Chau	4,143	6,579
Tuyen Quang	8,000	23,630
Ban Ve	5,492	13,790
A Vuong	941	1,582
Song Tranh 2	2,900	4,300
Yaly	6,450	24,610
Pleikrong	5,328	6,000

Source: CODE 2010 p19

3.2 Poor practice in compensating for land taken for hydropower plant development

Costs for resettlement and compensation for resettled people in hydropower projects often include:

- Compensation for land and material losses in the clearing of the site for the reservoir and hydropower plant construction;
- Investment in building resettlement areas;
- Support for resettled people; and
- Expenses for surveys, reports and implementation management.

However, involuntarily resettled people in many hydropower projects in Viet Nam have not received enough compensation for their land which is taken for hydropower plant development. Many received less land and land of worse quality compared to their former land, which seriously affects their capacity of recovering agriculture and forestry based livelihoods.

Before the issuance of the Land Law 1993, there were no detailed regulations on compensation for land taken by the State. The Land Law 1993 regulated in Article 27 that the State would compensate for people and organizations when it confiscated their land. Decree 90/1994/CP issued on August 17, 1994 regulated more specific compensation measures, particularly land-for-land compensation. The principle is that if the State decides to take land used by people for other purposes, it should compensate people with other land, which is of equal size, quality and value. If it cannot allocate resettlement land meeting those standards, it will pay the difference in money to resettled people. Since 1994, land-for-land compensation has become a core principle for compensation in land confiscation cases conducted by the State, including those for hydropower development.

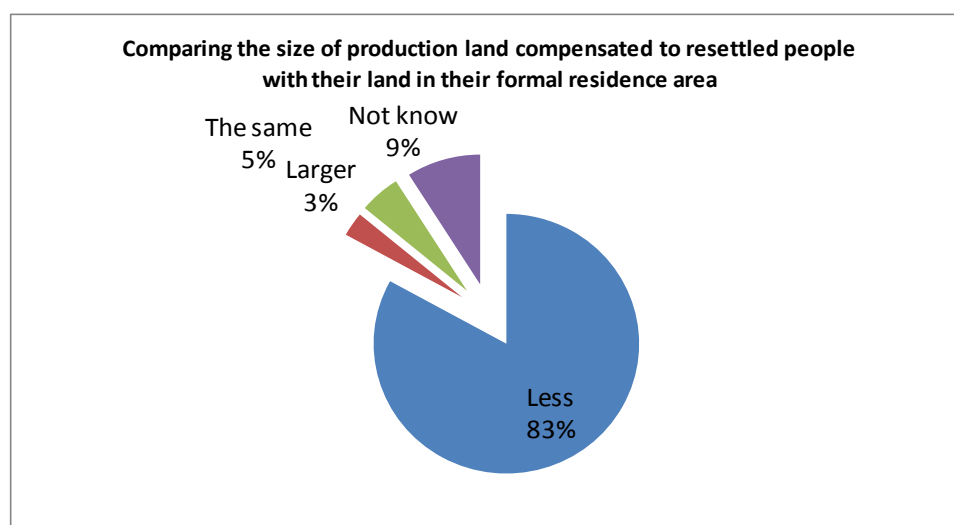
Most hydropower projects developed after 1994 have implemented the land-for-land compensation principle. However, the land given to resettled people as compensation is usually less in quantity and worse in quality than the land that was confiscated. The scarcity of land, particularly agricultural land with equal conditions to the land confiscated for hydropower development, may be one key reason for this situation.

Several studies have shown evidence for this. A study in 2010 about life and livelihoods in the resettlement areas of four big hydropower plants, including Hoa Binh, Ban Ve, Yali and Tuyen Quang, showed that 79% of resettled people received less land than their former land. Particularly, 83% received less agricultural land and 77% received agricultural land which was of worse quality than that of their earlier location, as shown in Figure 1 and Figure 2.

In 2009, a study about resettlement areas of hydropower projects in the Vu Gia – Thu Bon River System in Quang Nam province concluded: *“Compensated land is not equally fertile to the land in their earlier location. These lands are in highly sloping areas, between 10° to 25°, which is very difficult for cultivation. Land levelling in those areas [conducted by hydropower investors and/or local authorities] is not sufficient because levelled areas are not near streams and rivers, so it is difficult to build irrigation system to supply water to the fields, and investments in making those lands into rice fields are much bigger than the financial capacity of resettled people”* (Doan T., 2009 p40).

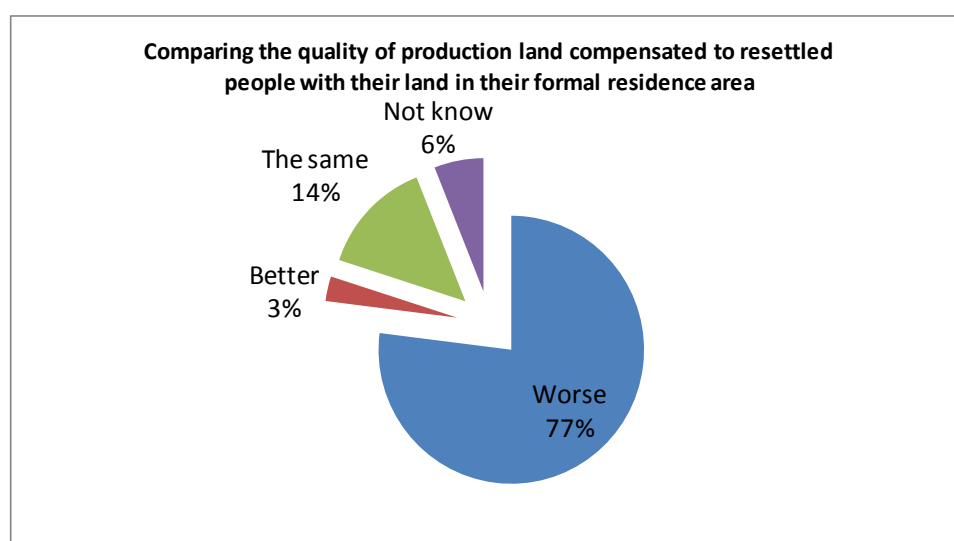
Those studies point out that resettled people in big hydropower projects received less land and land of poorer quality than their old land in their old place. As those people mainly rely on agricultural production for their livelihoods, the loss of land seriously affects them.

Figure 1 - The size of production land given to resettled people compared to their land in former residential areas in Hoa Binh, Ban Ve, Yaly and Tuyen Quang hydropower projects



Source: CODE 2010 p.74

Figure 2 - The quality of production land given to resettled people compared to their land in former residential areas in Hoa Binh, Ban Ve, Yaly and Tuyen Quang hydropower projects



Source: CODE 2010 p.75

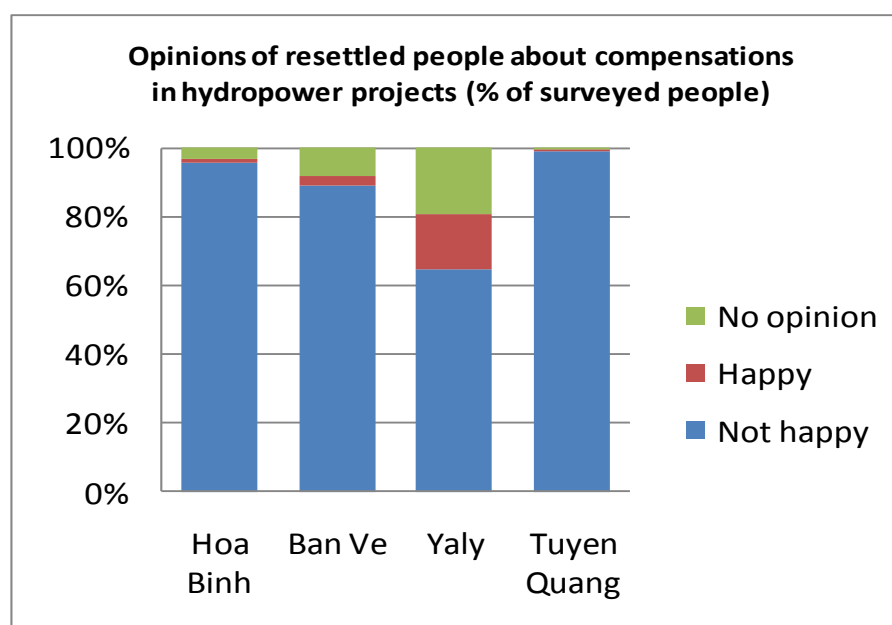
3.3 Poor practices in recovering livelihoods for resettled people

The gap in land compensation has strongly affected the livelihoods of resettled people who generally rely on land and agricultural production. They cannot continue their old agricultural practices in the new areas because the new land, the water availability and other conditions are very different from those in their old places. Although investors do pay extra money for the land size difference and additional money for supporting resettled people to start agricultural practices in new resettlement areas, the support is usually insufficient for resettled people to have similar lives and income let alone improve that when compared with their situation before resettlement.

The problem is exposed in several studies. In 2006, a study about the resettlement area of Son La hydropower project concluded that *“There is a scarcity of land. Thus, a percentage of affected people will have to move where land is available, even if it is very far away and with a completely different soil structure. This is leading to greater insecurity and changes in livelihood. Many will not be able to cultivate the same crops they once grew and will require new agricultural techniques...Households that depend on fishing and boating now face even greater risks of impoverishment when forced to move further upstream or away from the river. It will take them more time to adjust their new life; or worse than that, to seek a completely different livelihood”* (VUSTA 2006 p25 & 26).

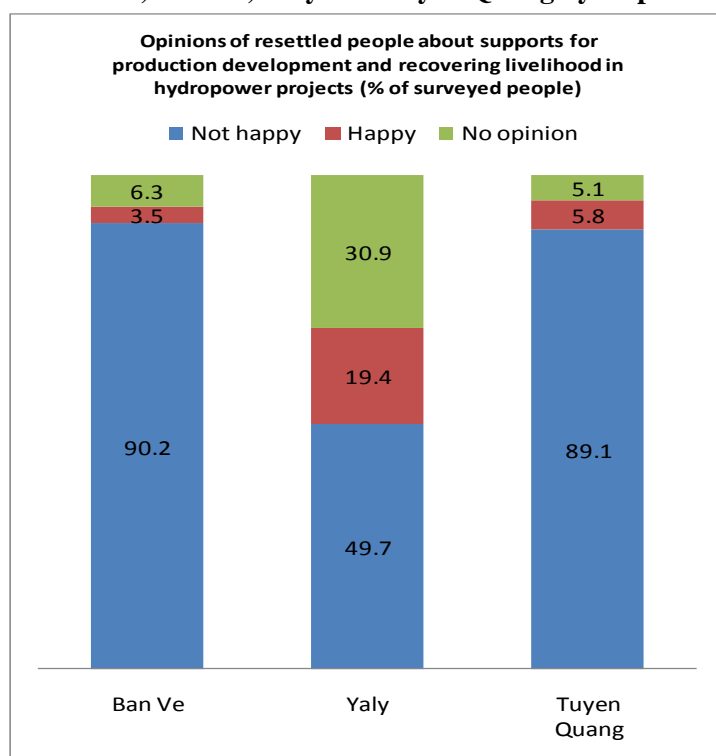
The 2010 study on life and livelihoods in the resettlement areas of four big hydropower plants, including Hoa Binh, Ban Ve, Yali and Tuyen Quang also reported the same shortage in practices of supporting resettled people to recover their livelihood in resettlement areas of big hydropower projects. *“Field surveys about the common situation of compensation works in many resettlement projects in hydropower sector show that the compensations are not sufficient to ensure the recovery and enhancement of the livelihood and equal value or replacement for the people to re-purchase land and change jobs. Economic activities of the majority of the involuntarily resettled communities relied on agriculture and forestry. But most resettlement projects do not have enough land, including for residence and production, to conduct land-for-land compensation. As a result, in many projects, a part of production land must be compensated by money. In some place, there is not any land, resettled people have to change ways of earning living, for instance in hydropower projects of Pleikrong, Tuyen Quang, Song Tranh 2, which reduces the fundamental livelihood of people being stuck to agriculture and largely affects the livelihood recovery after the initial resettlement”* (CODE 2010 p58). This is illustrated in Figure 3, Figure 4 and Figure 5.

Figure 3 - Opinions of resettled people about compensation and Support in Hoa Binh, Ban Ve, Yaly and Tuyen Quang in hydropower projects (% of surveyed people)



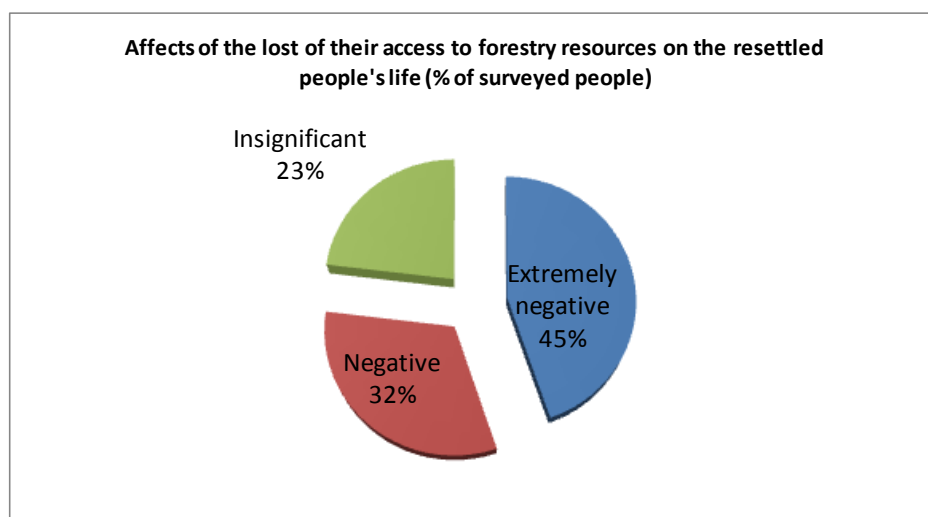
Source: Data from CODE 2010 p6, histogram drawn by the authors

Figure 4 - Opinions of resettled people about support for production development and recovering livelihood in Hoa Binh, Ban Ve, Yaly and Tuyen Quang hydropower projects



Source: Data from CODE 2010 p84, histogram drawn by the authors

Figure 5 - Effects of the loss of access to forestry resources on the resettled people's life in some hydropower projects



Source: Data from CODE 2010 p86, graphic drawn by the authors

The findings of those studies pointed out that lives of resettled people have become more difficult because of the loss of their familiar livelihood and failure to create a similar livelihood in resettlement areas due to land shortages and different natural conditions. Resettled people, thus, need supports to change to new ways of earning a living, through good vocational training, job creation programs and

for example food support over a decent period of time so that they can live until they create a sustainable livelihood in resettlement areas.

The practices of supports for recovering and generating livelihoods for resettled people in many hydropower projects have not met the needs. Resettled people usually receive food support equal to 30 kilograms of rice per person per month over 1-2 years and agricultural production support, including seeds, fertilizers and pesticides, for the first two crops. That period of time is too short compared to the needs given the above-mentioned difficult conditions of land for production in resettlement areas. In some cases, resettled people can attend free-of-charge vocational training courses but the training courses are not accompanied by decent job creation programs for resettled people. Thus, they are unable to make use of the newly acquired skills. Those supports are not enough to recover or renew their livelihoods. They are at risk of impoverishment because of the loss of their familiar livelihoods and failure in creating new livelihoods.

The gaps in compensation for land loss and support for recovering livelihood have made lives of resettled people in many hydropower projects in Viet Nam become more difficult. These are big costs to the resettled people which should have been included in the final costs of hydropower projects. The gaps have limited the investment costs of hydropower plants and the burden was shifted to the shoulders of resettled people.

3.4 Legal review on compensations and supports for resettled people in hydropower projects

In 1994, the first Decree regulating land-for-land compensation principle in cases of land confiscation by the State was issued, after the issuance of the Land Law 1993. Since then, the land-for-land compensation principle has become key in government Decrees and Decisions about compensation for land for hydropower development. Six Decrees and Decisions about resettlements and livelihood recovery for resettled people have been issued. This legal review focuses on comparing regulations about compensations and supports, mainly in recovering livelihood of resettled people, and shows that involuntarily resettled people in earlier hydropower projects received less compensation for land loss and less support for recovering livelihoods than those in projects after 2009.

Decree 90-CP about land-for-land compensation was issued by the Government on August 17, 1994, a key principle in the State's land confiscation cases, including for hydropower development. The principle is that if the State decides to take land used by people for other purposes, it should compensate people with other land that is of equal size, quality and value. If it cannot allocate resettlement land meeting those standards, it will pay the difference in money to resettled people⁴. However, Decree 90-CP did not include principles about resettlement and support for recovering livelihoods of people whose land was confiscated.

The first Decree on resettlement was not issued until 1998. Before this time, resettlement for hydropower projects mainly followed the *di ven* model, meaning that people in areas affected by hydropower reservoirs had to move to higher land in the same area when the reservoirs started receiving water, i.e. there was no organized resettlement program. Local people just had to find new land for their home and cultivation by themselves. An example is the resettlement for the Hoa Binh hydropower project in 1979-1989. The government paid resettled people compensation but it did not have a resettlement program for the project, which submerged 75,000 hectares and forced 89,720 people to move away from their homes and land. Most of these people moved to live in areas near the reservoir, whereas some moved to new areas. The compensation paid was insufficient for those people to start a new life in new areas (CODE 2011 p28).

⁴ Regulation on compensation in land confiscation for the purposes of national defence, national security, national benefits and public benefits, attached to Decree 90-CP, Article 6

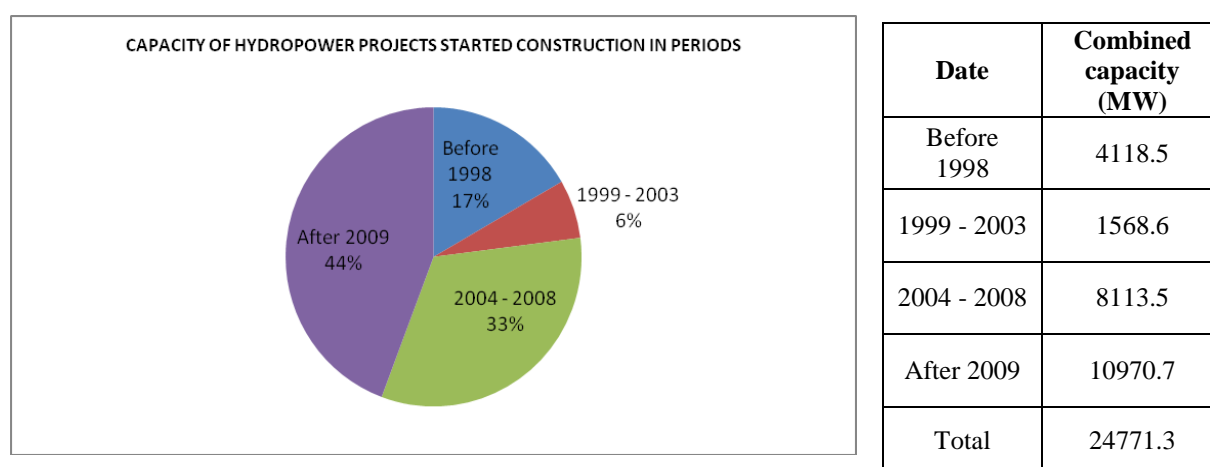
In 1998, Decree 22/1998/ND-CP on compensation for losses when the State confiscates land for the purposes of national defence, security, national interests and public interests was issued. It was then followed by four other Decrees and Decisions on resettlement and support for resettled people in hydropower projects. The main contents are reviewed in Table 7.

A review and comparison of key contents of the six governmental Decrees and Decision listed in Table 7 shows significant improvements in the legal framework on resettlement and support for resettled people in hydropower projects after 2009. In the period of 2009 – 2012, Decree 69/2009/ND-CP, Decision 34/2010/QĐ-TTg and Decree 52/2012/ND-CP were issued. These Decrees include specific regulations about more tangible and higher levels of support for livelihood recovery in resettlement areas of hydropower projects. Particularly Decree 69/2009/ND-CP regulates a significant support for job changing for people whose agricultural land is confiscated.

In general, people affected by hydropower projects started before 2009 do not benefit from the new regulations. They received compensation and support at lower levels than those affected by projects approved and started after 2009. Should all of these be implemented according to the regulations about resettlement issued from 2009 to 2012, the costs for resettlement would be significantly higher.

Figure 6 shows that up to 56% of the above-30MW hydropower projects were started before 2009. The poor practice of compensation and support for resettled people in hydropower projects is a direct consequence of shortfalls in the legislative framework, especially the former legal framework.

Figure 6 - Capacity of hydropower projects started construction in different periods



Source: author's review of hydropower projects

The level of compensation for land lost and supports to resettled people affected by hydropower projects and livelihood recovery in new areas have not been calculated and paid to the full extent in most hydropower projects. This is a result of gaps in regulations on these issues. The gaps were partly improved from 2009, but by then the majority of hydropower projects had been approved and conducted. Thus, many people did not benefit from the improvements in regulations on compensation. The poor practice of compensation and support for people who lose land in hydropower projects can lead to increased poverty and deforestation practices among resettled people.

3.5 Value of land for resettlement not included

The government and provincial authorities make decisions to take land for hydropower construction. They will have to allocate land in other areas for resettlement and reforestation. However, the government does not make investors pay for the resettlement land (Land Law 2003 Article 33.4). The investors, specifically the State as well as domestic private investors (who may be in partnership with international investors) only pay for building resettlement areas, the difference in land value between the agricultural land taken and that in the resettlement area and for reforestation.

Meanwhile, since the mid-2000s, all types and parcels of land have had the prices regulated by provincial authorities. Should hydropower investors pay for the value of the resettlement land, then this would increase the investment costs significantly because resettlement areas cover large areas.

Resettlement in hydropower projects has been poorly conducted with very limited investment in recovering of the livelihoods of resettled people and/or providing them with alternative livelihood opportunities. This is caused by weaknesses in the relevant legal frameworks which were not detailed enough until 2009-2010. There also appear to be weaknesses in enforcement of the more recent regulations, applying to the newest hydropower projects. This has led to risks of poverty among resettled people and the increase in forest loss caused by resettled people to make their living, though this may be only temporary. At the same time, the cost of resettlement land is still not accounted in the total investment costs for hydropower projects. These expenses could significantly increase the total investment cost of hydropower projects.

Table 7 - Legal review on compensations and supports for resettled people in hydropower projects

Relevant Decrees/Decisions	Principle	Details on support for moving house and livelihood recovery	Gaps
Decree 90 – CP issued on August 17, 1994, on compensation for losses when the State confiscates land for the purposes of national defence, security, national benefit and public benefit	When the State confiscates land, it will compensate for losses	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> No regulations about resettlement and supports for resettled people to recover livelihood after the land confiscation
Decree 22/1998/ND-CP on compensation for losses when the State confiscates land for the purposes of national defence, security, national interests and public interests	When the State confiscates land, people whose land is confiscated will be compensated with money, house or land	<ul style="list-style-type: none"> Support for stabilizing production and life: money equal to 30kg of rice per person per month, for 6 -12 months. Support for job training for agricultural labourers who have to change to other jobs because of land confiscation (no specific amount regulated). If the investors have new labour recruitment demands, they must put priority in recruiting labourers whose land is taken by their projects. Support for moving on time: VND 5 million per household. Support for households receiving the State's social benefit support named “<i>Gia dinh chinh sach</i>”⁵: VND1 million per household. <p>This Decree applied to 8 hydropower projects with the combined installed capacity of 1,568.6MW that were started in the 1999-2003 period.</p>	<ul style="list-style-type: none"> Not regulated how the project investors had to develop job training and job creation projects for resettled people and how much should be accounted to the project costs
Decree 197/2004/ND-CP on compensation, support measures and resettlement when the State confiscates land (followed by Circular 116/2004/TT-BTC and Circular 69/2006/TT-BTC)	<ul style="list-style-type: none"> Compensation or support for all land confiscated by the State. Compensation or support for assets on the land and investment in the land confiscated 	<ul style="list-style-type: none"> Support for stabilizing production and life: Money equal to 30kg of rice per person per month in 03 -12 months. Support for job training for agricultural labourers who have to change to other jobs because of the land taking (no specific amount regulated). Support for seeds and animals for the first agricultural crop, agriculture and forestry promotion services, services in plant protection, a vet, agricultural and animal breeding techniques and technical assistance for industrial and trading activities. Assistance in creating some jobs in resettlement areas suitable to local labourers, particularly female labourers. 	<ul style="list-style-type: none"> Not regulated specifically how much the support for job training must be and for how long.

⁵“*Gia dinh chinh sach*”, meaning households with one or more members who are soldiers died or were injured in missions or who contributed greatly to the country, mainly during the wars.

Relevant Decrees/Decisions	Principle	Details on support for moving house and livelihood recovery	Gaps
	<p>by the State.</p> <ul style="list-style-type: none"> • Support for moving, stabilizing life, training for changing jobs and other supports for people whose land was confiscated. • Support for stabilizing production and life in resettlement areas. 	<p>This Decree applied to 47 projects with the combined capacity of 8,113.5 MW that were started in the 2004 – 2008 period.</p>	
Decree 69/2009/ND-CP on land use planning, land price, land confiscation, compensation, support and resettlement	<p>People whose land is confiscated by the State are compensated by land with the same use purpose. If there is not land for compensation, the people are compensated by money equal to their land-use right counted on the land price at the confiscation decision time.</p>	<ul style="list-style-type: none"> • Support for stabilizing production and life: money equal to 30kg of rice per person per month in 6 – 36 months; those conducting agriculture, forestry and aquaculture practices and businesses on the taken land (they do not own the land, only work on it) receive money, which can be as high as the compensation for the taken land; the support for people who owned the land taken by the projects and received land compensation are in forms of seeds for the first agricultural crop, animals, agriculture and forestry services, services in plant protection, a vet, agricultural and animal breeding techniques and technical assistance for industrial and trading activities. • Support for job changing and creation: in case there is no compensation land for those who owned the land taken by the projects, they will receive money in compensation. Besides, they also receive job changing and creation support in form of either: <ul style="list-style-type: none"> ▪ Financial support equal to 1.5 – 5.0 times of agricultural land price for the total agricultural land being taken; though the area being supported must not be larger than the agricultural land limit of the location; or ▪ Support by one piece of land for housing or an apartment or a piece of non-agricultural land for production or trading if the supported people have demands for this land; if the value of the supported land or apartment is less than the support regulated in (a), the value difference is paid by money. Besides, they are also entitled to attend one job training course free of charge. 	

Relevant Decrees/Decisions	Principle	Details on support for moving house and livelihood recovery	Gaps
		<ul style="list-style-type: none"> Hydropower investors must develop job changing and creation programs with opinions of the people who lost their land, and have them approved at the same time with their compensation, support and resettlement programs. These costs will be included in hydropower projects' costs. Other support measures are the same as those in Decree 197/2004/ND-CP 	
Decision 34/2010/QĐ-TTg on compensation, support, resettlement in irrigation and hydropower projects (This decision is implemented on top of the implementation of Decree 69/2009/ND-CP)	Ensuring that resettled people have a living place, a stable life, conditions for production, improving incomes and infrastructure; that their material, cultural and spiritual life is better than that in their old place for long time.	<p>Support for stabilizing life:</p> <ul style="list-style-type: none"> Food support: money equal to 30kg of rice per person per month in 24 - 48 months. Healthcare support: One time free-of-charge healthcare equal to VND30,000 (USD1.43) per person. Education support: 1 set of school books; exemption from tuition fee for 1 year; exemption from school development contributions for 3 years. Lighting support: 1.5 litre of kerosene per person per month in 12 months or money equal to the kerosene value. Fuel support: 3 litre of kerosene per person per month in 12 months or money equal to the kerosene value. <p>Support for production:</p> <ul style="list-style-type: none"> Plantation support: 100% of costs for buying new seeds, fertilizer and pesticides in 2 crops. The level of support is counted on the actual agricultural land and crops; 20 – 50% of total investments in long-time and industrial trees, for not more than 1 hectare per household. Animal breeding support: money for buying two pigs of 10kg each and one 10-month-old cow. Forestry support: On top of existing support for forestry, 50% of investment for forest development counted on the investment of 'keo' tree plantation for 5 – 7 years, for not more than 2 hectare per household. Resettled households receive free training, technical training and supports for building models of planting trees as per the production development program. The support level is in Circular 102/2007/TTLT/BTC-BLDTBXH. Support is provided for: <ul style="list-style-type: none"> leaving the old house: VND3 million/household (USD143) leaving old house on time: VND5 million/household (USD239). households receiving the State's social benefit support: VND2 million. conducting spiritual ceremony for moving tombs for ethnic minorities. 	

Relevant Decrees/Decisions	Principle	Details on support for moving house and livelihood recovery	Gaps
<u>Decree 52/2012/ND-CP on policies on support for job creation and vocational training for labourers whose agricultural lands are confiscated</u>		<p>Support for job changing and job creation for agricultural labourers for 3 years since their land taking decisions become effective. The support include:</p> <ul style="list-style-type: none"> ▪ Job training: <ul style="list-style-type: none"> + Short-term training: 1956/2009/QD-TTg. + College: 1 course ▪ Preferential loan for students. ▪ Domestic job creation: <ul style="list-style-type: none"> + Consultancy for job training and job introduction free of charge at Provincial Job Introduction Centers. + Priority in receiving preferential loans from the national job fund. + Business bases receiving many labourers from land-taken households will receive preferential treatments in land, credit, and tax. ▪ Support for labour export: <ul style="list-style-type: none"> + 100% costs of training for job skills, foreign language, and other knowledge for labour export. + 100% costs for health check, passport, visa and CV. + Money for meals during the training time. + Money for 1 two-day travel by public transport from their home to the training destination if the distance is more than 15 km. + Preferential loans from the Social Policy Bank to pay for expenses for labour export. <p>53 projects with the combined capacity of 10,970MW were and are to be started after 2009.</p>	

4. Forest Losses

4.1 Introduction

Hydropower projects are usually located in areas with forests. Large forest areas have been cleared for use as reservoir and construction sites. According to the Ministry of Agriculture and Rural Development, 19,792 hectare of forest in 29 provinces and cities has been chopped down for the construction of 160 hydropower projects in the period from 2006-2012. That area included 3,060 hectares of protection forest; 4,411 hectares of special use forest; and 12,321 hectares of production forest (MARD 2012).

“In reality, the area of lost forest for the construction of 160 hydropower projects can be larger than 19,792 hectare, because the construction of hydropower projects required more land for resettlement. Those land areas have not been counted...Most hydropower projects have been built in mountainous and upstream areas where natural forests locate. Thus, the loss of the forest lead to changes in natural flows, increase in floods and landslides and affect ecological systems in those areas...Works on bordering and defining corridors for reservoir and dam protections are conducted slowly, which lead to uncontrollable encroachments of flood flow areas and forest loss.” (MARD 2012)

Mitigation measures for forest loss are usually considered in the EIAs of the projects. Costs for mitigating forest loss affects in hydropower projects usually cover:

- Compensation for forest owners for lost forest trees, forest use rights or forest ownership rights.
- Budgets for reforestation, theoretically at the same size as the lost forest.
- Planning and implementing forest loss prevention measures.

However, the real costs of forest loss caused by hydropower projects are much higher than those usually calculated and planned for compensation in EIAs of those projects.

This chapter analyzes the two biggest gaps in calculating the real costs of forest loss caused by hydropower projects, including the underestimated value of lost forests and poor practices of reforestation and/or forest enhancement. Investors are paying for the value of forest directly chopped down for hydropower reservoirs and construction sites but they do not usually pay the full value of the lost forest. This is analyzed in depth in section 4.2. Investors also plan to reforest sites that are to be decided by local authorities to compensate for the lost forest but according to MARD statistics only 735 hectare has been reforested by hydropower investors so far, equal to 3.7% of the lost forest area. This point is analyzed further in section 4.3.

The legal review in section 4.2 shows that the gaps were partly caused by the absence of specific legal regulations until 2008, by then many hydropower projects had been built and vast forest areas had already been chopped down.

4.2. Underestimated value of lost forests

In assessing the value of lost forest due to hydropower projects, investors usually count the value of forest land use rights and the value of forest trees to be chopped down, which are regulated by Decree 48/2007/ND-CP and Circular 65/2008/TTLT-BNN-BTC. They do not count the value of environmental services of the lost forest.

Research in 2008 suggested that the ecosystem services of forests are quite significant, including the values of protecting land and monitoring water resources in upstream areas, scenic value, and their value as carbon sinks and absorbing carbon (see Table 8) (Vu T. P. 2008).

Table 8 - Value of forest in Viet Nam

	Yen Bai	ThuaThien Hue & Quang Binh	Gia Lai
I. Forest environmental service value			
1. Land protection (VND 1,000/hectare/year)	85 – 895	120 - 419	148 - 520
2. Water infiltration and storage (VND 1,000/hectare/year)	189 – 231	116 - 142	36 - 47
3. Preventing wind erosion (VND 1,000/hectare/year)	n/a	525	n/a
4. Forest scenery (VND 1,000/hectare/year)	700 – 2,300	500 – 1,200	200 - 500
5. Carbon sink (VND 1,000/hectare)	35,000 – 84,000	37,000 – 91,000	46,000 – 91,000
6. Carbon absorption (VND 1,000/hectare/year)	400 – 1,300	500 – 1,500	600 – 1,500
Sub – total of I (VND 1,000/hectare)	36,374 – 88,726	38,761 – 94,786	46,984 – 93,567
II. Values of forest product and forest-use rights			
Forest products (VND1,000/hectare)	18.8 – 361.3	19 – 412.4	40 – 338.8
Forest-use rights in 50 years (VND1,000/hectare)	3.9 - 75	7.2 – 84.6	3.8 – 89.7
Sub – total of II (VND 1,000/hectare)	22.7 – 436.3	26.2 - 497	43.8 – 428.5
TOTAL of I + II (VND 1,000/hectare)	36,396.7 – 89,162.3	38,787.2 – 95,283	47,027.8 – 93,995.5

Source: Vu T. P., 2008 p4, 5 & 6; this table is drawn by the authors

The estimations conducted in this study are much higher than the level of compensation for forest losses and budget for reforestation in many hydropower projects. For instance, an average value of VND13.06 million per hectare was estimated for 851.14 hectare of forest land to be submerged by the construction of the Song Tranh 2 hydropower project in Quang Nam province (EVN 2005 p122 & 124). Table 7 is a example of underestimation of forest value in some hydropower projects in Lao Cai province. Another example is the evaluation of forest value in the EIA of Dong Nai 6 & 6A hydropower projects the construction of which are being opposed strongly by environmental experts since these would be too low. The Dong Nai 6 project threatens to permanently flood 197 hectare of Cat Tien National Park and Dong Nai 6A threatens 175 hectare. Yet, their compensation budgets are only VND460 million and VND558 million, subsequently, equal to VND2.3 million per hectare in the former case and VND3.2 million per hectare in the latter case⁶.

The calculation of the services suggested by Dr Phuong in 2008 pointed out that the value is much bigger than that being accounted in hydropower project costs. The absence of the value in calculation

⁶Le A. T. et al. 2012 p32

of hydropower projects' costs has significantly reduced the apparent final costs and shifted the cost to the environment and society.

Table 9 - Compensation for forest loss in some hydropower projects in Lao Cai province

Hydropower Project	Total area of claimed land (hectare)	Area of vacant land being claimed (hectare)	Area of natural forest being claimed (hectare)	Area of grown forest being claimed (hectare)	Total compensation for claimed land (million VND)	Average compensation for 1 hectare of claimed land (million VND)	Total value of 1 hectare of forest in Lao Cai Province*(million VND)
Seo Chung Ho	63.54		30.78	32.75	1,284.78	20.22	36.4 – 89.16
Su Pan 2	12.35	6.08		6.27	315.97	25.58	
Nam Toong	20.79		20.79		325.08	15.63	
Nam Cang	21.09	2.97		18.12	126.45	5.99	

Source: Nguyen V. D., et al. 2010 p9; Vu T. P. 2008. * as suggested in Vu T. P. 2008.

Since 2010, operators of hydropower plants also have to pay a forest ecosystem service fee at VND20 per kWh as regulated by Decree 99/2010/ND-CP. However, this fee is for existing forest from which the reservoirs benefit because forests protect soil, water infiltration and upstream river flow, not for the forest lost or to be lost due to hydropower projects. Before 2010, this fee did not exist. Ecosystems services of the forest in the upstream river basins should be included in operation costs of hydropower stations.

4.3. Poor practices of reforestation and/or forest enhancement

Investors of hydropower projects also plan a fund for reforestation to cover lost forest areas due to their projects. The reforestation is regulated in Decree 23/2006/ND-CP, Article 29. However, the implementation is poor because of land scarcity and the shortages in enforcement by provincial authorities. According to MARD, only 735 hectare of forest has been reforested by hydropower investors so far, equal to 3.7% of the lost forest area (MARD 2012).

“Most local authorities have not seriously implemented the regulation on re-growing forest.” (MARD 2012)

Hydropower projects also cause further forest loss beyond their initial forest loss for the reservoirs and hydropower plant construction. It is because resettled people often rely on their access to forest to make their living. As they are moved to other areas with usually less and worse agricultural land and inadequate support for their livelihood recovery or alternative livelihoods, many of them start to exploit the forest for their immediate needs, including deforestation. Though there are no fully comprehensive and detailed studies, some research has shows for example that *“When not yet receiving land, they still have to deforest for agricultural land. Up to 90% of interviewed households said that they did burn forest for agricultural land.”* (Doan T., 2009 p29). The construction of hydropower plants also opens more ways for loggers and poachers to access further forest areas, including natural reserves with precious flora and fauna. This secondary forest loss is usually not counted in reforestation plans of hydropower projects' investors.

There are many hydropower projects in natural reserves in Viet Nam. *“In one of our studies in 2010, we found that there were at that time on average 2.5 hydropower projects being planned to locate in one natural reserve in Viet Nam. The reserves with the highest number of hydropower projects*

include *Pu Hoat, Sop Cot, Cat Tien, Bu Gia Map and Mu Cang Chai*”, Mr Nguyen Viet Dung, Program Director, Policy and Education in PanNature⁷. The forest loss in those cases is even more serious because the natural reserves’ environmental value is higher than other forests. Hardly any reforestation plans in those cases could recover the loss.

It is concluded that hydropower investors in Viet Nam have not reforested and/or conducted forest enhancement at a significant scale to cover the forest loss caused by their projects, directly and indirectly. The forest loss due to hydropower projects is not mitigated fully. However, there are no in depth studies on this in Viet Nam. It is suggested that more studies on this issue should be done in Viet Nam to facilitate considerations of measures to deal with it.

4.4 Legal review on compensation for forest loss and reforestation in hydropower projects

There are two laws, four governmental Decrees and four ministerial Circulars having regulated compensations for forest loss and reforestation in hydropower projects since 1991. In the period of 1991 – 2004, there were only one law and one governmental Decree regulated the issue by very general principles without specific measures. Detailed regulations on the issue were only issued in 2008. For a long time, the absence of detailed regulations resulted in poor practices of compensation for forest loss and reforestation in many hydropower projects (see Table 10).

It is clear from the list in Table 10 that the legal framework on compensation for forest loss in hydropower projects became more detailed in mid-2008 when Circular 65/2008/TTLT-BNN-BTC on methods of evaluating forests was issued with specific calculation of forest values for compensation. By that time, up to 56% of all hydropower projects, counted by December 2012, with a combined installed capacity of 13,800MW, had been approved and started. In principle, the value of forests chopped down in those projects was not calculated as detailed as those approved after the circular came into force. All forest lost due to hydropower development was not counted for their environmental service value until 2012 when Decree 99/2010/ND-CP and three circulars instructing its implementation were issued.

The list in Table 10 also shows gaps in the current legal frameworks. There are no regulations on recovering forests grown by people which are chopped down for hydropower development, punishing government offices which fail to have reforestation conducted to the full scale, and evaluating forest environmental services of forest areas being destroyed in hydropower projects. Besides, there is no regulation forcing hydropower investors to contribute to protecting or replanting forest being deforested by local people and loggers due to the construction of their plants. Because of those gaps, hydropower investors in Viet Nam have not paid the full scale of forest loss due to their projects.

Hydropower projects have led to substantial forest losses in Viet Nam. The costs of lost forest and reforestation have not been fully calculated in the final costs of the projects. The deficiency in the legal framework on compensations and reforestation for forest loss in hydropower project is one key reason for the situation. The poor practices of calculating the scale and full value of lost forest due to hydropower projects and of mitigating the losses have led to the following risks:

- 1) Serious losses of forest and negative impacts on forest biodiversity;
- 2) More serious floods and droughts in downstream areas due to the reduction of forest coverage;
- 3) Negative impacts on forest-dependent economic activities.

There is no comprehensive study about forest losses due to hydropower in Viet Nam. It is suggested that such a study should be conducted to facilitate improvements in the legal framework and activities

⁷Source: Direct interview with Mr Nguyen Viet Dung conducted by Ms Le Kim Thai on March 8, 2013.

preventing further losses in the future. It is also recommended that in the meantime the implementation of the existing rules on forest protection in hydropower projects should be enforced.

Table 10 - Legal review on compensation for forest loss and reforestation in hydropower projects

Legal document	Main points on compensation for forest loss and reforestation in hydropower projects	Gaps
Law on Forest Protection and Development issued in 1991; and Decree 17/HDBT issued by the Council of Ministers on January 17, 1992 on the implementation of the Law on Forest Protection and Development 1991	Organizations and individuals receiving forest and forest land for using for other purposes must compensate for the values of forest, forest land, labour results, investment result at market prices and as per the situation of forest and forest land. (Law on Forest Protection and Development, Article 13; and Decree 17/HDBT, Article 10)	- No regulation on the State's compensation and mitigation for environmental and social effects of its decisions and activities to change forests to other use purposes, like hydropower development - No regulation on how to calculate the value of forest and forest land for compensation.
Law on Forest Protection and Development (2004)	When the land of natural forest is changed to other use purpose, there must be a plan to grow new forest to ensure sustainable development of forest in each location and in the country (Article 13.2)	- No regulation on recovering the areas of forests grown by people (production forest), once they are changed to other use purposes, like hydropower reservoir and plant
Decree 23/2006/ND-CP, issued by the Government on March 3, 2006, on instructing the implementation of the Law on Forest Protection and Development 2004	Government offices permitting the change of use purpose of forests to other use purposes must ensure reforestation to replace the forest area to be changed to other use purposes. (Article 29.5)	No regulation on enforcement measures from higher State bodies when the in-charge offices fail to enforce reforestation in those cases
Decree 48/2007/ND-CP on principles and methods of evaluating forests; Circular 65/2008/TTLT-BNN-BTC on instructing the implementation of Decree 48/2007/ND-CP	The Decree and Circular regulates principles and methods of evaluating forests, which are used to plan compensation for forest lost in hydropower projects.	No method of evaluating forest environmental services for forest areas, particularly for use in evaluating compensations for forest areas lost or to be lost for hydropower development
Decree 99/2010/ND-CP on policies on payments for forest ecosystem services; and Circular 80/2011/TT-BNNPTNT issued by MARD on November 23, 2011 on instructing methods for counting payment for forest ecosystem services; and Circular 20/2012/TT-BNNPTNT issued by MARD on May 7, 2012 on instructing procedures for accepting payment for forest ecosystem services. Circular 85/2012/TT-BTC issued by Ministry of Finance on May 25, 2012 on financial management scheme for Fund for Forest Protection and Development.	The Decree and Circulars include regulations and instructions for paying forest ecosystem services. Particularly, hydropower plants have to pay VND20 per kWh of their electricity output for forest ecosystem services (Decree 99/2010/ND-CP, Article 11.1a)	

5. Impacts on Biodiversity

5.1 Negative impact on biodiversity

The construction of hydropower plants has caused negative impacts on biodiversity by losses of forests and changes in the river environment. Investors in hydropower projects have listed, and maybe implemented, measures to prevent and mitigate direct negative impacts of their projects on biodiversity of the surrounding areas. However, there are two major impacts that are generally not mitigated properly: blocking of the river flow due to the dams and the forest loss for hydropower plant construction (construction site and reservoir). Construction also which also opens more ways for wildlife hunting in a wider area, for example as access roads are constructed.

Up to 94% of 117 above-30MW hydropower projects and 98% of the total hydropower capacity, including operating, under-construction and planned hydropower plants, are conventional plants with reservoirs and dams that block river flows. Only 6% of the projects and 2% of the capacity are run-of-river hydropower plants, which maintain river flows and travel paths for aquatic organisms. None of the hydropower plants were built or designed to incorporate fish cascades or travel ways for aquatic fauna. Consequently, the habitat of aquatic fauna in those rivers has changed for the worse. This is particularly damaging considering that all main river systems have several big hydropower plants blocking the main streams and many small hydropower plants blocking tributaries. They cause cumulative impacts on aquatic biodiversity that go beyond the impacts of a single project.

“Taxonomic diversity and ecosystem integrity, at the basin level and nationally, are in constant state of degradation resulting from the impacts of multiple dams – an issue not fully understood or appreciated among all stakeholders because of the absence of overall strategic analysis of all projects in the pipeline for all basins in the country.” (Carew-Reid et al. 2010 p27)

Table 11 shows a summary of the effects of hydropower projects on biodiversity in 10 major river basins. The research was conducted by the International Centre for Environmental Management (ICEM) in 2010⁸. All studied river basins were found to have their biodiversity negatively impacted by the development of hydropower projects, from moderate to high levels. The most impacted basins are those of the Ba, Da, Dong Nai and Se San rivers.

Table 12 gives an example of negative impacts of hydropower projects on the Hoang Lien National Park in Lao Cai province through assessment by local forestry officers in the park. Their opinions were collected in a study in 2010 conducted by a group of NGOs. According to local forestry officers, different groups of flora and fauna species in the National Park were at risk or at high risk because of hydropower projects. Bears and other mammals were at such a high risk that they could become extinct.

⁸ Carew-Reid et al. 2010

Table 11 - Summary of effects of assessed hydropower development on biodiversity by river basin

River basin	Terrestrial Ecosystem			Terrestrial Species			Riparian/Aquatic Ecosystems			Riparian/Aquatic Species		
	PA/KBA inundated	Increase in access/threats to PA/KBA	Increase in fragmentation of PA/KBA	Loss of habitat for key species	Increase in threats for key species	Decrease in mobility of key species	Inundation of KBA/PA riparian habitat	Threat to river system of high biodiversity value	Threat of invasive species from other dams	Loss of habitat for key species	Threat to commercial species	Threat to key/endemic species
HIGHER IMPACT RIVER BASINS												
Ba	No	Yes	Yes	No	Yes	No	No	Yes	No	Yes	?	?
Da	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	?	?
Dong Nai	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	?	?	?
Se San	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	?	?
MODERATE IMPACT RIVER BASINS												
Ca	No	No	No	No	Yes	No	No	Yes	No	Yes	?	?
TRa Khuc – Huong	No	Yes	No	Yes	Yes	Yes	No	?	No	No	?	?
Lo – Gam Chay	No	Yes	Yes	No	?	No	No	No	No	No	?	?
Ma – Chu	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	?	?	?
Srepok	Yes?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	?	?
Vu Gia – Thu Bon	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes?	Yes

Source: Carew-Reid et al., 2010 p41

PA: Protected area

KBA: Key biodiversity area

Table 12 - Opinions of three Forestry Officers of Hoang Lien National Park about Hydropower Projects' effects

Criteria	Very high risk “Can become extinct, disappear and never be recovered”	High risk “Reduced, degraded, unable to be recovered, at risk of absolutely disappearing”	Risk “Bad affects, predictable and controllable”	No risk “No bad affect, no need high intervention on the conservation zone”	To be better “Create more favourable conditions for the development of the conservation zone”
1) Integrity and stability of the territory and borders of the conservation zone.	X				
2) Management authority in the conservation zone of the Management Board			X		
3) Natural forest, ecological scenery, flora bed.		X			
4) Quality of surface and underground water		X			
5) Bears and other mammals	X				
6) Pheasants and other bird species		X			
7) Orchids and <i>Rhododendron occidentale</i>			X		
8) Ecological tourism			X		
9) Infrastructure and office of the forest protection station				X	
10) Foreign and domestic investments for the conservation zone		X			
11) Work passion of forestry officers of the conservation zone			X		

Source: Nguyen V. D., et al 2010 p10

EIAs of hydropower projects usually include an assessment of the effects of the projects on wildlife in the surrounding areas. They usually conclude that dams have minor effects after the mitigation measures are implemented, so that the hydropower projects can go ahead with construction. However, a closer look at the mitigation measures for wildlife in the surrounding area of Song Tranh 2 hydropower project, as listed in its EIA, makes it obvious that the mitigation measures are not enough for protecting the wildlife. While it assessed that: *“Tourism service in the reservoir can open and there will be more accesses for human to local ecological and animal systems. Hunting and trapping for local wildlife can happen, which has negative impacts on local wildlife”* (EVN 2006 - 1 p72), the EIA then only includes one mitigation line: *“Prohibiting all hunting, trading and catching wildlife forest animal in the project site and the surrounding area”* (EIA p79). There is no more specific measure on who is responsible for this prohibition and how to implement it. There is no budget line for this mitigation measure. Although the investor can prohibit its workers from doing those activities, it is very difficult to prevent local people from doing so, particularly those losing land due to the project and who have not yet stabilized their lives in the resettlement area. The project opens access to a vast forest area, whilst the project site is as large as 1,893.2 hectare (EVN p53), which makes it easier for loggers and poachers to hunt wildlife. It can be very costly for the investor to implement strictly the proposed measures to protect local wildlife in such a vast area.

5.2 Legal review and recommendations

The poor protection of biodiversity from the negative impacts of hydropower projects come from the lack of regulation on this issue until 2010, whilst the legislative framework is still in the process of improvement. The legal framework includes:

- Law on Biodiversity (2008);
- Decree 65/2010/ND-CP issued on June 11, 2010 with detailed regulations and instructions for the implementation of some articles in the Law on Biodiversity.

So far, no ministerial circular on the implementation of Decree 65/2010/ND-CP has been issued, so the legal framework on this issue has not been completed. Consequently, in hydropower projects, little has been done for protecting biodiversity.

Hydropower development has caused negative impacts on biodiversity. Though there are no specific statistics on the losses, it is obvious that hydropower projects have not implemented sufficient mitigation measures, which makes the projects appear cheaper than they should be as they pose risks of biodiversity loss, affecting the environment and society. The situation is at least partly caused by the incompleteness of the legal framework on protecting biodiversity, specifically in the case of hydropower development.

Research on this issue is mainly qualitative, which only points out the broad trend of negative impacts of hydropower development on biodiversity. It is suggested that more quantitative research should be conducted on this issue to quantify the negative impacts and to make concrete recommendations to address this issue.

6. Dam Safety

6.1 Introduction

There are potential risks from hydropower dam construction and operation in Viet Nam and therefore questions around safety of lives and livelihoods of people in the vicinity of hydropower plants and downstream. The full costs of guaranteeing dam safety are not planned for and implemented in hydropower project construction and operation, and current regulation does not require that. There are shortages in assessing the risks of induced earthquakes in the designing of the dams, as outlined in section 6.2, and gaps in the legal frameworks on guaranteeing dam safety and safe operation of hydropower dams and the enforcement of relevant regulations, as discussed in section 6.3.

6.2 Weaknesses in assessing risks of dam failure and safe operation

Hydropower dams and reservoirs sometimes induce earthquakes in the surrounding areas, especially over the first period after starting operation. *“Since 1931, scientists have found that artificial lakes can cause earthquakes. 0.3% of 10-meter-deep lakes, 10% of 90-meter-deep lakes and 21% of over-140-meter-deep lakes can cause earthquakes”*⁹. The level and effects of the earthquakes vary, depending on factors such as local geological characteristics and reservoir design and construction. One obvious point is that possibilities of induced earthquakes must be carefully estimated and considered in hydropower design, construction and operation. That has not commonly been done in many hydropower projects in Viet Nam.

The EIA of Song Tranh 2 Hydropower Plant (EVN 2006) only includes a half page conclusion about the impossibility of inducing earthquakes at the plant site (EVN 2006, p69)¹⁰. Yet, a short time after the plant started operation in 2011 a series of 52 induced earthquakes happened near the plant site, which peaked at 4.2 on the Richter scale on September 3, 2012 and damaged many houses in the surrounding area. *“Assessment of earthquake possibilities and their prevention measures for hydropower works should not be part of EIAs. They must be in a separate document with careful assessment on the basis of specific measurements”* said Associate Professor, Dr. Pham Hong Giang, Chairman of Viet Nam National Committee on Large Dams and Water Resources Development¹¹. Furthermore, serious water leakage is happening through the dam. This causes concerns about the possibility of dam failure, especially if the plant starts operation.

Under existing regulations, the main responsibility for guaranteeing dam safety is with the investors and owners of hydropower plants and projects while MOIT and provincial DOIT are only responsible for approving hydropower projects and supervising dam safety. This arrangement of responsibilities is weak since there are reports that many investors and owners of hydropower plants/projects do not have sufficient capacity to carry their responsibility and neither do DOITs and parts of MOIT. As is reported on the MOIT website: *“Vice Minister Hoang Quoc Vuong said that in many years, dam safety management has not received sufficient attention...Out of 51 operating above-30MW hydropower plants, only 45 have dam safety registrations, 29 projects have reports on dam safety, 43 projects have dam observation conducted, 33 projects have dam protection plans, 42 projects have plans for dam safety in floods, 8 projects have flood prevention plans for downstream areas. Among 151 operating under-30MW hydropower plants, only 63 have reservoir operation schemes, 32 have dam safety registration, 19 have dam safety reports, 18 have dam sight conducted, 16 have dam protection plans, 18 have dam protection in floods and 20 have flood prevention plans for downstream areas. Among 66 hydropower dams due for safety inspection, only 15 have the inspection completed, 5 are being inspected and 46 have not had the inspection conducted”* (Cong Thuong August 11, 2012).

⁹ Cao D. T. 2012

¹⁰ The conclusion is from Mr Le Tran Chan, who later stated in the local media that he did not make that statement for Song Tranh 2 Hydropower Plant.

¹¹ Interview with Mr Pham Hong Giang on March 3, 2013 conducted by Ms Le Kim Thai

A report by MOIT to the Government in 2010 pointed out that DOITs lack both resources and capacity to fulfil their responsibilities over hydropower plants. *“Because provincial DOITs do not have hydropower specialists, cooperation among provincial offices is not effective, and there are limits in budgets for provincial master plan development, provincial hydropower master plans and basic designs of specific hydropower plants have not met requirements and they usually need adjustments and amendments”*(MOIT, 2010 p3). The report also pointed out that many investors, designers and builders of hydropower projects did not have the sufficient capacity to ensure quality of those works (MOIT 2010 p4). Meanwhile, there is no specific punishment defined for departments, agencies and experts responsible for major mistakes and wrong doings in the design and construction of hydropower works. Consequently, several low-capacity investors and builders continue building hydropower plants whose safety and that of the surrounding people and their livelihoods, as well as the environment are at risk.

Many hydropower dams in Viet Nam have potential safety risks because they are built without specific design to resist induced earthquakes, serious safety supervision by ministerial and provincial authorities, and in some cases, by unqualified investors and builders¹². However, there has not been a full-scale study on this issue to facilitate further investigation. The legal review in the following section will show gaps in the legal framework that are a major cause of this situation.

6.3 Legal review of hydropower dam construction, operation and safety

The concerns regarding safety of hydropower projects and operation is a result of gaps in the legal framework on this issue. There are 16 legal documents related to dam safety in Viet Nam. This section focuses on weaknesses in ensuring dam safety in legislation and the enforcement of rules. This includes the absence of technical requirements for assessing the possibility of inducing earthquakes, insufficient supervision by authorities on dam safety, and shortages of stringent regulations on capacities of investors and builders of hydropower works.

Current legal documents related to dam safety include the following:

- Vietnamese Standard QPTL.C 1-75 on calculating hydraulic power
- Vietnamese Standard TCXD 57-73 on designing bulkheads in water constructional works
- Vietnamese Standard TCN 56-88 on designing concrete dams and steel-enforced concrete dam
- Vietnamese Standard TCXDVN 285-2002 on fundamental standards on designing hydraulic construction works (replaced by QCVN 04-05 2011/BNNPTNT from 2011)
- Law on Electricity, 2004
- Law on Bidding, 2005
- Vietnamese TCXD 375 – 2006 on Designs of structures for earthquake resistance.
- Decision 285/2006/QĐ-TTg issued by the Prime Minister on December 25, 2006 on authority on issuance and implementation of hydropower reservoir operational schemes.
- Decision 30/2006/QĐ-BCN issued by Ministry of Industry (MOI) on August 31, 2006 on regulations on managing investments and constructions of independent power projects
- Decision 37/2007/QĐ-BCN issued by MOI on August 7, 2007 on investment in conditioned industries
- Decree 72/2007/NĐ-CP issued by GoV on May 7, 2007 on dam safety
- Circular 33/2008/TT-BNN issued by MARD on February 4, 2008 on instructing the implementation of some regulations in Decree 72/2007/NĐ-CP
- Decree 112/2008/NĐ-CP issued by GoV on October 20, 2008 on management, protection and comprehensive exploitation of resources and environment in hydropower and irrigation reservoirs.

¹² On November 22, 2012, the dam of Dak Mek 3 Hydropower Plant in Kon Tum Province, which was still under construction, collapsed. The provincial authorities then concluded that the investors and builders did not follow the approved design and built the dam with so little cement that it led to the collapse of 109 meters on a total length of 165 meters (24h November 29, 2012).

- Decree 12/2009/ND-CP issued by GoV on February 12, 2009 on managing construction projects
- Circular 34/2010/TT-BCT issued by MOIT on October 7, 2010 on regulations on dam safety management in hydropower plants.
- Vietnamese Standard QCVN 04-05 2011/BNNPTNT - National technical regulation on hydraulic structures – The basic stipulation for design.

There are no criteria for estimating and calculating possibilities of induced earthquakes in hydropower dam and reservoir design and construction in the official technical standards of hydraulic works in Viet Nam. The Standards on Construction include TCXDVN 285-2002 (issued in 2002) about hydraulic structures, TCXD 375-2006 on Design of structures for earthquake resistance (issued in 2006) and QCVN 04-05 2011/BNNPTNT, issued in 2011 (replacing the TCXDVN 285-2002). The latest Standards include two requirements about considering earthquake possibilities in the design and construction of hydropower dams (QCVN 04-05 2011/BNNPTNT p29 & 49). However, they are not specific about induced earthquakes.

In the current regulations on responsibility of guaranteeing the safety of hydropower plants, including design, construction and operation, the main responsibility is with the plants/projects investors and owners, whilst supervision by authorities (notably DOITs) is often insufficient. The regulations include Decision 30/2006/QD-BCN, Decree 72/2007/ND-CP and Circular 33/2008/TT-BNN. Investors and owners are responsible for their hydropower projects, including design, construction, operation, dam safety measure design and implementation, dam safety check and report to provincial and ministerial authorities (Decree 72/2007/ND-CP). Meanwhile, provincial People's Committees and MOIT are responsible for approving designs and licensing hydropower projects, conduct quality checks and check their safety, and accept the hydropower plants before they are put into operation (Decision 30/2006/QD-BCN and Decree 72/2007/ND-CP). However, the legal documents do not specifically regulate how and how often the provincial and ministerial offices conduct their roles. There is no regulation on punishment of e.g. DOITs if they fail to fulfil their role.

Another gap in the legal framework on hydropower plant construction and operation is the absence of specific and stringent legal requirements for technical and financial capacity and experience of investors, owners and builders of hydropower plants. The legal framework includes the Law on Electricity, the Law on Bidding 2005, Decree 72/2007/ND-CP on Dam Safety Management, Decree 12/2009/ND-CP on Construction Project Management, Decision 37/2007/QD-BCN on Investment in Conditioned Industries and Decision 30/2006/QD-BCN on Managing Investment and Construction of Independent Power Projects. Among those documents, only Decision 30/2006/QD-BCN has regulations for entities and individuals participating in electricity works, but not specifically about hydropower plants¹³.

“There should be very specific regulations about qualifications, capacities and experience of investors and builders of hydropower projects.” Associate Professor, Dr. Pham Hong Giang, Chairman of Viet Nam National Committee on Large Dams and Water Resources Development¹⁴.

There are many gaps in the current legislative framework, in State management roles and responsibility and human resources involved with hydropower dam safety, which allow poor practices by investors, particularly in medium and small-scale dams approved and supervised by the provincial authorities. Consequently, human lives, physical assets and environment in downstream areas are at risk, including serious damage and/or complete losses if a dam failure happens. It is suggested that both legal frameworks and State management capacities in this serious issue should be enhanced to ensure safety for human and environment in downstream areas whose costs cannot just be counted in financial terms.

¹³ Article 5.2: bidders in IPPs have to submit documents of their business registration, project implementation capacity and experience, financial and technical capacity, list of projects implemented in the last 5 years and financial audit report in the last 3 years.

¹⁴ Source: Direct interview conducted by the authors with Mr Giang on March 3, 2013

7. Gaps in EIA Requirements

The above gaps in assessing and mitigating the environmental and social impacts and safety risks of hydropower projects partly result from gaps in the requirements for EIAs. According to the Environment Protection Law (2005), every hydropower project approved after 2005 needs its own EIA, which must be approved before project approval. In other words, the approval of EIAs is a legal condition for hydropower project approvals. However, regulations about the contents of EIAs lack specific requirements. EIAs and their implementation have not been effective in safeguarding and mitigating environmental and social costs and risks of hydropower projects.

Legal document related to EIAs:

- Law on Environmental Protection, issued in 2005
- Decree 80/2006/ND-CP, issued by the GoV on August 9, 2006 on detailing and guiding implementation of the Law on Environment Protection (2005)
- Circular 08/2006/TT-BTNMT, issued by MoNRE on September 8, 2006 on guiding on SEA, EIA and environmental protection commitment.
- Circular 05/2008/TT-BTNMT, issued by MoNRE on December 8, 2008 on guiding on SEA, EIA and environmental protection commitment.
- Decree 29/2011/ND-CP, issued by GoV on April 18, 2011 on regulations on SEA, EIA and environmental protection commitment.
- Circular 26/2011/TT-BTNMT, issued by MoNRE on July 18, 2011 on some details for regulations in Decree 29/2011/ND-CP.

The above legal documents do not include specific requirements about critical aspects such as project alternatives, scoping, data accuracy and source, measuring of impacts, and strict mitigation plans. A comparative study conducted by ERM, an international firm specializing in financial arrangements for energy projects, shows that requirements for EIAs are hollow in comparison with requirements from international financial institutions and banks (Kennish R. and Pham H. 2012). For instance, local EIAs are only required to include assessments of their specific projects while international financial institutes, like the International Finance Corporation (IFC) under the World Bank, require environmental and social impact assessments (ESIAs) which include cumulative impacts and impacts that the specific projects add on top of existing projects or situations. Requirements about an Environmental Management Plan as a part of EIAs do not include a specific and priority action plan with a particular schedule, such as those required by the IFC (also see Annex 1).

In addition to the gaps in EIA requirements, the enforcement of existing regulation is also weak. For instance, the EIA of the Song Tranh 2 hydropower project was approved by MONRE on February 2, 2007 (Decision 137/QD-BTNMT) (MONRE 2012). However, the construction of Song Tranh 2 started one year earlier, on March 5, 2006¹⁵. So the project was approved and started before the approval of the EIA. This fact suggests that the EIA plays at best a minor role in having the project approved and implemented.

EIAs have generally had very limited effect on safeguarding environmental and social impacts of hydropower projects, as their requirements lack details and enforcement is not strict. Consequently, environmental and social costs and risks of hydropower projects are under-estimated and often not mitigated well.

¹⁵ Thanh Nien, March 6, 2006

8. Conclusions and Recommendations

8.1 General conclusions

Hydropower in Viet Nam is not as cheap as currently estimated because many environmental and social costs in hydropower projects are under-estimated or not estimated, and budgets for mitigation measures are too limited. This applies to costs for resettlement and livelihood recovery, compensation for forest loss and direct and indirect negative impacts on biodiversity caused by the projects, and for dam safety and risk mitigation.

Some obvious impacts of dams are not at all mitigated, and some only partially. Particularly the need for alternative livelihoods of affected people is under-recognized: little or no retraining or for example credit for new livelihood activities is being planned and supplied. Cost of land for compensation and resettlement are not always (fully) born by the investment projects. People taking compensation land find that there is no irrigation water available and land is of low quality. Mitigation of forest losses through replanting is not comprehensively implemented even in the cases where that was agreed. Biodiversity losses are frequently dismissed as temporary and minor and no measures are proposed and taken. Dam failure and mismanagement of dams including reservoir operation pose risks for local people as well as downstream people and communities but are usually not considered and therefore not costed for the investment and the operation of hydropower dams.

The failures to fully mitigate social and environmental impacts and reduce risks from hydropower plants leads to risks of poverty among resettled people, increasing forest losses and negative impacts on biodiversity, and possibilities of serious damages and losses if dam failure happens. These arguments are specifically illustrated by the Song Tranh 2 case study in Part 2.

The overall cost-gap cannot be estimated accurately for all dams in Viet Nam and not even for individual cases such as the Song Tranh 2 dam. However, expert judgement is summarized in Table 5 and their judgement is supported by data and analysis in different chapters of this report. This demonstrates that the cost-gap between actual social and environmental impacts and those mitigated as part of hydropower projects is very significant. Full recognition of all costs and implementation of comprehensive mitigation measures should lead to substantially higher cost prices of hydroelectricity production.

The cost-gaps are mainly caused by weaknesses in the current legislative framework as well as weaknesses in their enforcement, including regulations on EIA and EIA enforcement. The causes also include a lack of qualified human resources, in particular regarding dam safety.

8.2 Recommendations

The data and analysis above suggests that the following should be undertaken to address the gaps and weaknesses in hydropower development and operation, and contribute to more sustainable development of hydropower in the country.

1. Review and revise costs estimates for new hydropower plant construction to include all environmental and social costs and risks as well as costs of mitigation of negative impacts; and the full and real costs of maintenance, monitoring and operation of existing hydro-electric power generation plants to minimise impacts on people, livelihoods and natural resources as well as risks.
2. Set up schemes for resettled people displaced by all hydropower projects to receive benefits from the projects, such as a benefit-sharing scheme, at least to the levels of compensation and support regulated in Decree 69/2009/ND-CP and Decision 34/2010/QD-TTg.

3. Regulate and enforce compulsory Social Impact Assessment (SIA) as part of the approval process, besides Environmental Impact Assessment. Existing requirements by the IFC and the Equator Principles for environmental, social and health impact assessments for projects receiving their loans may be a good reference for enhancing requirements about EIAs and SIAs in Viet Nam.
4. Strictly enforce regulations on investors' payments for full-scale and full-price forest loss and compensation for negative impacts on biodiversity caused by hydropower projects.
5. Improve the legal framework for hydropower plant investment and reservoir/dam operation/management, dam safety and safety risk mitigation and their enforcement. This may be partly reflected in the forthcoming revised Law on Environment Protection and/or a separate law.
6. Strictly monitor the implementation of existing inter-reservoir operational schemes and review their impacts on local environment and society; and if necessary adjust those schemes.
7. Implement a comprehensive review and incorporate underestimated and underpaid environmental and social costs in the total costs of hydropower investment and operation. This should be a basis for reconsidering strategies on hydropower and energy development.
8. Strengthen human resource development in MOIT and provincial level DOITs in order to ensure that they have the necessary expertise to undertake the necessary approval process for hydropower plant design, monitoring of construction, and of operation of reservoirs.

PART 2 CASE STUDY OF SONG TRANH 2 HYDROPOWER PLANT

I. Introduction

Song Tranh 2 hydropower project, with an installed capacity of 190MW, is located on the mainstream of the Tranh River in Quang Nam province, which is a part of the Vu Gia – Thu Bon River System in the Central Region of Viet Nam. It was developed and built by Electricity (Group of) Viet Nam (EVN) during 2006 to 2011. After the reservoir was filled with water in 2011, dozens of earthquakes with different magnitudes occurred in the surrounding areas. Water leakages from the dam were discovered in 2012. After many inspections and discussions, the Government of Viet Nam (GoV) has not yet¹⁶ permitted the plant to start operation, causing losses in capital and opportunity cost for the project investment of around VND5,100 billion (USD239.8 million)¹⁷.

A study: *“Analysis on environmental and social costs and risks of hydropower dams, with a case study of Song Tranh 2 hydropower plant”* was commissioned by UNDP in 2012 to GreenID, a Vietnamese NGO. This case study of Song Tranh 2 is a part of the overall study.

This case study shows gaps in the estimation and mitigation of social and environmental costs and risks in the planning, design and construction of this dam and reservoir.

The case study begins by presenting the main indicators and costs calculated for Song Tranh 2 according to its Environmental Impact Assessment (EIA) of 2005 and a media review about reports on problems of Song Tranh 2, which emerged in 2012¹⁸.

The study then analyzes gaps and weaknesses in dam safety assessment; repairs of damage caused by earthquakes triggered by the power plant; the implementation of the compensation and resettlement programme; the prevention of deforestation and negative impacts on biodiversity; and weaknesses in the EIA that was conducted. A table in Appendix 1 compares the planned cost of the project in 2006 and estimated cost of the project if all EIA aspects and gaps would be included.

The case study was conducted using the following methodology:

- A media review: screening and analyzing local media reports on Song Tranh 2 problems (up to December 2012).
- A document review: reviewing and analyzing all available documents on Song Tranh 2.
- A site visit: undertaking a field trip to Bac Tra My District, Quang Nam province (March 5th-7th, 2013) to conduct a series of semi-structured interviews with local people and authorities about their livelihoods and concerns.

¹⁶ As of June 1, 2013

¹⁷ Exchange rate used: 1 USD = VND 20,850

¹⁸ Detailed assessment, design, construction, operation and monitoring reports of the dam and reservoir were not available to the researchers

II. Basic information about Song Tranh 2

This part gives basic information about the Song Tranh 2 hydropower plant, including location, key indicators and key legal documents on the plant's operation.

The Song Tranh 2 hydropower plant is located in Bac Tra My District, Quang Nam Province, on the Song Tranh river, which belongs to the Vu Gia - Thu Bon basin (see Figure 7). Song Tranh 2 construction began in March 2006 and was completed in mid-2011. The design capacity of the reservoir for the hydropower plant was more than 730 million cubic meters of water, making it one of the biggest reservoirs in the central region of Viet Nam (see Table 13). The main dam was built with Roller Compact Concrete technology. The plant has two turbines with a total design capacity of 190MW. The annual electricity output potential is up to 680 million kWh. The investor and owner of the plant is EVN.

Figure 7 - Map showing Song Tranh 2 and all other hydropower projects in the Vu Gia – Thu Bon River System



(Source: Doan T. 2009 p.15)

Table 13 - Main design characteristics of the Song Tranh 2 hydropower plant

	Indicator	Unit	Value
I	Basin		
1	Catchment area	km ²	1100
2	Annual mean flow	m ³ /s	110.5
3	Total annual flow	million m ³ /s	3,500
4	Flood discharge (1,000 year flood)	m ³ /s	14,100
II	Reservoir		
1	Full supply water level (FSL)	M	175
2	Constant water discharge level	M	155
3	Minimum operating water level (MOL)	M	140
4	Highest water level (a 1,000 year flood)	m	178.51
5	Reservoir surface area		
	- At full supply water level (FSL)	km ²	21.52
	- at the highest water level	km ²	23.01
6	Reservoir volume		
	- Total volume	million m ³	733.4
	- Active volume	million m ³	521.1
	- Dead volume (at MOL)	million m ³	212.3
III	Tail water level		
1	Highest tail water level	m	91.8
2	At one unit operational	m	70.9
3	Maximum plant flow	m ³ /s	245.52
IV	Energy		
1	Firm capacity Ndb	MW	41.0
2	Installed capacity Nlm	MW	190
3	Annual production output Eo	million kWh	679.6
V	Salient parameters		
1	Dam		
	Type	Rolled Compacted Concrete	
	Crest elevation	m	180
	Crest elevation of breakwater wall	m	180.5
	Crest length	m	640
2	Water intake		
	Type	Concrete	
	Crest elevation	m	181
	Seal elevation	m	122
	Number of intake		1
	Number of orifice		2
	Orifice dimensions	m	4.75 x 8.5
	Length of intake	m	24.9
	Height of intake	m	63
VI	Project cost	million VND	3,963,402.68
	Construction	million VND	1,661,454.32
	Equipment	million VND	941,710.13
	Compensations and resettlements	million VND	488,488.94
	Project management	million VND	63,826.03
	Other costs	million VND	210,137.13
	Interests for loans within the construction period	million VND	261,224.48
	Contingencies 10%	million VND	336,561.66

Source: EVN 2006, No.1 p.14-15

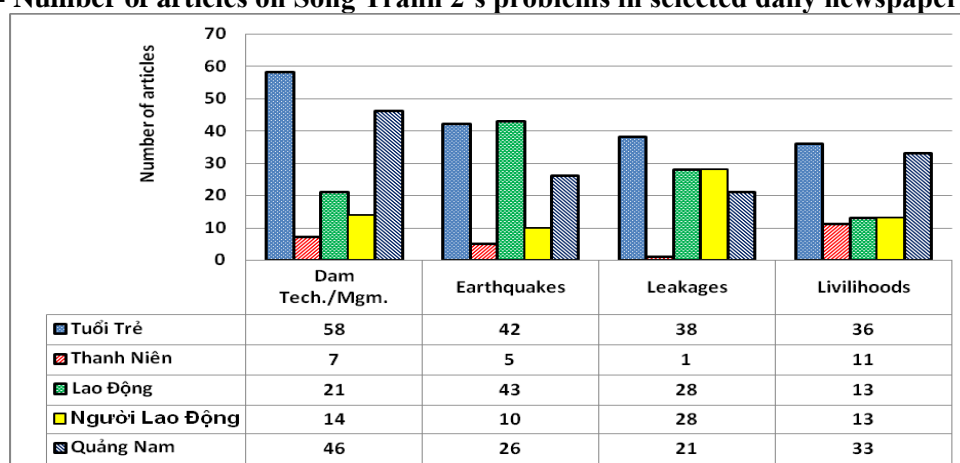
The main legal documents relevant to the operation of Song Tranh 2 reservoir are the following:

- Decision 723/QD-EVN-HDQT¹⁹, issued on December 16, 2005 and 86/QD-EVN-HDQT issued on January 26, 2007 by EVN approving the Technical Designs for Song Tranh 2 in Period 1 and Period 2.
- Decision 5081/QD-BCT, issued by MOIT on September 30, 2010 on the operation of Song Tranh 2 hydropower reservoir.
- Decision 1880/QD-TTg, issued by the Prime Minister on October 13, 2010 on the inter-reservoir operational scheme for A Vuong, Dak Mi 4 and Song Tranh 2 hydropower reservoirs.
- Decision 2805/QD-UBND, issued by the People's Committee of Quang Nam province on August 29, 2012 approving the dam protection plan for Song Tranh 2.
- Decision 7878/QD-BCT, issued by MOIT on December 24, 2012 on the operation of Song Tranh 2 hydropower reservoir in flood season in 2012.
- Decision 5795/QD-BCT, issued by MOIT on October 3, 2012 approving the flood prevention and dam safety guarantee plans for Song Tranh 2.
- Decision 3421/QD-UBND, issued by the People's Committee of Quang Nam province on October 11, 2012 approving the flood prevention plan for downstream area of Song Tranh 2.

III. Media review on the problems of Song Tranh 2

A short time after the plant started operation in 2011, dozens of earthquakes happened in the surrounding areas of Song Tranh 2. The strongest earthquake was 4.7 on the Richter scale²⁰ and occurred on 15 November 2012. At the same time, water leakages were seen on many places on the body of the Song Tranh 2 dam. The problems led to a high number of media reports in 2012. A review of national daily news papers with high circulation, i.e. the *Tuổi Trẻ*, *Thanh Niên*, *Lao Động*, *Người Lao Động*, and one local daily newspaper, the *Quảng Nam*, shows four major concerns in their articles: (1) hydropower dam technical issues and management; (2) earthquakes; (3) water leakages and (4) residents' livelihoods. By using an internet search engine a count was made of articles mentioning related key words for each newspaper's website during the period from 2011 – 2012. Figure 8 summarizes the number of articles that discussed Song Tranh 2's problems. Figure 9 shows pictures of water leakage in March 2013.

Figure 8 - Number of articles on Song Tranh 2's problems in selected daily newspapers



¹⁹ Decision 723/QD-EVN-HDQT was not available for review, but other legal documents are published online

²⁰ The Richter magnitude scale quantifies the energy released during an earthquake. The magnitude is defined as the logarithm of the ratio of the amplitude of waves measured by a seismograph. See: http://en.wikipedia.org/wiki/Richter_magnitude_scale

Figure 9 - Water leaks through Song Tranh 2 dam in March 2012
(Source: VnExpress, March 28, 2012)



The high frequency of media reports on the Song Tranh 2 problems shows public concern for the local people and about the project. The concerns are mainly about the safety of local people and the possibility of putting the plant into operation. These concerns remain as most technical documents about the project and the resolution of these problems are not available for public scrutiny (mid-2013).

IV. Dam safety and operation management

Since the problems on Song Tranh 2 were reported widely in the local media, the GoV has conducted many activities to fix the water leakages and to guarantee the safety of the dam under different scenarios, including earthquake possibilities. However, the GoV has not (yet) published for public scrutiny the main documents about the repairs needed or undertaken and the dam safety plans, resulting in continuing media and public concerns about the dam.

IV.1 Water leakage

A press release by the National Acceptance Council of Construction Works on September 27, 2012 reported that there were water leakages in all of the 30 contraction joints in Song Tranh 2 dam. Ten major cracks led to a total leakage of 26.2 litres per second. Twenty small cracks led to a total leakage of 0.015 litres per second. The water seepage through the dam's foundation was estimated at 4.2 litres per second (National Acceptance Council of Construction Works 2012).

Government bodies hired a Chinese agency to fix 10 places with serious leakages on the dam while the Institute for Building Science and Technology of Viet Nam fixed 20 places with less serious leakages. After the leakages repair, the GoV hired AF-Colenco, a Swiss consultancy firm, to inspect and examine the dam safety, including construction quality and its capacity of withstanding earthquakes under different scenarios. A press release by the National Acceptance Council of Construction Works on September 27, 2012 confirmed that the water leakages were through contraction joints²¹ of which more than 90% were reduced by September 2012. However, the inspection report by AF-Colencos is not available for public review.

Meanwhile, domestic experts still disagree with one another about the seriousness of the water leakage through Song Tranh 2 dam. Some say that they are acceptable and were fixed properly. Some say that they are dangerous and not fixed properly.

“Water leaks do happen in dams but they are often small quantity and collected within the dams. When water leaks through a dam, particularly in big quantity, it is a dangerous sign of the dam's poor quality,” said Associate Professor, Dr. Pham Hong Giang, Chairman of the National Committee on Large Dams and Water Resources Development²².

“It is clear that the leakage was only through contraction joints, which can be caused by some faults in construction in those areas only and do not affect the dam safety. The leakages have also been fixed.” Mr. Tran Dinh Sinh, an expert on hydraulic works in the No.1 Power Engineering Construction and Consultancy Company under EVN²³.

So far, there is no consensus on the dam's safety regarding water leakage. The public concerns remain unsolved and the GoV has not yet permitted filling of the reservoir. The plant is operating on the river flow only.

IV.2 Earthquakes and aftermath

The series of earthquakes in 2012 caused cracks in houses and public buildings in Bac Tra My district and concerns for safety of local people in the area. Although the press release of the National Acceptance Council of Construction Works says that the Song Tranh 2 dam passed tough quality checks, it has not eliminated such concerns.

The press release of the National Acceptance Council of Construction Works of September 27, 2012 confirmed that the dam is capable of withstanding earthquakes up to level 8 (220cm/s) on the

²¹ There are 30 contraction joints designed along Song Tranh 2 dams (one every 20 meters)

²² Source: Direct interview with Mr. Pham Hong Giang conducted by Ms. Le Kim Thai on March 3, 2013

²³ Source: Direct interview with Mr. Tran Dinh Sinh conducted by Ms. Le Kim Thai on April 15, 2013

Medvedev–Sponheuer–Karnik (MSK) scale²⁴, which is higher than the highest possibility of earthquake level 7 (150cm/s) on the MSK scale, which is estimated to happen once every 4750 years in the area (National Acceptance Council of Construction Works 2012). The series of earthquakes in the plant area peaked in 2012 at level 6 on the MSK scale. However, the final report of AF-Colenco – the Swiss consulting firm independently examining the dam – is not available for public review. The GoV has not permitted the reservoir filling even after it confirmed that the dam is safe.

The earthquakes caused cracks in local houses and buildings with an estimated total damage of VND3.7 billion (USD177,458). The provincial road No. 616 was damaged, too, which cost around VND20 billion (USD959,232) to repair²⁵. The Management Board of Song Tranh 2 is planning to provide each household whose house was cracked due to the earthquakes with a cash support of VND 2-4 million (USD95.9 – USD191) for repairing the cracks, and it plans to fund the repair of Road No. 616.

However, the damage to the area cannot just be counted in money. An official of Bac Tra My district said that because of worries about earthquake possibilities, many investors leave the district and stop their investment, officials want to move to other areas, families move their children to their homeland. He also said that local ethnic minorities do not want to continue saving money because they think that if the dam fails, they will die. *“In this village, most ethnic minority households sell their cows and buffaloes because they are afraid that they could be swept away by flood if the dam fails. Many families withdraw their banks savings for immediate expenses because they think that they can die at any time,”* said an ethnic minority man in Village No4, Tra Tan commune, Bac Tra My district²⁶.

By the end of October 2012, the Red Cross of Quang Nam province and the Hydropower Project Management Board No3 organized six training courses on earthquake response for local people. However, those activities do not stop local people’s concerns about the possibility of earthquakes.

The concerns are understandable because the public has no access to plans on dam safety guarantees for Song Tranh 2. The plans were not developed and approved until the third quarter of 2012, one year after the plant started operation and when several earthquakes and water leakages had already happened in the area.

The decisions on Song Tranh 2 dam safety include:

- Decision 2805/QD-UBND issued by the People’s Committee of Quang Nam province on August 29, 2012 approving the dam protection plan for Song Tranh 2.
- Decision 5795/QD-BCT issued by MOIT on October 3, 2012 approving the flood prevention and dam safety guarantee plans for Song Tranh 2.
- Decision 3421/QD-UBND issued by the People’s Committee of Quang Nam province on October 11, 2012 approving the flood prevention plan for downstream area of Song Tranh2.

A review of the EIA of Song Tranh 2 project found evidence of poor assessment of earthquake risks in the area. The Song Tranh 2 dam is located in an area with geological tectonic fault lines²⁷. But the EIA only included four lines about the possibility of earthquakes in the area²⁸. It does not include scientific analyses on geological stability in the locations of the main structural works of Song Tranh 2, nor warnings about the potential for geological changes during the construction and operation of Song Tranh 2. The review about the possibility of induced earthquakes through dam and reservoir

²⁴ The Medvedev–Sponheuer–Karnik scale, also known as the MSK or MSK-64, is a macro-seismic intensity scale used to evaluate the severity of ground shaking on the basis of observed effects in an area of the earthquake occurrence. The scale was first proposed by Sergei Medvedev (USSR), Wilhelm Sponheuer (East Germany), and Vít Kárník (Czechoslovakia) in 1964. (Source: http://en.wikipedia.org/wiki/Medvedev%E2%80%93Sponheuer%E2%80%93Kárník_scale)

²⁵ Source: DOIT Quang Nam province 2013

²⁶ Direct interview conducted by GreenID staff during the field trip to Song Tranh 2 area from March 5-7, 2013

²⁷ EVN 2006 No1 p.34-35

²⁸ EVN 2006 No1 p.37

construction and operation is only based on some general conditions for induced earthquakes²⁹ and concludes that “*there is not a possibility of induced earthquake in Song Tranh 2, which will not cause environmental risk*”³⁰. Song Tranh 2 was designed when the Vietnamese Standards TCXD 375 – 2006 for Designs of Structures for Earthquake Resistance were not yet issued.

It remains unclear whether the Song Tranh 2 dam is safe and whether the reservoir should be permitted to start filling. Without public accesses to the technical documents of the controversial dam, the public concerns about the dam safety are likely to remain, which has negative impacts on local people and the economy.

V. Recovering livelihoods

For the construction of Song Tranh 2 plant, 3,249 hectares of agricultural and forestry land were confiscated and 1,046 households had to resettle in new areas in Bac Tra My and Nam Tra My districts in Quang Nam province³¹. Recovering livelihoods has been a continuing concern of local people as they were involuntarily resettled for the plant construction. There have been limitations in land compensation and support for resettled people when compared to their rights and expectations, which remain unfulfilled until now.

V.1 Compensation policy written in the EIA Song Tranh 2 in 2006

- The households will be resettled in other areas in the same districts of Bac Tra My and Nam Tra My.
- Each household will receive a piece of land of 1,000m², including 400m² for a yard around a house and 600m² for a garden.
- Each household will receive 1.2 – 1.5 hectares of agricultural land and 1.5 – 2 hectares of forest land.
- Each household will receive a house:
 - + Household of 6 persons and more: 54m²
 - + Household of 3-5 persons: 50m²
 - + Household of 1-2 persons: 25m²Each house will also have additional area for kitchen (9m²), bathroom (3m²) and toilet (3m²)³².

The total investment of Song Tranh 2 was planned in 2005 to be VND 4,150.44 billion (approximately USD207 million). The total environmental and social mitigation budget was planned to be VND 488.49 billion, equal to 12% of the total investment (see also Table 14 and Table 15).

²⁹ These are general conditions for induced earthquakes to happen in hydropower reservoirs, not specifically for Song Tranh 2. The conditions were presented by Mr Le Tran Chan in a workshop in 1998. (Source: <http://m.kienthuc.net.vn/tin-tuc/201209/Thuy-dien-Song-Tranh-2-May-ong-ay-lieu-qua-881630/>)

³⁰ EVN 2006 No1 p.69

³¹ Source: Quang Nam Province People's Committee 2012, Appendix 3

³² EVN 2006 No1 p.125-127

Table 14 - Budget for compensation and resettlement related to the construction of Song Tranh 2 hydropower plant, as per the EIA of Song Tranh 2, 2006

	Criteria	Unit	QTY	Price per unit (mln VND)	Expense (million VND)
A	RESERVOIR AREA				438,127
1.	Compensation				150,642
1.1	Sanitary works, bathrooms, cages and kitchens		1,042	15	15,630
1.2	Compensations for land value differences				17,939
1.3	Compensation for non-staple crops and fish ponds				61,259
1.4	Roads	km	15.6	3,000	46,800
1.5	Electrical grids 22KV	km	4.6	400	1,840
1.6	Unforeseen quantities		5%		7,173
2.	Building residential area				254,359
2.1	Land clearance for building resettlement area				18,781
2.2	Building houses in the resettlement area	house	1,042	70	72,940
2.3	Uncovering and dissolving bombs, landmines and chemical toxics				25,891
2.4	Levelling land and building fields				13,579
2.5	Building irrigation works				10,706
2.6	Building transport works				72,500
2.6.1	Building inter-commune roads	km	25	2,000	50,000
2.6.2	Building inter-village roads	km	31	500	15,500
2.6.3	Building other transport works (bridges, canals, ports and boats)				7,000
2.7	Building electrical system for domestic use				12,088
2.8	Water supply system for domestic use	well	1042	7	7,294
2.9	Architecture works				8,468
2.10	Unforeseen works		5%		12,112
3.	Support for resettlement				33,126
3.1	Support for movement	household	1,042	2	2,084
3.2	Food support (30 kg of rice/month/person in 12 months)	person	5,379	1.8	9,682
3.3	Support for production and agriculture development	household	1,042		16,672
3.3.1	Support for agriculture development	household	1,042	3	3,126
3.3.2	Investment in growing annual crops				13,546
	- Cinnamon	household	1,042	5	5,210
	- Other long-term trees	household	1,042	3	3,126
	- Material forest	household	1,042	5	5,210
3.4	Support for on-time movement	household	1,042	2	2,084
3.5	Support for welfare-benefit households	household	104	5	520
3.6	Other support (moving village and tombs)	household	1,042	2	2,084
B	CONSTRUCTION SITE				6,945
	A + B				445,072
	Expense for surveys and designs	%	2		8,901
	Expense for management	%	2		9,079
	Total				463,053
	Value-added tax on building the resettlement area				25,436
	TOTAL EXPENSE AFTER TAX				488,489

Source: EVN 2006 No1 p.140

V.2 Compensation in practice

In March 2013, some months after the surge of discussions about Song Tranh 2 in the local media cooled down, GreenID staff made a field trip to Bac Tra My district to conduct a series of semi-structured interviews with resettled people and local authorities about their livelihoods. It was found that the actual compensation received by the resettled households have been less than those detailed in the resettlement plan in the EIA, causing difficulties for resettled people to recover their livelihoods.

Out of the 1,046 households who had to resettle due to the construction of Song Tranh 2, 429 households moved to the resettlement areas assigned for them by the provincial authorities while 617 households moved to other areas of their own choice. Each household in the resettlement area received 1,000 m² for homestead and garden, with a ready-built house on it. Those moving to other areas received compensation of VND8,000 (USD0.38) per m² of their lost house and garden.

Only 28 households moving to the resettlement area accepted land compensation for their lost agricultural land. The province assigned 42 hectares of agricultural land for the compensation, or 1.5 hectare per household on average³³. The remaining 1,018 households accepted financial compensation for lost agricultural land. The average compensation was VND4,000 (USD0.19) per square meter of agricultural land in flat areas, VND2,000 (USD0.09) per square meter of hilly agricultural land. As of the end of 2012, the provincial authorities had not compensated them for their lost forest land³⁴.

Some households used the money to buy land in the province or moved to other provinces, and many of them now do non-agricultural work. Those receiving land compensation complained that the compensated agricultural land is far from water resource and without irrigation system, which makes it impossible for them to grow crops. They have not received any forest land to conduct forestation, whilst households have lost their livelihoods related to their old land. As a result, many households have had to cut forest trees for crop land and for taking forest products for sale. Although local authorities did implement programs to introduce aquaculture (fish cages) in the reservoir for resettled people, local people have not yet been able to make stable income out of this practice.

“In the old place, my household had 8 hectare of rice field and hill land. Now in the new resettlement area, we only received 1,000 m² of land for house and garden, no land for rice field. We only received very low compensation, including VND1,000 (USD0.04) per m² of hilly cultivation land, VND2,000 (USD 0.09) per m² of vacant land, VND4,000 (USD0.19) per m² of forest land, VND8,000 (USD0.38) per m² of house and garden, VND4,000 (USD 0.19) per m² of fish pond surface, VND400,000 (USD19.18) per cinnamon trees with diameter of 30cm and VND3,000 (USD0.14) per cinnamon tree of 1-2 years old. We are not happy with the compensation”

(NVD, 60 years old, Tra Bui commune)³⁵

Local people (i.e. people who were compensated financially and yet stayed in the locality, as well people who chose to be compensated with land), as well as commune officials said that local life had changed a lot for the worse³⁶. According to the People's Committee of Tra Bui commune, the ratio of poor households among the total number of households in the commune increased from 0.4% in 2012 to 8.76% in 2013. Ethnic minority households become poor after using up the compensation money from Song Tranh 2.

³³ Source: Quang Nam Province People's Committee 2012 Appendix 1

³⁴ Source: Quang Nam Province People's Committee 2012 Appendix 1 and Appendix 3

³⁵ Source: direct interview by GreenID with Mr NVD in Tra Bui Commune, Bac Tra My district, Quang Nam, 6-7 March 2013

³⁶ Source: Interviews and group discussions with local people in Tra Tan and Tra Bui communes in Bac Tra My district, Quang Nam province on March 6-7, 2013. The interviews and group discussions were conducted by GreenID staff.

The field research findings are consistent with the findings of a resettlement study of the Song Tranh 2 project in 2009. This study³⁷ reported that in Tra Bui commune 674 households, or 77% of its total 875 households were resettled for Song Tranh 2 plant construction. By 2009 most of the resettled households had not received agricultural and forestry land in the resettlement areas³⁸. The little agricultural land near the resettlement area was narrow and had steep slopes, while more level land was far from the resettlement area. Garden land for the resettled people had many stones, making it difficult for the households to garden. Commune and district authorities acknowledged that negative impacts had been happening in the community, including illegal deforestation for creating crop fields and the selling of timber, increasing unemployment and theft, as well as illegal gold mining. Many resettled households were selling their houses to move to places where they have better access to agricultural land (Doan T. 2009 p.28-30).

The findings show that the land-for-land compensation and resettlement in Song Tranh 2 was not fully conducted as proposed in the EIA, mainly due to the shortage of quality land for compensation. The EIA did not propose any job creation or vocational training program for resettled people. It is assumed that no such program has been implemented by the EVN. The livelihoods of resettled people were not fully stabilized. This social cost of the project is being loaded on the shoulders of resettled people, instead of the project's investor.

Table 15 - Environmental and social risks reported in the EIA of the Song Tranh 2 project (EVN, 2006) with mitigation measures and budget for environment

		MITIGATION COSTS (million VND)		
RISKS	MITIGATION MEASURES	Compensation & resettlement	Environmntal management and supervision	Environment protection
I. DURING THE CONSTRUCTION PERIOD				
Changes in geological surface of the area	<ul style="list-style-type: none">Limits on digging and cutting in geological surface of the area.Re-growing local plants.	<ul style="list-style-type: none">N/A		
Air pollution	<ul style="list-style-type: none">Spraying water during field levelling works.Covering trucks transporting construction materials by large coverage mats.Ensuring that means of transport and construction equipments pass quality checks.Building two 0.3ha garbage dumps		8.77	
Noise pollution	<ul style="list-style-type: none">Implementing noise control measures in order to meet Vietnamese Standards of TCVN5949:1998, TCVN 3254:1989, TCVN 3255:1986, TCVN 6962:1998		3.45	
Water pollution	<ul style="list-style-type: none">Implementing measures to control clean and safe use of oil, petrol and lubricantsProcessing waste water to meet Vietnamese Standard TCVN980:2001 before discharge	<ul style="list-style-type: none">N/A		
Waste pollution	<ul style="list-style-type: none">Separating organic and non-organic domestic wastes and dumping them in proper dumping places.Clearing wastes in construction site.		60	
Effects on ecological	<ul style="list-style-type: none">Prohibiting deforestation, wildlife hunting and fishing by electricity and chemicals		16.8	

³⁷ The study covered resettled households in Tra Bui commune, Bac Tra My district, Quang Nam province, where 77% of 875 households in the commune had to resettle for the Song Tranh 2 hydropower plant construction.

³⁸ Doan T. (2009)

RISKS	MITIGATION MEASURES	MITIGATION COSTS (million VND)		
		Compensation & resettlement	Environmental management and supervision	Environment protection
system in the project site	<ul style="list-style-type: none"> Replanting 851.14 hectare of forest Recovering flora in soil and stone mines after the excavations are completed. 			
Soil erosion			60	
Safety during the construction	<ul style="list-style-type: none"> Exploring and dissolving bombs, landmines and chemicals. Implementing fire and explosion prevention measures. Implementing labour safety measures 			10,000
Losses of minerals in the reservoir bed	<ul style="list-style-type: none"> Exploiting all minerals in the reservoir bed before filling the reservoir with river water 	• N/A		
Public health	<ul style="list-style-type: none"> Intensifying healthcare and disease prevention measures 		120	
Making report	<ul style="list-style-type: none"> 		30	
II. DURING OPERATION PERIOD				
Land erosion in the basin	<ul style="list-style-type: none"> Developing forest around the reservoir and the basin Preventing deforestation around the reservoir 		60	
Water pollution	<ul style="list-style-type: none"> Clearing plants, residential construction and chemicals in the reservoir bed 		17.64	3,664.46
Water loss through dam	<ul style="list-style-type: none"> Building a water-proof layer of 4-5 meters under the concrete dam which allows maximum leakage of 0.03 litres per minute 	N/A		
Short of water flow after dam	<ul style="list-style-type: none"> Discharging a minimum amount of 4.4m³ per second through the dam in dry season 	N/A		
Dam problem	<ul style="list-style-type: none"> Implementing national and American standards in designing and building the dam, including TCN 56-88, QPTL.C 1-75, TCXD 57-73, EM 1110-2-2200, ER 1110-2-1806, AC1 207.5R-99 Installing dam observation system 		50	
Resettlement of local people	<ul style="list-style-type: none"> Compensation Investments in building resettlement areas and support for recovering the livelihoods of resettled people 	488,493.94		
Loss of forest	<ul style="list-style-type: none"> Replanting 851.14 hectare of forest (VND1.5 million per hectare) 			1,276.7
Effects on ecological system in the project site			16.8	
Public health			90	
Making report			30	
TOTAL EXPENSE		503,998.56		

Source: EVN 2006 No1 p.45–88 & 96

VI. Loss of forest and negative impacts on biodiversity

The plant construction has caused forest loss beyond the initial estimated area, and negative impacts on biodiversity. The impacts have not been mitigated properly, leading to risks to the local environment.

According to the EIA of 2006, the reservoir of Song Tranh 2 was planned to flood 2,446.9 hectare of land, including 1,042.1 hectare of agricultural land, 781 hectare of annual crops, 256.3 hectare of long-term trees, 5 hectare of aquaculture ponds, 81.14 hectare of natural forest and 734 hectare of production forest. To make the construction site for Song Tranh 2, 220 hectare of land was cleared, including 32 hectare of agricultural land and 133 hectare of forest³⁹. In reality, 3,249 hectares of agricultural and forestry land were confiscated for the project⁴⁰.

The average forest value of VND13.06 million (USD626.37) per hectare was estimated for 851.14 hectare of forest land to be submerged in the reservoir of Song Tranh 2 hydropower project in Quang Nam province (EVN 2006 No1, p.122 & 124). That estimation was lower than the value of forests in Thua Thien Hue and Quang Binh provinces in the same (central) region, being VND38.78 million (USD1,859) per hectare⁴¹.

As a consequence of facing instability in their livelihoods, many relocated people are now involved in illegal deforestation for timber and forest products and to clear land for cultivation. The field research found that three households have been brought to a court and 15 resettled people were reprimanded for illegal deforestation activities. Local authorities in Bac Tra My district also expressed their concerns about increasing deforestation by resettled people. That practice has contributed to extending the area of forest lost by the project and caused more negative impacts on the local biodiversity.

The EIA included a budget to replant 851.14 hectare of forest with the cost of VND1.5 million (USD71.9) per hectare. This rate is very low compared to the VND4 million (USD191.8) per hectare in the first four years regulated in Decision 5246/QD-BNN-LN in 2003.

In the planning process towards the construction of the dam, the authors of the EIA concluded: *“dust pollution is not significant”* (p.46); *“insignificant impact to air quality of the project site”*, *“impacts on water quality of Song Tranh is not significant and can be mitigated”*, *“the construction of Song Tranh 2 does not cause significant impacts to flora systems in the project site. The impacts are long term and will be partly mitigated”*, *“[impacts on wildlife] are unavoidable...small and temporary”* (EVN 2006 No1 p.46-55). Those conclusions lead to mitigation measures as shown in Table 15 which were short of specific implementation steps and particularly without a specific budget for their implementation⁴².

A closer look at the mitigation measures for wildlife in the surrounding area of Song Tranh 2 hydropower project, which are listed in its EIA, shows gaps in the mitigation measures planned for protecting wildlife. While it asserts that: *“Tourism service in the reservoir can open and there will be more accesses for human to local ecological and animal systems. Hunting and trapping for local wildlife can happen, which has negative impacts on local wildlife”*,⁴³ the EIA then only includes one line on mitigation: *“Prohibiting all hunting, trading and catching wildlife forest animals in the project site and the surrounding area”*⁴⁴. There are no specific measures proposed on how the investor will enforce the prohibition. There are also no specific budget lines for mitigation measures in this case. Although the investor can prohibit its workers from being involved in those activities, it is very difficult to prevent local people from so doing, particularly those losing land due to the project and

³⁹ EVN 2006 No1, p.52-53

⁴⁰ That area included 1790 hectares of agricultural land and 1,459 hectares of forestry land. However, it was unclear whether all of the forestry land actually had been forested. Quang Nam Province People's Committee 2012 Appendix 3

⁴¹ Estimated by Dr Vu Tan Phuong from the Vietnam Institute for Forestry in 2008 (Vu T. P., 2008)

⁴² Comments from Dr. Dao Trong Tu and Dr. Le Anh Tuan who are members of the team conducting this case study

⁴³ EVN 2006 No1 p.72

⁴⁴ EVN 2006 No1 p.79

who have not yet been able to stabilize their lives in the resettlement areas. The project site itself was planned to be as large as 1,893.2 hectare⁴⁵, and the project opened access to a large forest area, which made it easier for local people to hunt wild animals. It can be very costly if the investor would have implemented strict and effective measures to really protect local wildlife in a large area.

There is no separate study about the impact of Song Tranh 2 on fish and fauna in the Tranh River. However, as it is the second biggest hydropower plant among the eight hydropower plants with a capacity of more than 30MW in the Vu Gia – Thu Bon River System, it may be surmised that the reservoir will significantly contribute to negative impacts on the fish and fauna system which were assessed to be devastating: *“Imposing 8 major and 34 minor hydropower developments on a single river system appears certain to devastate the fish fauna. It will prevent crucial migrations, directly degrade or alter aquatic habitats, disrupt meta-population dynamics of habitat specialists, fragment populations of widespread species, and alter nutrient flows and dynamics.”*⁴⁶

Loss of forest and negative impacts on biodiversity caused by the construction of Song Tranh 2 were not fully calculated and mitigated. These costs would add significantly to the total cost of the project.

VII. Conclusions

The poor mitigation of social and environmental risks in Song Tranh 2 is evidence of poor enforcement of regulations on those issues. The Song Tranh 2 EIA was approved by MONRE on February 2, 2007 by Decision 137/QĐ-BTNMT (MONRE 2012). However, the construction of Song Tranh 2 started around one year earlier, on March 5, 2006⁴⁷. In other words, the project was approved and started long before the approval of the EIA. This suggests that the EIA played no serious role in project approval which is likely to undermine the commitment to formulation as well as implementation of environmental and social mitigation measures.

Neither the EIA, nor plans or measures on providing water for irrigation and drinking water to people in the downstream area or to the resettled people have been made available publicly for review, also not after approval⁴⁸. From these documents it is assumed that the dam is only operated for power generation purposes and neglects water-use needs of downstream areas. This can lead to negative impacts on agricultural production and on human lives in the downstream areas- damage that cannot be evaluated immediately. Experience from some other hydropower plants in Viet Nam suggests that water-use needs of downstream areas are only considered and partly met by hydropower plant operators after heated discussions and interventions at the ministerial level⁴⁹.

The construction and operation of Song Tranh 2 has caused serious losses for local people and environment, which go well beyond the mitigation costs estimated in the 2005 EIA, especially in terms of risks of dam failure and for example damage to local houses as a result of the tremors caused by the dam construction. The latest update of the actual cost of the project is about VND 5,100 billion (USD239.8 million)⁵⁰, though this is not yet the final figure, which should also include the costs of the

⁴⁵ EVN 2006 No1 p.53

⁴⁶ Sheaves M., et al 2008 p21

⁴⁷ Thanh Nien March 6, 2006

⁴⁸ This refers to the following decisions:

- Decision 2805/QĐ-UBND, issued by the People’s Committee of Quang Nam province on August 29, 2012 approving the dam protection plan for Song Tranh 2.
- Decision 5795/QĐ-BCT, issued by MoIT on October 3, 2012 approving the flood prevention and dam safety guarantee plans for Song Tranh 2.
- Decision 3421/QĐ-UBND, issued by the People’s Committee of Quang Nam province on October 11, 2012 approving the flood prevention plan for downstream area of Song Tranh 2.

These decisions are available online, but the online versions do not include the plans that they approved.

⁴⁹ The hottest debate on water-use purposes so far is the one between Dak Mi 4 Hydropower Plant and people and authorities in Da Nang City. For further details see <http://thanhtra.com.vn/tabid/77/newsid/66362/temidclicked/34/seo/dua-van-de-thieu-nuoc-ra-Quoc-hoi/Default.aspx>

⁵⁰ Source: DoIT, Quang Nam, 2013

recent assessments of damage and risks as well as dam repairs that are discussed above, as well as repairs of local people's houses following the tremors reported in 2012.

As this text describes, many problems related to the recovery of livelihoods for resettled people, replanting forest land and preventing further deforestation remain unsolved. Compensation paid for lost land of different kinds was low even by local comparison; costs estimated for replanting were lower than the levels prescribed in regulation. Land given as compensation is of low quality and without access to irrigation water; forest land has not been given in compensation. The EIA and actual implementation of the project did not support vocational training or job creation whilst the majority of people evicted from their land have been forced to seek alternative livelihoods in the area and elsewhere. Costs to fish fauna, forest and terrestrial wildlife have not been estimated and virtually no mitigation measure was proposed or implemented

If all costs for assessments, repairs, and especially for implementing proper social, environmental and risk mitigation measures are counted, they would add significant amounts to the final cost of the project. Also, better pre-project studies that would have included assessment of geological risks, as well as risks of dam failure and mismanagement for local and downstream populations would have been more expensive. And many actual costs and risk to local people and their livelihoods as well as the environment are not costed and unpaid. Some not-yet-counted costs are estimated in Appendix I, and other costs that should have been made but cannot be confidently estimated by this research are also listed. A crude estimate is however that if everything would have been better assessed, more comprehensive mitigation measures would have been made, and all appropriate mitigation measures would have been implemented then the actual costs of the hydroelectric plant would have to be considerably higher when compared to the total estimated in 2005.

Appendix I Planned and suggested costs for Song Tranh 2 (million VND)

Note: The boxes in green are additional costs (not included in the EIA) or changed costs (included in EIA at lower quantity, and changed to higher quantity).

PLANNED COST IN 2005						SUGGESTED COST (Research 2013)				
	Criteria	Unit	Planned QTY	Price per unit (mln VND)	Expense (mln VND)	Suggested criteria	Unit	Suggested QTY	Suggested price / unit (mln VND)	Suggested expense (mln VND)
I	COMPENSATION AND RESETTLEMENT					COMPENSATIONS AND RESETTLEMENT				
A	<i>Reservoir area</i>				438,127	<i>Reservoir area</i>				
1	Compensation				150,642	Compensation				
1.1	Sanitary works, bathrooms, cages and kitchens		1,042	15	15,630	Sanitary works, bathrooms, cages and kitchens	household	1,046	15	15,690
1.2	Compensation for land value differences				17,939	Compensation for housing land and gardens (value of resettlement land)	household	1,046	230	240,580
1.3	Compensation for non-staple crops and fish ponds				61,259	Compensation for non-staple crops and fish ponds	household	1,046	58.8	61,504
						Compensation for agricultural land (value of agricultural land in resettlement area)	household	1,046	276	288,696
						Compensation for forest land (value of forest land compensated to households in resettlement area)	household	1,046	207	216,522

PLANNED COST IN 2005						SUGGESTED COST (Research 2013)				
	Criteria	Unit	Planned QTY	Price per unit (mln VND)	Expense (mln VND)	Suggested criteria	Unit	Suggested QTY	Suggested price / unit (mln VND)	Suggested expense (mln VND)
						Compensation for value of lost forest chopped down for the plant construction	hectare	851.14	67	57,026
						Budget for replanting and/or enhancing forest for the area of forest being chopped down for the plant construction.	hectare	851.14	38.78	33,007
						Contribution to preventing further deforestation related to the plant construction.	forest guard	5	600	3,000
						Contribution to mitigating negative impacts on biodiversity related to the plant construction.	forest guard and aquaculture expert	20	600	12,000
1.4	Roads	km	15.6	3,000	46,800	Roads	km			46,800
1.5	Electrical grids 22KV	km	4.6	400	1,840	Electrical grids 22KV	km			1,840
1.6	Unforeseen quantities		5%		7,173	Unforeseen quantities		5%		48,833
2	Building residential areas				254,359	Building residential areas				
2.1	Land clearance for building resettlement area				18,781	Land clearance for building resettlement area				18,781

PLANNED COST IN 2005						SUGGESTED COST (Research 2013)				
	Criteria	Unit	Planned QTY	Price per unit (mln VND)	Expense (mln VND)	Suggested criteria	Unit	Suggested QTY	Suggested price / unit (mln VND)	Suggested expense (mln VND)
2.2	Building houses in the resettlement area	house	1,042	70	72,940	Building houses in the resettlement area	household	1,046	100	104,600
2.3	Uncovering and dissolving bombs, landmines and chemical toxics				25,891	Uncovering and diffusing bombs, landmines and chemical toxics				25,891
2.4	Leveling land and building fields				13,579	Levelling land and building fields				13,579
2.5	Building irrigation works				10,706	Building irrigation works				10,706
2.6	Building transport works				72,500	Building transport works				72,500
2.6.1	Building inter-commune roads	km	25	2,000	50,000	Building inter-commune roads				50,000
2.6.2	Building inter-village roads	km	31	500	15,500	Building inter-village roads				15,500
2.6.3	Building other transport works (bridges, canals, ports and boats)				7,000	Building other transport works (bridges, canals, ports and boats)				7,000
2.7	Building electrical system for domestic use				12,088	Building electrical system for domestic use				12,088
2.8	Water supply system for domestic use	well	1,042	7	7,294	Water supply system for domestic use	well	1,046	7	7,322
2.9	Architecture works				8,468	Architecture works				8,468
2.1	Unforeseen works		5%		12,112	Unforeseen works		5%		17,322
3	Support for resettlement				33,126	Support for resettlement				

PLANNED COST IN 2005						SUGGESTED COST (Research 2013)				
	Criteria	Unit	Planned QTY	Price per unit (mln VND)	Expense (mln VND)	Suggested criteria	Unit	Suggested QTY	Suggested price / unit (mln VND)	Suggested expense (mln VND)
3.1	Support for movement	household	1,042	2	2,084	Support for movement	household	1,046	3	3,138
3.2	Food support (30 kg of rice/month/person in 12 months)	person	5,379	1.8	9,682	Food support (30 kg of rice/month/person in 48 months)	person	5,399	7.2	38,872
3.3	Support for production and agriculture development	household	1,042		16,672	Support for production and agriculture development				
3.3.1	Support for agriculture development	household	1,042	3	3,126	Support for agriculture development	household	1,046	3	3,138
3.3.2	Investment in growing annual crops				13,546	Investment in growing annual crops				
	- Cinnamon	household	1,042	5	5,210	- Cinnamon	household	1,046	20	20,920
	- Other long-term trees	household	1,042	3	3,126	- Other long-term trees	household	1,046	20	20,920
	- Material forest	household	1,042	5	5.21	- Material forest	household	1,046	20	20,920
3.4	Support for on-time movement	household	1,042	2	2,084	Support for on-time movement	household	1,046	5	5,230
3.5	Support for welfare-benefit households	household	104	5	520	Support for welfare-benefit households	household	104	5	520
3.6	Other support (moving village and tombs)	household	1,042	2	2,084	Other support (moving villages and tombs)	household	1,046	2	2,092

PLANNED COST IN 2005						SUGGESTED COST (Research 2013)				
	Criteria	Unit	Planned QTY	Price per unit (mln VND)	Expense (mln VND)	Suggested criteria	Unit	Suggested QTY	Suggested price / unit (mln VND)	Suggested expense (mln VND)
						Support for job changing and job creation	household	1,046	828	866,088
B	Construction site				6,945	Construction site				6,945
	A + B				445,072	Sub-total				2,378,040
	Expense for surveys and designs	%	2		8,901	Expense for surveys and designs		2%		47,560
	Expense for management	%	2		9,079	Expense for management		2%		47,560
	Total				463,053	Pre-VAT total				2,473,161
	Value-added tax on building the resettlement area				25,436	Value-added tax on building the resettlement area				36,375
	Total expense for compensation and resettlement after tax				488,489	Total expense for compensation and resettlement after tax				4,982,698
II	CONSTRUCTION				1,661,454	CONSTRUCTION				1,661,454
III	EQUIPMENT				941,710	EQUIPMENT				941,710
IV	PROJECT MANAGEMENT AND OTHER EXPENSES				535,188	PROJECT MANAGEMENT AND OTHER EXPENSES				535,187
V	UNFORESEEN EXPENSES 10%				336,562	UNFORESEEN EXPENSES 10%				336,561
						FIXING PROBLEMS IN THE DAM IN 2012				47,000
						COMPENSATION FOR HOUSES BEING CRACKED DUE TO EARTHQUAKES IN 2012				5,500

PLANNED COST IN 2005						SUGGESTED COST (Research 2013)				
	Criteria	Unit	Planned QTY	Price per unit (mln VND)	Expense (mln VND)	Suggested criteria	Unit	Suggested QTY	Suggested price / unit (mln VND)	Suggested expense (mln VND)
						OPPORTUNITY COST OF THE TOTAL INVESTMENT BECAUSE OF THE DELAYED OPERATION OF SONG TRANH 2 PLANT		10%	2	1,702,022
						ASSESSMENT OF TECHNICAL PROBLEMS AND RISKS (TREMORS, LEAKAGES)				
						MITIGATING NEGATIVE IMPACTS OF SONG TRANH 2 ON OTHER WATER-USE NEEDS IN DOWNSTREAM AREA				
						DEVELOPING AND IMPLEMENTING DAM SAFETY, FLOOD PREVENTION AND DAM FAILURE SIMULATION PLANS FOR DOWNSTREAM AREA				
	GRAND TOTAL				3,963,403	GRAND TOTAL				10,212,135
	GRAND TOTAL IN USD (million)				190.09	GRAND TOTAL IN USD (million)				489.79

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