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Hydropower development and natural resource allocation between competing users and uses: evidence from Southeast Asia and Africa

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Abstract

Hydropower development is a key energy priority in low and middle income countries as a means to increase energy access and promote national development. Nevertheless hydropower dams can also negatively impact people's livelihoods by reducing access to local natural resources such as land, water and food. This paper analyses local resource use competition between different uses (food, energy, livelihoods) and users (villagers, urban settlers, local government and dam builders) in selected case studies in Asia and Africa, namely Kamchay dam in Cambodia, Bakun dam in Malaysia and Bui dam in Ghana. It illustrates from a political ecology perspective how divergence between national priorities of energy production and local development needs can result in the unequal distribution of costs and benefits between the national and local scales.

Introduction

In the pursuit of climate change mitigation and energy access hydropower is experiencing a new renaissance (World Bank, 2013). 1.3 billion people world-wide do not have access to electricity and 2.7 billion people rely on traditional biomass – such as fuel wood and dung- for basic needs such as cooking and heating. At the global level, Sub-Saharan Africa and developing Asia account collectively for 97% of the total population without access to electricity (IEA, 2015). In Southeast Asia the population without access to electricity is estimated at 120 million, in Sub-Saharan Africa at 634 million. Energy poverty is therefore wide-spread and poses a development challenge to countries in Africa and Southeast Asia. The need to ensure energy security in the forms of electricity and modern cooking fuels is recognized as critical in Africa and Asia to the achievement of the Millennium Development Goals (MDGs). To increase energy access in the last years, new large hydropower projects have been planned all over the world and Southeast Asia and Africa are the most targeted continents. Africa holds about 12% of the world's hydropower potential, with a technically feasible output of about 1,800 TWh/year. Yet Africa produces only about 3% of the global hydropower and exploits less than 10% of its technical potential, the lowest proportion of any of the world's regions (Appleyard D., 2014). Therefore, many large hydropower dams are being built or considered in Africa (International Rivers, 2015a). On the same direction, Southeast Asia countries plan to construct 61 gigawatts (GW) of new hydroelectric generating capacity through 2020 (Mayes, 2015). As a result, 72 new projects have been planned in Laos, 10 in Sarawak, Malaysia and at least 60 new projects are under consideration in Burma and in Cambodia (International Rivers, 2015b).

Despite the importance of large dams for improving energy access in energy poor countries, water provision for irrigation and the production of clean energy, the interrelated dynamics between human populations and the environment are severely affected by the construction of big infrastructure projects such as dams (WCD, 2000; Tullos et al., 2013; Tilt et al., 2009). The severity of adverse impacts on local populations depends to some extent on how mitigation strategies are being implemented to secure a balanced natural resource access between competing users and uses. This paper aims to discuss the impacts of large dams on natural resource access and local resource use competition between different uses (food, energy, livelihoods) and users (villagers, urban settlers, local government and dam builders) in selected case studies in Asia and Africa, namely Kamchay dam in Cambodia, Bakun dam in Malaysia and Bui dam in Ghana. All dams are financed and built by Chinese banks and companies, highlighting the importance of Chinese actors in the hydropower sector in Asia and Africa. Chinese dam-builders are directly involved in the construction of 333 overseas dams all over the world according to the latest International Rivers' database on Chinese overseas dam projects (International Rivers, 2013). The majority of these dams are located in Asia (57%, mainly in Southeast Asia, 38%), followed by Africa (26%), Latin America (8%), Europe (7%, mainly Eastern Europe) and the Middle East and the Pacific (1% each). Most of these dams are located in environmentally and socially high-risk areas, such as remote rural areas affected by poverty; areas with high biodiversity values, such as natural parks; or areas highly important for the supply of food and livelihoods to local populations, such as the Mekong River system or other rivers (Ziv et al., 2012). Linkages between water and land use, energy production and access, food security and governance of the impacts are at the core of the analysis. The paper illustrates from a political ecology perspective how divergence between national priorities of energy production and local development needs can result in the unequal distribution and conflicts over access to resources, such as water, land, and forest. It suggests that the principles of distributive justice (fairness in the distribution of access to natural resources) and procedural justice (fairness of procedures in terms of opportunities for participation in the decision making process of affected communities), should be taken into account by dam builders and developers from early stages of project management to achieve a more equitable distribution of costs and benefits of such projects (Marques et al., 2015).

The analysis draws on extensive research and fieldwork in Cambodia, Ghana, Malaysia and China funded by the UK Economics and Research Council's (ESRC) Rising Powers programme (ESRC reference ES/J01320X/1).

Conceptual framework and methodology

Conceptual framework

This paper uses the political ecology framework (Wolf 1972, Greenberg and Park 1994) as a basis for analysing the conflicts caused by the varied forms of appropriation and control over the access to natural resources such as land, water and energy (Bryant and Bailey 1998, Blaikie 1985, Peet & Watts 2004; Tan-Mullins, 2007). Bryant and Bailey (1997) developed three fundamental assumptions in practicing political ecology in developing countries. First, costs and benefits associated with environmental change are distributed unequally. Second, this unequal distribution inevitably reinforces or reduces existing social and economic inequalities. Third, the unequal distribution of costs and benefits and the reinforcing or reducing of pre-existing inequalities holds political implications in terms of the altered power relationships that result. Large dam construction is usually associated with irreversible social and environmental changes, whose costs and benefits are often not equally distributed between conflicting users (such as affected communities, urban settlers, local government and dam builders) and uses (such as livelihoods, energy and food production). Usually people displaced for large dam construction cannot live in the immediate vicinity of their previous settlement and have to change their customary economic models, cultural traditions and existing social ties (Terminski, 2015). In the case of people affected by dam construction, restoring livelihoods and readapt to places which are very far away from the previous settlement is a very difficult and long-term process. The same problems apply to people who, even though do not need to be resettled, after the construction of large dams lose their access to important livelihood assets, such as land, forest and water. Moreover, compensation of material and non-material conditions for affected people often results problematic and poorly managed by the local governments, dam builders and financiers, particularly in the global south. The most common problems are lack or poor compensation for people who do not have legal rights to the land they live on or use for their livelihoods and inadequacy of compensation for property and assets left behind or lost. From a political ecology approach this paper discusses the costs and benefits associated to the construction of large dam projects in low and middle income countries and their social consequences, in terms of livelihood impacts, compensation issues and access to resources, such as land, water, energy and food for the affected communities.

Methodology

The research involves an interdisciplinary, multi-sited, comparative case study approach. We selected three dams as case studies in Southeast Asia and Africa. The dams are the Bui dam in Ghana, the Kamchay dam in Cambodia, the Bakun dam in Malaysia. Each of these dams involves the Chinese as dam developers, and has a capacity of more than 50MW. The methodology includes detailed fieldwork at the three dam sites and in China. We conducted 69 semi-structured in-depths interviews with local communities directly affected by the dam through resettlements and/or changes to livelihoods, 28 focus group consultations with the same affected communities (of which 50% with women and 50% with men). The 4 affected communities interviewed in Ghana are farming and fishing communities resettled after the construction of the dam (Bator, Bui, Gyama and Dokokyina). The affected communities interviewed in Cambodia are Bat Kbal Damrei, Mortpeam, Ou Touch, Snam Prampir, Tvi Khang Cheung. These communities rely mainly on farming, fishing and the collection of forest products, such as timber, wild fruits and bamboo. The major ethnics group resettled due to the Bakun dam are the Kayan and Kenyah, 3 longhouses were chosen to represent them, namely Uma Belor and Uma Balui Ukap (Kayan), as well Uma Badeng (Kenyah). The minority ethnic groups who were included in the study were the Lahanan, Ukit and Penan. We also conducted 42 interviews with institutional actors from the national and local governments and NGOs in Ghana Cambodia and Malaysia, as well as 23 interviews with Chinese actors such as Sinohydro, regulators and financiers. Table 1 shows the number of interviews carried out for each case study.

Table 1 Interview setup

Targets	Methods	No of interviews	Further details
Affected local communities at Dam sites	Focus groups	Cambodia: 10 Ghana: 11 Malaysia: 7	50% women; 50% men
Affected individuals from local communities	Semi-structured interviews	Cambodia: 24 Ghana: 25 Malaysia: 20	Men and women
Institutional actors	Semi-structured interviews	Cambodia: 19 Ghana: 15 Malaysia: 8	National/local government, NGOs
Chinese actors	Semi-structured interviews	23	Sinohydro, regulators and financiers

We also conducted a multi-level stakeholder mapping to identify key stakeholders engaged in Chinese overseas hydropower projects for each of the host countries. This required several stakeholder mappings at the national levels and the Chinese side. We used the Net-Mapping Approach for the stakeholder analysis to determine key stakeholders, direct and indirect links to other stakeholders and power relations (Schiffer and Hauck, 2010).

We also compiled secondary data to assess the environmental impacts of dams and their governance implications by examining the Environmental impact Assessment (EIA) reports of the dams. We analyzed the qualitative data obtained through interviews and FGDs by categorizing and coding the sources as a means of comparing and contrasting interpretations of events (Wolcott, 1990). We used the Nvivo 10 software to analyse the interview and focus group consultation data. These were analysed using narrative analysis (Wiles et al, 2005) rather than conventional 'code and retrieve' since the former allows for more layers of embodied meaning to be revealed by including narrative style. This allows us to compare several cases to be able to draw parallels from similar findings and flag up any differences (Yin, 2009). Table 2 shows the Nvivo coding tree structure used for analysing the individual interviews and FGDs in which references are the number of selections within each source that have been coded to any theme and sub-theme.

Table 2 Coding structure using Nvivo

Coding structure	Cambodia		Ghana		Malaysia	
	Sources	References	Sources	References	Sources	References
Compensation	10	34	7	18	7	19
Social impacts						
Energy access	29	280	21	26	15	34
Livelihood changes	18	45	52	118	1	1
Improvement of livelihood	8	36	6	11	12	37
Decreasing livelihood	18	102	23	52	13	46
Shifting livelihood strategies	11	48	17	30	11	42
Social network	12	40	5	10	10	48
Education	26	90	12	13	17	56
Health care	5	21	17	21	13	19
Lifestyle, access to road & market	13	47	6	10	11	33
Interactions with immigrants	2	6	24	44	11	17
Employments	31	407	0	0	0	0

Life changes	11	20	20	43	13	28
Ecological impacts						
Water flow and quality	35	124	1	1	11	23
Flooding	26	86	6	7	5	10
Decreased water flow	4	9	1	2	2	3
Fish stocks and aquatic life	27	85	7	10	3	5
Fauna and flora	8	10	16	25	9	12
Environmental protection	5	10	3	3	5	5
Land	27	112	19	34	7	17
Other environmental impacts	0	0	18	20	0	0
Access to local resources	29	301	22	42	17	106
Expectations						
Past	21	66	27	61	9	14
Future	25	87	33	75	13	30
Involvement and consultation						
Resettlement	8	17	21	35	12	25
Compensation	14	74	23	53	16	117
Complaint	23	130	27	58	9	31
Conflicts	8	18	13	18	11	38
Interaction and communication	9	60	30	74	15	115
Cultural impacts	0	0	17	30	9	31
Other challenges	25	365	20	65	8	13

Case studies

The three case studies, the Bui dam in Ghana, the Kamchay dam in Cambodia and the Bakun dam in Malaysia have been selected for their social and environmental vulnerability, as specified below.

Bui dam

The Bui dam has a power generating capacity of 400MW, a net average energy production of 980 gigawatt hours/year (GWh/yr) and cost an estimated US$621 million. The power generated by the Bui dam is delivered by three new transmission lines to the national grid. The electricity is mainly used to satisfy the energy demand of Accra and other urban areas. The dam started operation in 2013 (Environmental Resources Management, 2007). The builder of the Bui dam is Sinohydro, the Chinese dam construction leading company for overseas projects, and the developer is the Ghana Government. The Bui dam project in Ghana is an Engineering, Procurement and Construction (EPC) / Turn-key Project Contract, which means that once the infrastructure is finished the Ghanian government becomes immediately the owner of the project. The Bui dam is the largest Chinese-funded project and the largest foreign investment after the Akosombo Hydroelectric Power Project in Ghana. The project has been jointly funded by the Government of Ghana, the Chinese Exim-Bank via a commercial loan and buyer's credit, as well as the Government of China via a concessional loan (International Rivers, 2014). For the payment of the loans there is a trade agreement between China and Ghana, in that Ghana is paying back the loans to China's Exim-Bank with revenues derived from cocoa production (Dwinger, 2010). There are a range of environmental and social issues related to resettlement of the local population, building the dam in a National Park and threatening the habitat of the endangered species, such as the endemic black hippo (Hensengerth 2011). As a result of the construction of the

dam six villages have been inundated and 1 partially inundated. This means a total of 1,216 people have been relocated from their old settlement to new settlements. Moreover, an additional four villages with about 7,500 people have lost access to portions of farmland and forests due to inundation and/or construction work in the dam site area (Environmental Resources Management, 2007). For what concerns environmental impacts, they are mainly associated with constructing the dam in Ghana's largest protected area, changing the natural river flow of the Black Volta River and the inundation of parts of the Bui National Park. Due to the creation of the reservoir, 23,450 ha of riverine forest and adjacent savannah woodland have been permanently lost. This equals about a quarter of the total forest and woodland area within the national park. As a consequence riparian gallery forest and savannah habitats have been fragmented causing negative impacts on vegetation reproduction and wildlife (Environmental Resources Management, 2007).

Kamchay dam

The Kamchay Dam is the first large hydropower dam in Cambodia. The Department of Environment in Kampot province claims that the dam can supply up to 60% of Cambodia's energy demand, at least in the wet season. The Kamchay dam has a generating capacity of 193MW and the expected annual output is 498 GWh, however in the dry season the generating capacity may be as low as 60 MW, which is less than a third of the nameplate capacity (NGO Forum, 2013). The electricity produced by Kamchay dam is mainly used to satisfy the energy demand of the capital city, Phnom Penh. This dam is a 'classical' Sinohydro-ExIm Bank project, similar to most Chinese overseas dams. The dam cost an estimated US$280 million and is financed by China ExIm Bank as part of a US$600 million aid package to Cambodia. The dam is based on a concessional loan from ExIm Bank that has to be re-paid with 6% interest rates (International Rivers, 2010). The Kamchay dam contract between Sinohydro and the Cambodian government is a Build, Operate, Transfer contract (BOT). Sinohydro will transfer the ownership of the dam to the Cambodian government after 44 years, in 2050. As in the case of Bui dam, even though resettlement did not take place, there are a range of reported environmental and social issues related to loss of livelihoods of the local population, dam construction in a National Park and late Environmental Impact Assessment (EIA) approvals (International Rivers, 2014). The dam is located on the Kamchay River in Bokor National Park. Again, as in the case of Ghana, the dam is located in a protected area that is the habitat of endemic and rare species (Middleton, 2008).

Bakun dam

The Bakun dam is the first and largest dam in Borneo, Malaysia. It is the third largest concrete face rock filled dam in the world. It is located in the tropical rainforest in Belaga District, East Malaysia, Sarawak, on the river Balui. The dam development includes a reservoir occupying 14,170 km^2, which corresponds to 12% of Sarawak State. The reservoir is the biggest in Malaysia. The area is a biodiversity hotspot and the habitat of many endemic and endangered species, including the orang utan. The Bakun dam has a generating capacity of 2,400MW and an estimated cost of US$2.6 billion. The financiers are thought to be ExIm Bank, while the developers are the Malaysia-China Hydro Joint Venture consortium composed of Malaysian Sime Darby, Chinese SOE Sinohydro and others. Sinohydro is also the builder. The dam operator is the Malaysian utility company Sarawak Hidro. The electricity is mainly used to satisfy the energy demand of urban areas in Sarawak. As in the case of Bui dam the contract is an Engineering, Procurement and Construction (EPC) / Turn-key Project Contract. Bakun is the first of a series of large dams built in a biodiversity hotspot in Borneo's tropical rainforest and on the land of the indigenous Orang Ulu people. A total of 15 longhouses composed of 9,000 indigenous people from the upper Balui river, including some semi-nomads, had to be resettled into sedentary settlements at Sungei Asap for the dam construction. Approximately 50% of the impoundment area of the Bakun dam is lands claimed under customary rights (Sovacool and Valentine 2011). The cost of resettlement was funded by the Federal Government. The actual implementation of resettlement was undertaken by the State government (interview Sarawak Hidro 29 June 2015).

Results

This section presents the results obtained by analysing the interviews and focus group discussions with affected communities. Table 3 summarises the main issues related to the positive and negative impacts on access to natural resources perceived by local communities in the three case studies. Land scarcity, reduced land fertility and land insecurity are some of the negative impacts affected villagers have perceived after the construction of the dam. Moreover, access to important natural assets needed to support local livelihoods, such as NTFPs, have become more problematic for indigenous people after the construction of the dam due to the presence of land enclosure put in place by private companies and dam builders. On the contrary, energy access has improved for resettled communities in Ghana and Sarawak, Malaysia. However, in the case of Cambodia there are still households located close to the dam without access to electricity. The following sections discuss the results with details form each case study.

Table 3 Positive (benefits) and negative (costs) impacts of large dams on affected communities in relation to access to land, food, forest products, water and energy

	Negative impacts (costs)			**Positive impacts (benefits)**		
	Bui	**Bakun**	**Kamchay**	**Bui**	**Bakun**	**Kamchay**
Access to land	Land scarcity; Reduced land fertility; Land enclosure	Land scarcity; Increased distance to access agricultural plots; Land enclosure; reduced land fertility	Land enclosure			Reduced flooding
Access to forest products	Reduced access to NTFPs; Increased distance to access NTFPs	Reduced access to NTFPs; Increased distance to access NTFPs	Reduced access to NTFPs; Increased distance to access NTFPs; land enclosure			
Access to food	Reduced food self-sufficiency; Commodification of food	Reduced food self-sufficiency; Commodification of food	Reduced food self-sufficiency; Commodification of food	Improved access to markets	Improved access to markets	Improved access to markets
Access to energy			Not energy access for all	Energy access	Energy access	Energy access
Access to water	Increased distance to access the river for fishing; Water scarcity and competition	Increased distance to access the reservoir for fishing; Decreased water quality	Decreased water flow and quality			

Access to land, food and forest products

In the case studies analyzed we found that the main sources of concern of the affected communities are land scarcity and access to forest products. Access to land for farming has dramatically decreased after resettlement in the Bui dam and Bakun dam case studies. This is causing problems either in terms of food self-sufficiency, community members after resettlement rely more on the market for food provision, or in terms of the possibility of engaging in commercial farming activities. Moreover, land fertility in the resettlement sites has also been mentioned by affected villagers as a huge problem.

In the case of Bakun dam, after resettlement each family was provided with 3 acres of land in the resettlement sites as compensation for the lost land in the reservoir area of the dam where people had free access to customary land. This land was cultivated mainly with rice and vegetables for subsistence purposes and it was enough to support family needs: *"After we moved here, the land is just 3 acres. In our old place, our land was large and they replaced it with only 3 acres. In one family there are so many siblings and the land is not enough for one family or for family expansion"; and "the 3 acres were used up during the first year we moved here with pepper, cocoa and other cultivations. Now, we want to plant rubber and oil palm, but the plot it's not enough, it is already full. If we want to plant outside the three acres, they will prohibit us"* (quotes from FGD with men in Uma Badeng). Issues of land fertility in the resettlement sites have been also mentioned by the villagers interviewed: *"almost everything is not suitable to be planted here, vegetables as well. The only thing that is suitable is oil palm trees, but there is not enough space to plant them in the three acres of land"* (quote from man respondent in Uma Juman). Difficult access to the three acres of land received by the government as compensation is also an issue for the resettled communities. Land allocated to resettled communities is often located far away from the resettlement site and there is no proper road to access the land. Some villagers reported that they have to walk for two hours to reach their lands: *"Regarding the agricultural plots, some villagers were unable to plant. It is impossible for you to walk for two hours carrying 50kg of fertilizers. At the old place we used waterways"* (quote from man respondent in Uma Juman).

In the case of Bui dam, complaints from the villagers interviewed were similar to the ones reported by resettled villagers in Malaysia as indicated in the following quotes: *"the land allocated to me over here is not enough, my land is about one and half acre" (*quote from FGD with male in Akanyakrom resettled village*) "Currently land for farming would be inadequate if people want to engage in commercial farming" (*quote from male respondent in Bui resettled village*) "land is very scarce here" "land shortage will continue [...] especially when every young man wants a plot to farm" (*quotes from the chief of Jama resettled village*).*

In terms of land fertility in the resettlement site the following quotes from villagers interviewed at the Bui dam resettlement site are also relevant: *"Previously [before resettlement] I was able to harvest 1000 tubers of yam, presently we can't harvest more than 30" (*quote from FGD with men in Dokokyena resettled village*).* Moreover, in terms of food self-sufficiency: *"Previously when we were at Nsuoano [near the river bank], we weren't buying food" (*quote from FGD with female in Jama resettled village*) and "Food stuff has become very expensive. In the old village, we use to get yam for 2 Cedis but today, yam goes for 10 Cedis for about three pieces" (*quote from male respondent in Bui resettled village*).*

Moreover, some resettled villagers in Sarawak, Malaysia reported that they do not have land titles in the resettlement sites, so they cannot sell the land and they are afraid about the fact that without titles the government could reclaim their lands in the future: *"(title for land) It is not freehold grant. This is TOL (Temporary Occupational License) grant. It expires within a fix period of time. Sixty years only. When the expiry date comes, the land is no longer ours. It can be renewed but there is a chance we would have to pay. I heard we have to pay at least RM30,000 for the three acres. This is what scares the villagers. The land was promised to us for a lifetime. Turns out, there's an expiry date. When that expiry date comes, how are those people who have no money going to renew the license*?"(quote from men respondents in Uma Badeng resettled longhouse).

In terms of access to food, the presence of land enclosures by private planting companies, such as oil palm and rubber companies (in the case of Sarawak, Malaysia) or dam builders (in the case of Ghana) make it difficult for resettled communities to access the lands surrounding the resettlement sites. This is restricting their ability to hunting and fishing, as reported in the following quote from a villager in the resettlement site in Sarawak, Malaysia: *"In the up river (old place), it was easy for us to find food and here the entire compounds have been blocked (by plantation and logging companies). We cannot go through the company's compound (because) they control it and there are gates for every company. We have to go to the old place to find the source of food. In the Ulu (upriver), we were free to catch fish, go farming and we were not limited as we are here"* (quote from FGD with men in Uma Badeng resettled longhouse). As a result, resettled communities are more dependent on the market for food provision and life is in general more costly in the resettlement area. Therefore, for some villagers who do not have access to remunerative jobs, such as the elderly and women, livelihoods have decreased, as reported in the following quotes:

"You must use money for everything here. When I was at the old place, at least I would get some income whenever I go hunting, fishing or searching for rattans" (quote from FGD with men in Uma Ukit resettled longhouse).

"In our old home, it was easier for us to earn a livelihood. We didn't use money. Now, that we have moved here we need to use money. If we go to the market to buy vegetables, buy meat, how could we live? Even transportation to the market costs RM5" (quote from man respondent in Uma Bakah resettled longhouse).

"Our lives were easier there. If we wanted to catch fish, it was easy. Here, we need to use money to even buy fish at the market" (quote from female respondent in Uma Belor resettled longhouse).

"We older people cannot farm as much as we did before. We raise chickens and pigs nearby. Now we no longer feed ourselves" (quote from female respondent in Uma Belor resettled longhouse).

Similarly in the case of Bui dam, access to fish is a source of concern of the affected communities. Even if the dam reservoir has led to a general boom in the fishing business, native communities have been unable to take advantage of the booming fishing industry. There are three main challenges that resettled communities complained about access to fish and fishing activities. These are: the long distance it takes to access the river from the resettlement site; the lack of skills to fish on the new expanded lake; and the fact that it is more expensive for them to buy fish as it was before. Before the construction of the dam when community members were not able to catch fish they paid 2 Cedis[1] to buy the amount necessary to make a soup for the whole household, after the construction of the dam they have to pay 5 Cedis to get the same amount of fish. As reported in the quotes above, respondents also stated that one of the reasons for the increasing food prices is the influx of construction workers into the resettlement and construction areas. Access to bush meat for both self-consumption and commercial purposes has also declined due to difficulty to access the forest from the resettled communities; villagers have to buy meat from the market now.

In the case of Kamchay dam, the interviewees reported that access to non-timber forest products (NTFPs), such as bamboo and firewood, but also access to fish downstream has dramatically decreased after the construction of the dam. The dam has flooded 2291 ha of land and forest in Bokor National Park, which was previously used by the local communities for the collection of NTFPs.

Moreover, villagers reported that occasionally Sinohydro puts a ban on bamboo collection and closes off access to the area completely: *"Before the construction of the dam, they (Sinohydro) never banned the bamboo ground just now they catch our boat, if we do not have a boat, we cannot go to cut bamboo" (*quote from FGD with female in Mortpeam*).* Due to the difficulties of reaching the remote bamboo forest area left after the construction of the dam and due to the ban villagers reported to be

[1] The value of the Ghana Cedi at the time of field work was 2GHS to 1USD.

able to collect only few bamboos, experiencing a sharp reduction of their livelihoods: *"We can collect less bamboo and spend more than before"; and "We spend on petrol, raft and truck fees" (*quotes from FGD with men in Ou Touch*).*

The reduced bamboo forest areas due to the inundation and the difficult access to the forest left upstream of the reservoir have severely undermined the livelihoods of the local communities, especially for those relying on NTFPs collection, such as bamboo collectors, firewood collectors and fruit sellers. The bamboo collectors are the biggest group that has been adversely affected by the Kamchay dam. They produce baskets from the bamboo they used to collect in the forests flooded by the dam's reservoir. The baskets are sold on the local market in the nearby Kampot town. Most of the bamboo collectors do not have any other sources of income, many of them do not own any land nor have any assets and most of them have very low literacy rates and can therefore not easily move on to more skilled jobs. As reported in the quotes below, the only livelihood alternative for the bamboo collectors is to work as construction workers; however the income they can get is not enough to support their family needs: *"We have no jobs to do beside that job (collecting bamboo), and working as a construction worker cannot support our family because you can earn only around ten thousand Riel per day, and collecting bamboo we can earn more than twenty thousand Riel per day"* (quote from FGD with men in Ou Touch). According to the bamboo collectors, the expenditures they have to sustain after the construction of the dam to access the forest area are almost doubled and the amount of baskets they can make is less than before: *"We spend more than ten thousand Riels per each (trip), and previously, we spent only five thousand Riels" and "we could collect bamboo for making seven to eight baskets. Previously, we spent less, only five thousand Riel, but now we spend much and get bamboo for making only two to three baskets, maximum four"* (quotes from FGD with women in Ou Touch).

The inundation of the forest area in Bokor National Park has also negatively impacted firewood collectors and fruit collectors. Firewood collectors reported that they have been banned by Sinohydro to access the dam area to avoid the illegal collection of timber from the dam site. *"Now we are not allowed for firewood collection, so everything gets stuck. Our request is that the company should allow people to collect firewood, and let them farm and collect resources on the mountains" (*quote from FGD with male in Snam Prampir*); and "There is not much firewood because we don't have many forests anymore" (*quote from woman respondent in Mortpeam*).* Moreover, fruit collectors reported that due to the clearance of the forest by Sinohydro many fruit trees were cut as well, impacting negatively the income of fruit sellers to tourists. However, Kamchay dam has also had some positive effects, especially for durian and other plantations growers. Importantly, it has helped protect some areas from annual flooding. Life is better for those living in the previously flood-prone villages, as reported: *"(after the construction of the dam) There is no flood, so our durian trees are not destroyed by flood"* (quote from FGD with women in Snam Prampir).

Similarly in the case of Bui dam, access to forest products (such as charcoal, firewood, commercial trees) has decreased after the construction of the dam, the resettlement sites are far away from the forest and therefore they don't collect them anymore. Most of the resettled communities have to buy firewood and charcoal which was freely collected from the forest before the construction of the dam. The same situation is for shea nuts, dawadawa, and medicinal plants and trees which were giving extra income to the villagers from the old sites.

Access to fish is also a source of concern of the affected communities in the resettlement site in Sarawak, Malaysia. Villagers reported that before the construction of the dam in the rain season the flow of the water from the mountain to the stream was abundant and they were able to catch a lot of fish. The water flow from the dam is now regulated by Sinohydro, and villagers complain that the flow is not enough, therefore the presence of the fish in the stream has decreased: *"We could catch from four to five kilograms per day, in flooded season. After the dam construction, we can catch only one or two fish per day for eating in the family"; and "Now, fishermen do not fish anymore; they buy fish from others"* (quotes from men respondents in Mortpeam).

Access to water

In terms of water access, according to the results of the Nvivo analysis water scarcity is a problem in some of the resettlement sites, such as in the case of Jama and Dokokyena villages in the Bui resettlement site. Respondents stated that in Dokokyena village for instance water boreholes are not enough to satisfy the water requirement of the population, which has increased after the construction of the dam due to the presence of immigrants moving into the village: *"We have inadequate access to water. We have only few boreholes; we have to queue for long hours to get water for households use" (*quote from female respondent in Dokokyena village resettled village*).*

In the case of Bakun dam, in terms of access to water resources villagers reported that the water they can access in the resettlement site is polluted, smelly (smell of rust) and with a yellowish colour. Moreover, sometimes the water supply is not regular and there is no water provision for several days due to problem with water pressure to pump the water from the river. Some villagers have also stated that water pollution comes from the chemicals used in the oil palm plantations owned by private companies located on the bank of the river, as commented here: *"The water is not clean, it is like mud. Although it seems clean now, if we put it in the bottle after 2 or 3 days there is sediment in yellow colour"; and "Because at the upstream, i.e. Koyan River (a water catchment), there are many oil palm plantations, they use a lot of pesticides, and they go into the water, it is a big problem. Moreover, the water filter doesn't work properly"; and "The colour of water is yellowish. How are we going to eat? That is why many of us in Asap always fall sick"* (quotes from FGD with men in Uma Badeng resettled longhouse).

Access to energy

In terms of energy access, looking at the quotes on energy access in the case of Bui dam in Ghana people resettled declared to be happy now since before the construction of the dam they were without electricity and after the construction of the dam the Government has provided them with electricity, as reported: *"The thing we appreciate most about our coming here is that previously we didn't have electricity at the village close to the lake but now we have light" (quote from FGD with men in Jama resettled village).* Similarly in the case of Bakun dam, in the old village people did not have electricity and used generators or kerosene lamp. In the resettlement site all villagers are connected to the grid and have electricity provided by the government, as stated here: *"Our lives are more convenient here with electricity"* (quote from female respondent in Uma Belor resettled longhouse).

In the case of Kamchay dam the energy access situation is different. As reported by the villagers interviewed there are houses located close to the dam that do not have access to electricity yet: *"Most of the houses do not use electricity, they use kerosene lamp" and "[...] the price of electricity is too expensive"* (quote from FGD with women in Mortpeam)*; "We are not yet getting electricity for utilization";* and *"They said that this area would get electricity for utilization without charging"* (quote from FGD with men in Mortpeam).

One of the main reasons for the lack of electricity in some of the houses is that the electricity used in the dam site area is not coming from the Kamchay dam but imported from neighbour countries, mainly Vietnam, and provided to the villagers by private companies at unaffordable prices for the poorest families in the area: *"This electricity is from Vietnam, private enterprise. We are also wondering that why we live next to the dam, but the price of electricity is more expensive than other villages in the province"* (quote from FGD with men in Bat Kbal Damrei).

Most of the electricity generated at the Kamchay dam is being used in Phnom Penh, as the capital needs power to generate economic growth. Nevertheless, the price of electricity after the construction of the dam has been reduced from 1,800 Riel per kWh to 920 Riel per kWh. This is however higher than the initially mentioned 500-600 Riel per kWh that was promised by Sinohydro, as indicated in the quote below: *"When inaugurated the dam, the price of electricity has been decreased, and the Chinese company also promised that they will try to reduce the price of electricity to six hundred Riel per kilowatt-hour"* (quote from FGD with women in Snam Prampir); and *"Electricity costs nine hundred and twenty Riel per kilowatt-hour. At the Rom Deng village the price of electricity is only six hundred*

Riel per kilowatt-hour, and the electricity in our village is more expensive. We live in the same province but the electricity imported from Vietnam has different prices" (quote from FGD with women in Tvi Khang Cheung). Moreover, in the case of Kamchay dam even though electricity has become more affordable many people do not have the financial means to connect to the grid as it requires a connection fee of US$160 per household, as the villagers report.

Issues related to the governance of the impacts of dam construction in the case study areas, such as the implementation of mitigation strategies, consultation with affected communities and compensation, are discussed in the following section.

Governance issues

According to most of the legislations in the countries where large dams are built, before construction can start an Environmental Impact Assessment (EIA) is usually required and needs to be approved by the local authorities. The ESIA should include a list of the social and environmental impacts of the dam, a resettlement planning framework, and the mitigation plan that details measures for reducing the environmental and social implications of the dam, including compensation provided to the affected communities. Moreover, according to international guidelines and standards affected communities should be consulted and actively involved in the decision making process since the beginning of the dam construction process (WCD, 2000). In the case studies analysed we found various shortcomings in the preparation of the EIA, consultation and participation of the local affected people, as well as the implementation of social and environmental safeguards measures, as specified hereafter.

Bui dam

In the case of Bui dam in Ghana the EIA has been commissioned before the construction of the dam by the Ministry of Energy of the Ghanaian government and carried out by the UK firm Environmental Resources Management (EMR) (Hensengerth, 2013; Environmental Resources Management, 2007). According to the environmental regulations in Ghana, before a development project is approved an environmental permit, obtained through the presentation of the EIA, has to be issued and presented to the Environment Protection Agency (EPA). Only when the environmental permit is obtained the loan agreement with the project funder, in this case China ExIm Bank, can be signed (Hensengerth, 2011). This procedure is important to assure that the EIA is carried out before the development of projects start. A new local authority was created by the Ghanaian government for the management of the dam and its impacts, including the implementation of the resettlement plan, namely the Bui Power Authority (BPA). BPA is also responsible for the control of the flow of water and flooding due to the creation of the reservoir and the acquisition of land and resettlement measures, including compensation measures to the local population. It is the only governmental authority with full decision power for the management, plan and execution of the Bui dam project. The Bui dam project in Ghana is an Engineering, Procurement and Construction (EPC) / Turn-key Project Contract in which the construction company is responsible for the construction of the dam, including the health and safety of the workers and their recruitment, but once the infrastructure is finished and operational the host government becomes immediately the owner and the only one responsible for the project. In this case, even though the company has to abide to the regulations of the host country, including environmental regulations, the company is not responsible for the execution of the EIA and the mitigation strategies. Even though environmental regulations and standards in Ghana are relatively strong and they reflect international standards, particularly those developed by the World Bank, and standards of the International Organisation for Standardisation (ISO) (Hensengerth, 2011), there were shortcomings in relation to the implementation of alternative livelihood schemes included in the EIA. People interviewed lamented in particular the lack of implementation of livelihood support schemes which were part of the social mitigation strategy. These included new skills training, such as providing farm equipment, new fishing techniques and new infrastructure, such as irrigation technologies, to support existing livelihoods particularly farming and fishing.

Kamchay dam

In the case of Kamchay dam, by Cambodian law, development projects such as dams are required to have an Environmental Impact Assessment (EIA) in place and approved before the dam construction

begins and consultation with all stakeholders is required. The main legal framework for the EIA is the Sub-decree on EIA passed by MoE (Ministry of Environment) in 1999. MoE is primarily responsible for organising the conduction of the EIA, reviewing the report and monitoring compliance with environmental legislation (Grimsditch, 2012).

However at the Kamchay dam, the full EIA was approved only after the construction started and the consultation process before the dam construction was patchy and ad-hoc with little local participation as our fieldwork finds and other reports confirmed (International Rivers, 2013). A man from Tvi Khang Cheung stated: *"we have never been invited to join meeting, but the village chief informed us"*. Another respondent from Bat Kbal Damrei said: *"None informed us. I just heard from other people who live in a Snam Prampir village, and they told the story from one to another"*. Many villagers were not invited to consultation processes and became only aware of the dam once construction had started. A man from Ou Touch reported: *"Before the construction of the dam, I did not know, but I went to the forest every day, then I saw them constructing the dam, so I knew that they constructed the dam"*. Another man respondent from Tvi Khang Cheung stated: *"Before they constructed the dam, I did not know about it. I just saw they cleared the land and I knew that they were constructing the dam"*. According to our interviews village chiefs were involved in the consultation process *"Before the dam construction, the Chinese Company came to ask and informed us that they will construct the dam"* (village chief in Ou Touch). However, village chiefs did not participate actively in the consultation process: *"They invited me to attend a consultation at their Hydropower Company. However, we just went to listen to them"*; and *"during consultation the company already told us that people should find alternative jobs instead of collecting bamboo"* (village chief in Ou Touch).

In addition, the Environmental Management Plan (EMP) which aims to implement mitigation measures to reduce the negative effects of the dam was not in place until the late stages of the dam construction. It is also being reported that Sinohydro refuses to implement any mitigation measures, as confirmed by our interviews and other reports (NGO Forum, 2013). Sinohydro is said to have set aside a so-far untouched budget of US$ 5 million for implementing mitigating measures, such as replanting 2,000ha of forest (Middleton, 2008), however even high-ranking officials at the provincial Department for the Environment and the EIA office are criticising Sinohydro for its inaction as confirmed by our interviews. Moreover, in terms of compensation bamboo collectors, fruit vendors and fishers who lost livelihood security to the dam were not considered for compensation payments, as they did not have legal rights to the land they were using for collecting NTFPs needed to support their livelihoods.

Bakun dam

In the case of Bakun dam, specific environmental requirements need to be fulfilled before large infrastructure projects such as dam can be built. One of the most important environmental requirements is the preparation of the EIA which after completion needs to be approved by the Director General of Environmental Quality. The project is not allowed to proceed unless approval of the EIA report has been granted (Department of Environment, 2010). University Malaysia Sarawak (UNIMAS) acted as the main consultant for the EIA of the Bakun project. Interaction and communication with resettled people during the preparation of the EIA including negotiations of compensation terms, land allocations and resettlement have been carried out mainly between village leaders, village committees and state departments. Suggestions for compensation were discussed within the communities and brought by the village leaders to the attention of the government. However, according to interviews with the affected communities and village leaders these suggestions were never taken into consideration by the government. Moreover, villagers have been only informed by the government about the benefits of the dam, they did not participate actively in the negotiation process, but only indirectly through their village leaders, as specified in the following quote: *"The suggestions (given from villagers to the government) were from everyone from the 15 villages that were involved. So, they gave suggestions about the resettlements (during a meeting organized by the government with village leaders), on the allocation of lands, compensation and all, but sadly the suggestions were not followed"; and "It was all because the Chief Minister of that time did not agree with it. A meeting was held with the Chief Minister and he angrily asked, "Why are you asking for so much land?" He gave an example of, "If given to the Chinese, even with a little land, they can grow as*

many plants" (quote from village man in Uma Juman). Moreover looking at compensation issues, interviewees stated that in terms of house compensation, only after more than ten years of complaints and struggles with the Government villagers obtained to get the new house in the resettlement site for free. Initially the Government was giving a new house at a value of RM[2] 52 thousands maximum, if the value of the old house at Bakun was lower, then villagers had to pay the price difference by loan. However after more than ten years of negotiations the villagers managed to get back the differential they paid to the Government. Moreover, land compensation given to the villagers is stated to be too small, only 3 acres instead of the 10 acres initially promised by the government to villagers.

Concluding remarks

In line with leading literature in this field (Tilt et al., 2009; Brown et al., 2009; WCD, 2000) our research findings suggest that large dams often disproportionally affect the rural poor, as is the case of the Kamchay, Bakun and Bui dams. In the pursuit of energy access and national development goals, local people's needs are usually not fully acknowledged in the planning and implementation of the projects.

Several beneficiaries of the dams can be identified. These are: dam builders which will receive revenue from the construction of the dams (such as Chinese overseas leading builder, Sinohydro); the recipient of the electricity in urban areas (Phnom Penh, Kampot and Sihanoukville in Cambodia, Accra in Ghana and towns in Sarawak, Malaysia); the host government in terms of improved energy access at the national level and the possibility of strengthening economic ties with Chinese investors. However, the majority of the villagers affected by the dam have had to shoulder the burden of its impacts. The main beneficiaries of the dam are therefore not the people who are affected by it only a daily basis, and in some cases, such as in Cambodia, many of them are being left without electricity access. For those people directly affected by dams, loss of access to natural resources such as fertile land, fisheries, forests and water puts an additional strain on their livelihood security.

In the case studies analysed, hectares of forestry resources were flooded or cordoned off, removing access to the local communities who are dependent on its provision for their livelihoods. As such, their livelihoods were threatened by the change in the physical environment of the dam building. In addition, the dams alter the water ecology and affect fisheries and water supplies (including drinking supplies) for the local communities. This further threatens their fundamental rights to food and water, which reinforce and reproduce social and economic inequality between the government officials, dam builders and local communities. At the same time, due to the poor implementation of social safeguards measures few of the affected people have access to considerable assets, adequate financial means, training and alternative livelihoods. Moreover, the limited participation and consultation of local affected people on one side and the dam-builders and host government agencies on the other side, illustrates the unequal power relations between these various stakeholders in the physical and political environments.

While large dams are considered a low carbon energy source, and can provide electricity to millions of people in countries in Africa and Asia, this project's research found significant room for improvement in the way the construction of the dams has been managed by the host governments in the case studies analysed.

We suggest that national governments, especially in the case of Cambodia and Sarawak, Malaysia, have strict EIA legislations and other environmental policies in place, in addition to robust enforcement of impact mitigation and ecological protection measures for large dams. Funding should be set aside and funding access rules should be clearly identified to enable the implementation of social and environmental mitigation measures such as afforestation programmes, training and education programmes. We recommend that no dam developments take place in national parks,

[2] RM is the Malaysian Ringgit, the currency of Malaysia.

protected areas, biodiversity hotspots or areas that are the habitat of endangered species. Moreover, compensation payments should be longer term and tailored to include all the affected villagers, including those relying on NTFPs from land with customary rights. In addition, we recommend that electricity access and competitive electricity prices should be available to people affected by dams.

Even though it is difficult to assess the overall effects of a specific dam, the weighing of benefits and costs will always be contentious, hydropower dams as a developmental project should involve public participation through various forums and the basic principles of good governance should be applied (i.e. procedural justice): transparent decision-making, informing local people properly and listening to and addressing their concerns. In other words, people's interests and values should be taken into account from early stages of project management, following a truly inclusive view of the communities. We also suggest that dam-builders and national governments to put in place social safeguards to support the lives and livelihoods of the people directly affected by dams. This could include offering employment, training and education, as well as by implementing a more holistic approach to impact mitigation by maintaining a balance between natural resource use for infrastructure development and natural resource access to affected communities (i.e. distributive justice).

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