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Large dams, energy justice and the divergence between international, national and local developmental needs and priorities in the global South

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ABSTRACT

This paper investigates from a socio-technical and energy justice perspective the lack of coordination of international, national and local developmental priorities and inclusion of local needs in the decision making process of large dam construction in the global South. The paper argues that the analysis of energy infrastructures as socio-technical systems requires an energy justice approach to capture the true environmental and social nature of energy production and consumption. In doing so, this paper proposes a conceptual framework called "The Energy Justice Framework for Dam Decision-Making" as a tool to inform energy decisions on infrastructure development based on energy justice principles and social impact assessment. The proposed framework is used in this paper to analyse distributional, procedural, restorative justice, and power relations throughout the entire dams' energy system in the case of four large dams located in Africa and Asia, namely Kamchay dam in Cambodia, Bakun dam in Malaysia, Bui dam in Ghana and the planned Zamfara dam in Nigeria.

1. Introduction

One of the main goal of the Sustainable Energy for All initiative promoted by the United Nations is to ensure access to affordable, reliable, sustainable and modern energy by 2030 from renewable sources, such as wind, water (i.e. hydropower), solar, biomass and geothermal [1]. Energy accounts for approximately 60% of global greenhouse gas emissions, therefore reducing the carbon intensity of energy production by increasing the share of renewable energy in the global energy mix is seen as a key objective in long term climate policies' strategies [1]. At the global level, Sub-Saharan Africa and developing Asia[1] account collectively for 97% of the total population without access to electricity [2]. Building hydropower dams has become an attractive policy solution to mitigate the climate and fuel development, especially in energy poor countries [3,4]. For example Africa holds almost 12% of the global hydropower potential but produces only 3% of global hydropower and exploits less than 10% of its technical capacity [5]. Many new large dam projects are planned in Sub-Saharan Africa with a projected increase in the share of electricity supply from 22% in 2014 to 26% in 2040 [6]. Southeast Asian countries plan to construct 61 gigawatts (GW) of new hydroelectric generating capacity by 2020 [7].

Indeed there are many benefits associated with hydropower development such as flood control, job creation, improved energy access [8]. However, large dams have also been the subject of controversy and debate for several decades as a result of their social and environmental impacts, the unequal distribution of costs and benefits and issues of fair and transparent decision making processes [9–13]. Moreover, Zarfl et al. [14] and Fearnside [15] argue that the climate mitigation potential of hydropower is being systematically overestimated, questioning its definition of a clean energy source. Sovacool and Valentine [16] argue that mega energy projects such as large hydropower dams are economically, socially and ecologically sub-optimal. This paper investigates the lack of coordination among international, national and local developmental priorities and the limited inclusion of local needs in the decision making process of large dam construction in the global South. It examines energy infrastructures as socio-technical systems from an energy justice perspective [17–19]. To do so this paper proposes the use of a new framework called *"The Energy Justice Framework for Dam Decision-Making"* (further discussed in Section 3.1) which brings together the most recent studies on large dams' social impacts

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[1] According to the International Energy Agency's classification [2] developing Asia is composed of Bangladesh, Brunei Darussalam, Cambodia, China, Chinese Taipei, India, Indonesia, the Democratic People's Republic of Korea, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Viet Nam and other Asian countries and territories (Afghanistan, Bhutan, Cook Islands, East Timor, Fiji, French Polynesia, Kiribati, Laos, Macau (China), Maldives, New Caledonia, Papua New Guinea, Samoa, Solomon Islands, Tonga and Vanuatu.

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evaluation [20] and energy justice principles [19,21]. While there are several frameworks in the literature that have been applied to the analysis of the social impacts of dams (for an overview of these frameworks please refer to Kirchherr et al. [22]), the novelty of the framework proposed in this paper is that it integrates the energy justice principles into the analysis of the decision-making process of dams' development. The application of this framework to specific case studies shows how energy justice principles can be used in practice to analyse if specific energy projects respond to questions of energy justice, such as procedural, distributional and restorative justice, both ex-ante, in the planning phase, and ex-post construction. In this paper the proposed framework is used as a post-construction assessment tool to analyse three case studies of hydropower dams already in operation, namely Kamchay dam in Cambodia, Bakun dam in Malaysia and Bui dam in Ghana, and as a pre-construction tool to analyse one case of a planned dam, the Zamfara dam in Nigeria.

2. Issues of energy justice and socio-technical systems in energy infrastructure development

Issues of energy justice, such as fairness of the energy decision making processes, equitable distribution of costs and benefits of energy services, recognition and restoration of the impacts, are pervasive in all aspects of the energy infrastructure supply chain, from production, transmission, right through to distribution and energy consumption [23,21,24]. For example, issues of production are inextricably connected to consumption when considering justice and equality in the location and distribution of energy services [25]. While energy supply is often viewed in the literature on energy studies as simply a technical and logistical process of boosting energy access, there is a growing interest in the interdisciplinary literature on energy transitions in analysing energy infrastructures as socio-technical systems [17,26,27,18]. Theories on socio-technical systems suggest that technological, environmental and social entities are intertwined in a complex web of interactions [28,29]. In this respect energy systems should be taken as both material in terms of their physical infrastructure and social in nature, as recognition that technologies involve a complex interaction with different dimensions, natural (i.e. the ecological context), socioeconomic (i.e. the people and the economic context) and political (i.e. institutions) [28–30]. From this perspective, equality and justice should be analysed throughout the entire energy system from decisions on infrastructure siting to how energy is produced, generated and transmitted to different beneficiaries [24]. Thus, from a socio-technical and energy justice perspective studies on energy infrastructures need to be reframed to look at energy services as a "political, deliberative challenge involving the satisfaction of competing preferences" in society ([19], p. 5). This way of looking at energy systems and infrastructures represents an opportunity to overcome the disconnection between energy policy and decision making with society, and therefore to reconcile energy decisions with international, national and local needs and priorities [31–33].

Nevertheless, even though scholars in the field of socio-technical systems acknowledge the importance of a just, fair and transparent decision making process for infrastructure development, aspects related to energy justice are still an emerging issue in the field. In the energy infrastructure literature, deliberative decision making processes and the interrelated justice aspects of distribution of costs and benefits and fair procedure are usually analysed as distinctive issues of concerns. Looking specifically at the literature on state-led energy projects, various studies highlight the unfair decision making process regarding these projects; usually, the people most affected are not involved in the planning and construction process [34–37]. In the case of dam projects, Marques et al. [38] uses a procedural justice approach to analyse the perceived trust of affected communities and shows the importance of project communication and involvement in the early phases of a project's implementation to increase acceptance within communities. Sellamuttu et al. [39] present different studies on dams' benefits distribution looking at institutional aspects and governance issues from a social justice perspective. Nordensvard and Urban [40] analyse the nexus between hydropower dams, corporate social responsibility and social justice using procedural and distributional justice and conclude that social innovation and justice should be considered by dam-builders to better mitigate the negative impacts of large dams. Studies on justice aspects applied to different energy technologies, such as wind and solar, are increasing but still few, especially for solar energy. Yenneti and Day [41] analyse procedural justice in the implementation of solar energy in India to illustrate how failures in the implementation of various aspects of procedural justice can result in negative livelihood impacts and marginalisation of rural communities. In relation to wind facility siting, Ottinger et al. [42] uses procedural justice to show how addressing community concerns can facilitate wind development and result in less controversial projects. Liljenfeldt and Pettersson [43] show that the poor consideration of distributional issues in the case of wind project development result in a higher likelihood of rejection of these projects by local populations. Even though the above mentioned studies provide good examples of how renewable energy projects can be analysed from a justice perspective they fail to provide a comprehensive framework integrating all the key elements of energy justice. In this paper we argue that to capture the true environmental and social nature of energy production and consumption, the analysis of energy infrastructures as socio-technical systems requires an approach which captures all the energy justice components, i.e. recognition, distribution, restoration and procedure. In doing so, in the next section we present an energy justice decision making framework that can be used as a tool to inform energy decisions on infrastructure development based on energy justice principles [19,21] and social impacts' evaluation [20]. It brings together technical aspects such as infrastructure siting, purpose of the dam and energy generation with energy justice concerns of distribution, procedure and restoration, as well as the energy justice principles of availability, affordability, inter/intragenerational equity, responsibility, resistance, due process, sustainability, intersectionality, transparency and accountability. Looking at energy decisions in the case of large dams from an energy justice decision making framework allows us also to consider power relations in terms of power and participation [44]. In other words, this paper analyses the ways in which state and corporate actors engage with host communities around project sites, particularly when resettlement takes place and when access to natural resources such as land, water and forests becomes limited to locals due to the dam-building [45–47]. Power in this case relates to the differential ability of different stakeholders (i.e. dam builders, financiers, government, local populations) to take part in the decision making process of dam construction and therefore to control and/or access natural resources and the benefits from resource exploitation [48–52,44].

3. Conceptual framework and methodology

3.1. The Energy Justice framework for dam decision-making

3.1.1. The Energy Justice framework

The Energy Justice Framework defines energy justice "as a global energy system that fairly disseminates both the benefits and costs of energy services, and one that contributes to more representative and impartial energy decision-making" ([19], p. 4), therefore it takes into account three key elements of justice, *recognition* of those affected by energy injustices, a fair *distribution* in society of costs and benefits derived from energy services and a fair *procedure* which refers to a fair decision making process. Moreover, the concept of *restorative justice* has been recently included as a new component of the Energy Justice framework. Restorative justice refers to the actions that need to be taken into account to mitigate the potential impacts that can result from energy decisions [24]. In the case of infrastructure development these

actions can include the realization of Social and Environmental Impact Assessments (SEIA) before energy decisions are made, the use of social safeguards measures, monitoring and mitigations of the impacts post construction and operation. Therefore, restorative justice is applied to all different phases of an energy infrastructure project from planning to operation.

The Energy Justice framework suggests different principles to analyse energy systems, such as *availability* (people deserve sufficient energy resources of high quality), *affordability* (access to affordable energy services, especially for the poor), *transparency and accountability* (access to high-quality information about energy and the environment, and fair, transparent and accountable forms of energy decision-making), *intragenerational and intergenerational equity* (fairly access to energy services for present and future generations), *responsibility* (protect the natural environment and reduce energy-related environmental threats), *due process* (respect human rights in the production and use of energy), *sustainability* (energy resources should not be depleted too quickly), *resistance* (opposition to energy injustices) *and intersectionality* (recognition of new modern identities in society and links with different forms of injustices, economic, environmental etc.) [21]. The roots of this framework can be found in literature on justice from a philosophical and ethical perspective. In this literature social justice is an extension of the idea of a fair allocation of punishments in the legal system to a fair allocation of goods in society as a whole [53–55]. In this respect the philosopher John Rawls reminds us that the primary subject of justice "[…] is the way in which the major social institutions determine the appropriate distribution of the benefits and burdens of social cooperation" ([56], p. 4 and p.11). Environmental justice theorists argue that energy services, as well as the benefits (e.g. electricity access) and costs (e.g. emissions) resulting from energy decisions, have, therefore, to be equally distributed in society [57–61].

3.1.2. The Matrix Framework on dams' social impacts

The Matrix Framework on Dams' Social impacts is a conceptual tool used to identify, organise and compare dams' impacts on society. This framework is structured around "dimensions" and "components" of the impacts. Components of the impacts are categorised as infrastructure (e.g. electricity, irrigation and water, flood control, roads and transport), livelihood (e.g. impacts on land and housing, health and nutrition, income and employment) and community (e.g. social cohesion and cultural change). Dimensions refer to the contexts in which components operate, defined as *space* (where the impacts occur), *time* (different phases of dams' construction) and *value* (positive and negative impacts) [20].

The Matrix Framework integrates the most used frameworks for the analysis of dams' social and environmental impacts and has been applied to the analysis of the Manwan dam in China [62]. An amended version which includes spatial considerations on the multiplier effects of impacts has been also used to analyse the impacts on downstream non-resettled communities at the Bui dam site in Ghana [63]. For the purpose of analysing large dams as socio-technical systems and from an energy justice approach, in the following section we present the conceptual framework used in this paper, which integrates energy justice aspects [19,21] into the Matrix Framework on Dams' Social impacts [20]. Our framework refers specifically to the original version of the Matrix Framework as applied in Ioannides and Tilt [62] as this paper does not focus on the spatially differentiated multiplier effect of impacts on downstream communities.

3.1.3. The Energy Justice framework for dam decision-making

In our paper we analyse equality and justice throughout the entire dams' energy system by combining the two frameworks explained above. Fig. 1 shows an amended version of The Matrix Framework on Dams' Social impacts which includes the energy justice components of distribution, procedure, restoration and the energy justice principles. In this amended version of the Matrix Framework on Dams' Social impacts the "community" and "livelihood" components are substituted by the energy justice components of distribution, procedure and restoration. In this new framework community and livelihood's impacts are analysed in terms of impacts' distribution, recognition and mitigation. This amended framework allows us not only to identify, organise and compare dams' impacts on society as proposed by the Matrix Framework, such as looking at energy access and impacts' distribution, but also to analyse the decision-making process of dams' development from an energy justice perspective as further explained hereafter.

This framework combines aspects of the decision-making process of dams' development in terms of decisions on infrastructure, distribution, procedure and restoration, such as decisions on dam's location and type of dams (i.e. infrastructure); on energy access and impacts' distribution between different beneficiaries (i.e. distribution); decisions on impacts' mitigation strategies and social safeguards processes (i.e. restoration), inclusiveness and participation (i.e. procedure). The different components explained above take into account different dimensions: "time", which means that we take into account the entire energy system from decisions on dams' site to post dams' construction impacts management; "space", looking at upstream and downstream impacts at different dams' sites; "value" looking at positive and negative impacts on communities, such as on access to resources, access to infrastructure and social amenities. Moreover, "components" are analysed based on the energy justice principles of *availability*, *affordability*, *inter/intragenerational equity, responsibility, resistance, transparency and accountability, sustainability, due process, intersectionality*. It is important to clarify that for reasons of access to information and data during the fieldwork the analysis realized in this paper uses six of the ten energy justice principles included in Fig. 1. In particular we did not take into account the intergenerational, sustainability, due process and intersectionality principles. Moreover, this study looks at distributional issues among people in the same generation more than at issues with future generations. The extended framework which includes all the energy justice principles can be used for future studies on energy projects. The energy justice principles can be also seen as the variables that are used in the proposed framework to analyse if specific energy projects respond to questions of energy justice, such as procedural, distributional and restorative justice. Just to provide some examples, decisions on dams' location, which refer to the "infrastructure" component, should be based on the principle of responsibility, which means that dams should not be located in areas with high environmental and social risks. Access to energy, which refers to the "distribution" component, should be analysed based on the principles of intragenerational equity, availability and affordability, which means that energy should be distributed fairly in society and be available to all people from the same generation at affordable costs. Power relations refer in this framework to how different stakeholders influence the decision making process of dam construction by looking at the ways in which state and corporate actors engage with the communities in terms of decisions on dams' sites ("infrastructure" component), resource access ("distribution" component), inclusiveness ("procedure" component) and impacts' mitigation ("restoration" component). They therefore refer to all the components in the framework and to the different dimensions, space, time and value.

Moreover, while the Energy Justice principles of *availability* and *affordability* refer in the Energy Justice literature only to the availability and affordability of energy services, we think it is important in the case of infrastructure development to extend these principles to the analysis of the availability and affordability of other natural resources for local populations affected by energy projects. In this way, the proposed framework look with a more holistic approach at how energy infrastructures influence the rights of the local population to access all natural resources, such as energy, water, land, forest products and food.

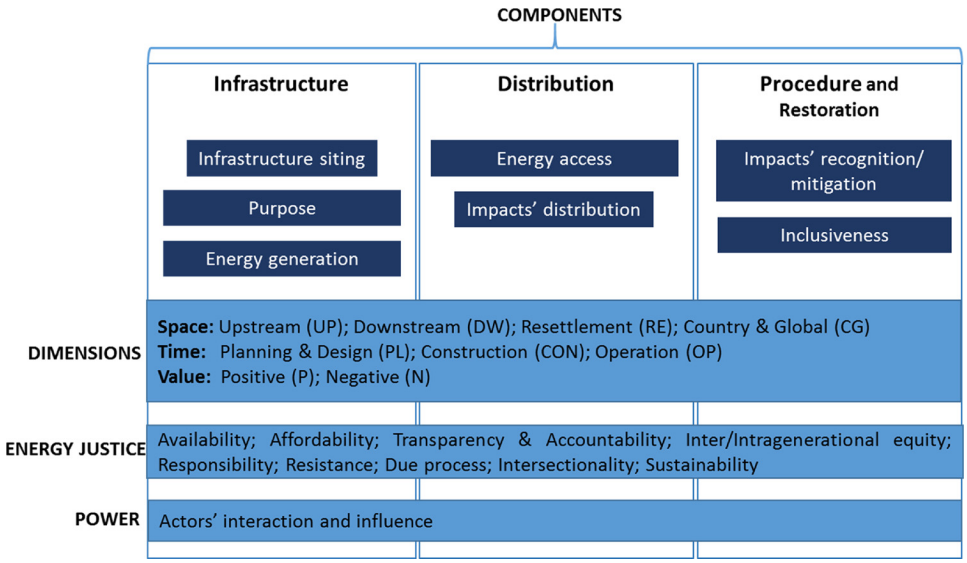

Fig. 1. The Energy Justice Framework for Dam Decision-Making. Derived and amended from Sovacool et al. [21] and Kirchherr and Charles [20].

3.2. Methodology

The Energy Justice Framework for Dam Decision-Making has been used in this paper to analyse and compare the decision-making process and impacts on society of four large dams, Bakun dam in Malaysia, Bui dam in Ghana, the planned Zamfara dam in Nigeria, and Kamchay dam in Cambodia. Each of the dams analysed in this paper has a capacity of more than 50MW. The research involved a comparative case study approach involving four years of empirical research between 2012 and 2016. The three dams in Cambodia, Malaysia and Ghana were successfully constructed and operationalized, whereas the Nigerian dam failed to proceed to construction after feasibility studies. Yet, we analysed it to understand the pre-construction negotiations and consultations between foreign dam-builders and Nigerian authorities. The literature shows that studying dams in the planning phase can provide interesting insights on the negative consequences on villages' development of projects whose construction is uncertain [64].

Secondary data were compiled to assess the environmental and social impacts of dams and their governance implications by examining the Environmental and Social Impact Assessment (ESIA) reports of the dams. We also conducted 153 semi-structured in-depth interviews in Cambodia, Malaysia, Ghana, Nigeria, and China with institutional actors (national and local governments, NGOs, regulators, dam builders, financiers) and community members and 40 focus group discussions (FGDs) with the affected communities. The four affected communities interviewed in Ghana are *upstream* farming and fishing communities resettled after the construction of the dam (Bator, Bui, Gyama and Dokokyina in North-West Ghana) (detailed information on the communities visited can be found in Yankson et al. [65]). The five affected communities interviewed in Cambodia are instead *downstream* communities, namely Bat Kbal Damrei, Mortpeam, Ou Touch, Snam Prampir, Tvi Khang Cheung in Southern Cambodia. These communities rely mainly on farming, fishing and the collection of forest products, such as timber, wild fruits and bamboo (detailed information on the communities visited can be found in Siciliano et al. [66]).

In Malaysia, the major ethnic groups resettled due to the Bakun dam are the Kayan and Kenyah, three longhouses[2] 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, all located in Sarawak, Borneo, East Malaysia (detailed information on the communities visited can be found in Cooke et al. [67]). In Northern Nigeria, nine communities affected by the dam-building plans were involved in the fieldwork (Gotowa, Kaface, Mokosa, Gidan Labbo Buzu, Duhu, Tsakauna, Kuturu, Rimmi, Tunga Bazace) (detailed information on the communities visited can be found in Olorunfemi et al. [68]). Limitations of data collection refer mainly to the fact that due to financial limits, duration of the project and accessibility of the areas not all affected communities have been involved in the study. Although from different locations both upstream (in Ghana and Malaysia) and downstream communities (in Cambodia) have been included in the analysis. Some of the data used in this paper have been previously analysed by the authors in other publications (see for instance [11,69–71]). However, this paper offers a novel contribution to the analysis of the case studies and of large dams in general by developing and applying a new framework based on Energy Justice. Moreover, this paper uses new data from fieldwork never presented before, such as access to infrastructures and social amenities, impacts and expectations of rural communities in the case of the planned Zamfara dam in Nigeria.

4. Results

Table 1 shows the results obtained by applying *The Energy Justice Framework for Dam Decision-Making* to the four case studies of large dams analysed in this paper. The results are structured according to the three components of *infrastructure*, *distribution*, *recognition and restoration*. Moreover, the spatial and temporal dimensions are analysed in terms of where and when decisions are made and impacts occur depending on the different projects. As specified in Section 3.1 the *infrastructure* component refers mainly to technical decisions, specifically decisions on dams' sites, purpose of the dam (i.e. electricity generation, irrigation, flood control etc.), energy generation and supply. These decisions are usually made during the planning and design phase and at the country level (i.e. spatial dimension, indicated in Table 1 as country and global) through multilateral agreements between national and international builders and investors. In the dams analysed in this paper, the Chinese can be involved as developer, investors and builders depending on the project. The *distribution* component refers to the analysis of the negative and positive impacts of dams' construction on downstream and upstream communities in terms of access to energy and other natural resources such as land, water, forest products, as well as social amenities and infrastructures. These impacts can occur in

[2] A longhouse is the traditional dwelling of indigenous peoples in Sarawak, Malaysia. They are usually built raised off the ground and are composed of a public area and private living quarters (fieldwork observation).

Table 1
Results of The Energy Justice Framework for Dam Decision-Making applied to the analysis of Bui dam in Ghana, Kamchay dam in Cambodia, Bakun dam in Malaysia and the planned Zamfara dam in Nigeria.

Infrastructure	Bui	Kamchay	Bakun	Zamfara
Purpose (PL; CG)	power generation (electricity)	power generation (electricity)	power generation (electricity)	power generation (electricity) and irrigation
Average annual energy generation capacity (GWh) (OP; CG)	980	498	16,785	N/A
Type of contract (PL; CG)	Engineering, Procurement and Construction (EPC)	Build, Operate, Transfer contract (BOT)	Engineering, Procurement and Construction (EPC)	N/A
Contractor (PL; CG)	Sinohydro	Sinohydro	Sinohydro	China Geo-Engineering
Developer (PL; CG)	Ghanaian Government	Sinohydro	Malaysia-China Hydro Joint Venture: Malaysian Sime Darby, Sinohydro and others	Zamfara State Government
Financiers (PL, CG)	Government of Ghana; Exim Bank; Government of China	ExIm Bank as part of a US$600 million aid package to Cambodia	ExIm Bank	ExIm Bank
Electricity supply (OP; CG)	National grid, Brong-Ahafo, Northern Regions of the Country	Kampot, Phnom Penh and Preah Sihanouk Province	Bintulu	N/A
Siting (PL; CG)	Black Volta River, Bui National Park: A quarter of the total forest and woodland area	Kamchay River in Bokor National Park: 2015 ha of protected forest	River Balui Belaga District, East Malaysia, Sarawak: biodiversity hotspot	North-West of Nigeria, Zamfara State
Distribution: resource access				
Energy (OP)	Energy access (P; UP, RE)	Energy access for some (P; DW). Some families are too poor to pay electricity fees and connect to the grid (N; DW)	Energy access (P; UP; RE)	Energy access (Exp) (P; UP; RE)
Land (CON, OP)	Land scarcity, reduced land fertility. Reduced land access due to land enclosures (N; UP; RE)	Reduced land access due to land enclosures (N; DW)	Land scarcity, reduced land fertility (N). Reduced land access due to land enclosures (N; UP; RE). Increased distance to access agricultural plots (N; UP; RE)	N/A
Forest products (CON, OP)	Reduced access. Increased distance to access NTFPs (N; UP; RE). Increased transportation costs to access NTFPs.	Reduced access. Increased distance to access NTFPs (N; DW)	Reduced access. Increased distance to access NTFPs (N; UP; RE)	N/A
Food (CON, OP)	Reduced food self-sufficiency. Marketization of food (N;UP; RE)	Reduced food self-sufficiency. Marketization of food (N; DW)	Reduced food self-sufficiency. Marketization of food (N; UP; RE)	N/A
Water (CON, OP)	Increased distance to access the river for fishing. Water scarcity and competition (N;UP; RE)	Decreased water flow and quality (N; DW)	Increased distance to access the river for fishing. Decreased water quality (N; UP; RE)	Improved irrigation and potable water access (Exp) (P; UP; DW; RE)
Social amenities (CON, OP)	Improved access to schools and clinics (P;UP; RE)	No school or clinics built in the area (N; DW)	Improved access to schools and clinics (P; UP; RE) Some families are too poor to pay the school transport costs (N)	
Infrastructures (CON, OP)	Improved access to roads and markets (P; UP; RE). Dam development has led to illegal logging and fishing (N;UP; RE)	Improved access to roads and markets (P; DW)	Improved access to roads and markets (P; UP; RE) Road development has led to forest area destruction and resource exploitation by palm oil companies (N; UP; RE)	Improved access to roads and markets (Exp) (P; UP; DW; RE)
Procedure and Restoration				
ESIA	Finalized before the construction of the dam by UK firm ERM (Environmental Resources management) (PL)	Finalized 7 months after the construction of the dam by Cambodian Ministry of Environment (MoE) (PL; CON)	Finalized before the construction of the dam by Malaysian Director General of Environmental Quality and University Malaysia Sarawak (PL)	N.A
Impacts' mitigation and monitoring	Mitigation plan prepared but not implemented (PL)	Some mitigation strategies defined but not implemented (PL)	No mitigation plan implemented	N/A
Consultation process (inclusiveness)	Village leaders and community members during planning and construction (PL; CON)	Patchy and ad-hoc with little local participation during planning and construction (PL; CON)	Village leaders, village committees during planning and construction. No community members (PL; CON)	Village leaders and community members informed in the planning phase (PL)

References: BPA [72], Keong [73], Sinohydro [74], GEO [75], and International Rivers [76]; Fieldwork data.
Legend: "Value" (type of impact): N = negative; P = positive; Exp = expected. "Time" (when impacts occur and decisions are made): PL = planning&design; CON = construction; OP = operation. "Space" (where impacts occur and decisions are made): UP = upstream; DW = downstream; RE = Resettlement; CG = Country & Global.

different phases of the project, such as planning, construction and operation (i.e. temporal dimension), as specified in Table 1. The *procedure and restoration* component refers to inclusiveness of the decision making process before, i.e. planning and design phase, and after construction, i.e. operational phase. It also refers to decisions on impacts' mitigation and monitoring, particularly to the governance of the Environmental Impact Assessment (EIA) and its implementation. It refers therefore to the different temporal dimensions, planning, construction and operation as indicated in Table 1. The three components mentioned above are also analysed through the Energy Justice principles of *availability*, *affordability*, *intragenerational equity, responsibility, resistance, transparency and accountability* as further discussed hereafter.

4.1. Decisions on dam siting and the energy justice principles of responsibility and resistance

The Energy Justice principle of *responsibility* refers in the energy justice literature to energy decisions in which "all actors have a responsibility to protect the natural environment and minimize energy-related environmental threats" [21]. Within this principle Energy Justice can be analysed as a spatial concept that both includes the physically unequal distribution of environmental costs and benefits depending on different localities, as well as the environmental consequences deriving from decisions on the location of energy projects [23]. The abilities to impose interests in determining locations of hydropower sites and access to energy represents the differentiated political capital empowering different stakeholder groups. Decisions on energy projects, for instance in relation to large dams' location, should be made by assuring that benefits are equally distributed and so are the negative environmental impacts. The latter should be as much as possible minimised and equally shared between populations located in different geographical areas, for instance between urban and rural dwellers. As indicated in Table 1 in the case of large dams analysed in this paper many of the hydropower projects are located in rural areas in developing countries characterised by high environmental and social risks in that they are located in national parks, and in lands under indigenous customary rights. Resistance in terms of opposition and complaints of injustices due to energy projects have been identified in the case of Bui dam, Kamchay dam and Bakun dam as specified below.

The Bui dam was built 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. A quarter of the total forest and woodland area within the national park have been permanently lost. As a consequence riparian gallery forest and savannah habitats have been fragmented causing negative impacts on vegetation reproduction and wildlife [77,78]. Moreover, six villages, for a total of 1216 people were relocated to new settlements and an additional four villages with about 7500 people with customary land rights have lost access to portions of farmland and forests due to inundation and/or construction work in the dam site area [77]. Opposition and complaints have been put forward from resettled communities to local authorities, mainly the BPA and community leaders, in relation to injustices resulting from the construction of the dam. The main complaints referred to land scarcity, lack of proofs of house ownership, lack of employment alternatives and new skills training, lack of security services and police stations to prevent the increasing crimes in the resettlement areas (mainly due to the presence of foreigners including Ghanaians migrants) and complaints about the location of the resettlement areas (too far from the river for formal fishing communities).

In the case of Kamchay dam in Cambodia, the dam is located on the Kamchay River in Bokor National Park. Even though resettlement of the local population did not take place, there are a range of reported environmental and social issues related to loss of livelihoods of downstream communities and the construction in a National Park [76]. 2015 ha of protected forest were lost due to the flooding for the reservoir and an overall total area of 2291 ha was destroyed [79]. Again, as in the case of Ghana, the dam is located in a protected area that is the habitat of endemic and rare species. The area is famous for its rich biodiversity, its forest-covered hills and its rivers. It hosts 39 mammal species – including 10 endangered species mentioned on the IUCN Red List – 68 bird species, 23 reptile species and 192 fish species [80,79]. The area confiscated by local authorities for dam construction was also used by the local population for livelihood activities. Opposition took place from affected communities that lost access to the forest for bamboo and rattan collection. The locals therefore asked the dam-builder and local authorities to reopen the access to the forest. After a three-day protest local authorities decided to allow local communities to access part of the confiscated area again. Several petitions were also issued by the locals.

The Bakun dam 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 area is a biodiversity hotspot in Borneo's tropical rainforest. Bakun is the first of a series of large dams built on the land of the indigenous Orang Ulu peoples with approximately 50% of the impoundment area on lands claimed under customary rights [16]. A total of 15 longhouses composed of about 10,000 indigenous peoples from the upper Balui River, including some semi-nomads, had to be resettled to sedentary settlements. The construction of the dam has been a source of conflicts between the State Government of Sarawak, international and local NGOs and indigenous people since the planning of the project in 1997 until today. During the protests indigenous communities asked the main contractor of the dam and the State government to abandon the project due to its negative social and environmental impacts and since the energy demand of the state was already satisfied by the energy produced, hence the rationale for the dam was unclear to locals [81]. After the dam construction, local people practiced resistance by occupying corporate land around the dam and using it for their small-holder agricultural purposes.

In the case studies analysed decisions on large dams have been mainly driven by technical issues, such as river capacity and energy generation. The principle of *responsibility* and *resistance* therefore socio-technical system considerations, such as complex social and environmental challenges and risks that can vary significantly by the place where dams are located, should be taken into account for better decision making on dams' location and minimization of dam-related environmental and social threats.

4.2. Resource distribution and the energy justice principles of availability, affordability and intragenerational equity

The energy justice principles of *availability and affordability* refers to the right of all people, irrespective of location and economic status, to have access to sufficient and affordable energy resources of high quality [21]. Moreover the principle of *intragenerational equity* states that energy decisions should result in a fairly access to energy services for all people in the same generation [21]. One of the most frequently used justifications for large dam development in energy- poor countries in Africa and Asia is that they can help eliminate poverty and enable a more equitable sharing of prosperity by increasing energy access, especially for poor populations located in remote rural areas in developing countries which rely strongly on natural resources access for their livelihoods [4].

In our case studies we found that the principles of availability, affordability and intragenerational equity of energy services distribution are not taken into consideration in the energy decision making of large dams development. As indicated in Table 1 the energy supply and energy services from dam construction are not equally distributed between urban and rural dwellers, as all the energy produced by the dams is used in urban areas. Populations directly affected by energy infrastructure development not always obtain access to energy services. This is for instance the case of the Kamchay dam in Cambodia where there

are still households located close to the dam without access to electricity. As reported by villagers, they did not benefit from the construction of the dam in terms of energy access because most of the electricity generated at the Kamchay dam is being used in Phnom Penh, as the capital needs power to generate economic growth, while locals receive electricity from Vietnam at unaffordable costs for the locals, as stated in the following quotes: *"There are around four to five families in this village that do not have electricity for use"; "The price of electricity and the connection to the grid is very expensive"* (quote from an interview conducted with a woman in Tvi Khan Cheung village). *"The electricity we use is from Vietnam, from a private enterprise. It is not good because it is low power and we cannot use it at night"; "Most of the houses do not use electricity, they use kerosene lamp"* (quotes from interviews conducted with a woman and a man in Moat Pream village). Despite the fact that electricity has become more affordable after the construction of the dam being reduced from 1800 to 920 Riel per kWh, this price is still too high and many people do not have the financial means to connect to the grid as it requires a connection fee of US$160 per household [11]. On the contrary, the resettled people at the Bui dam and Bakun dam that did not have access to electricity in their previous settlements have benefitted from access to electricity at reasonable prices after dam construction.

As specified in Section 3.1 in this paper we extend the meaning of the energy justice principles of *availability, affordability* and *intragenerational equity* of energy services to the implications that energy infrastructures can have on access to other resources for local populations, such as water, land, forest products, food, social amenities and infrastructures. In the case studies analysed as reported in Table 1 access to land for farming has decreased after resettlement in the Bui dam and Bakun dam case studies. This is causing problems either in terms of food self-sufficiency as 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, low land fertility in the resettlement sites has also been mentioned by affected villagers [11]. 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 hunt and fish. 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. In this respect other studies have also demonstrated that enclosures of land and water resources from hydropower development have resulted in particular challenges for the livelihoods of affected communities in Cambodia, Laos and Ghana [82,91].

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 under customary rights [11]. The reduced bamboo forest areas due to the flooding of the reservoir 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 and fruit sellers [83], as stated in the following quote: *"Since the dam was built, we cannot sell fruit well because there are not so many tourists due to the low water flow, and we cannot collect bamboo as we did before because they [Sinohydro] do not allow us to climb up to the mountain"* (quote from an interview conducted with a woman in Snam Prampir village). Water scarcity and access to water for fishing is also perceived as a problem in some of the resettlement sites, such as in the case of Jama and Dokokyena villages in the Bui resettlement area in Ghana. Respondents stated that 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 immigrant dam workers moving to the village: *"We have inadequate access to water, we have only few boreholes; we have to queue for long hours to get water for household use"* (quote from an interview conducted with a woman in Dokokyena village). *"Before resettlement water was sufficient for us but as the population increased water has become a major problem. Since very early in the morning people form queues to fetch water" (*quote from an interview conducted with a man in Jama village*)*. In total 1836 workers were employed for the construction of the dam, of which 1676 were Ghanaians (including 22 women), 100 Chinese and 60 Pakistanis [84]. Moreover, increasing competition between resident fishermen and immigrant fishermen has undermined the livelihoods of the local population coupled with the difficulty to access the lake, located far away from the resettlement site.

In the case of the Bakun dam, in terms of access to water resources villagers reported that the water they can access in the resettlement site is irregular, polluted, full of sediment, smelly (smell of rust) and with a yellowish colour. This is mainly due to problems with excessive sedimentation and insufficient water pressure to pump the water from the river. *"From what I know from my meetings with the District Office, the water quality index is not that good. Sometimes, there is no enough water pressure and we do not get water for one or two days"* (quote from an interview conducted with a man at Uma Ukit longhouse).

For the Zamfara dam, a lack of potable water, as well as water infrastructure and irrigation schemes constrain local people's daily lives and the possibility of engaging in commercial farming and livestock activities. "*We have a problem of potable drinking water, we don't have good drinking water. The only source of water we rely on is from the stream water or dug wells in our houses*" (quotes from focus group discussion with men conducted in Duhu village). A part from the production of hydropower, the Zamfara dam was meant to provide irrigation facilities to boost land fertility and agricultural production in the area, mainly for the cultivation of rice and tomatoes, in approximately 10,000 ha of land. This raises the hopes of the local people. *"The dam when constructed will provide water for irrigation and our livestock will get abundant pasture along the dam site"* (quotes from focus group discussion with men conducted in Duhu village). In addition, villagers are facing problems with desertification during the dry season: *"During dry season, all our farmlands become very dry. It's like a desert. We have desertification problems. We urge the government to come to our aid to prevent us from losing our land and farming activities"* (quote from an interview conducted with a woman in Tunga Bazace village). And *"The dam will provide enough water for irrigation and our people will engage in irrigation farming. Commercial crops will then be produced to improve our livings"* (quote from an interview conducted with a man in Gidan Labbo Buzu village).

While the dam-building or in the case of Zamfara dam the failure of the dam-building has mainly imposed costs on the local population with regards to access to natural resources as reported in the quotes above and in Table 1, there are benefits with regards to access to infrastructure and social amenities. The local communities at the Bakun dam in Borneo reported that the biggest positive impact of the dam-building is the access to clinics and schools. *"My three children couldn't go to school in the old settlement because it was too far". "In terms of education we find it quite good here because we now have two primary schools and a secondary school nearby"* (quotes from FGDs with female in Uma Ukit and with men Uma Badeng longhouses).

In terms of access to clinics, one important improvement in the resettlement site refers particularly to child birth which, according to the interviews conducted, has become safer for women as they are assisted by medics in the local clinic of the resettlement site, instead of at home or within hours of boat ride to the nearest clinic: *"For those people who have difficulties in giving birth, from the resettlement site they can easily go to the hospital nearby"* (quote from FGD with female Uma Badeng longhouse).

The local communities at Bui also strongly value the availability of schools and clinics at the resettlement areas, as for some communities access to education and hospitals has improved in the resettlement sites

as infrastructures are closer to the villages (especially for Bui and Jama villages). At the Kamchay dam however, no provision was made post-dam construction for social amenities like schools or clinics. On the negative side, the road constructions at Bakun not only opened up the rainforest for accessing the dam site, but also allowed access to a wide range of other commercial operations, most importantly logging and palm oil companies that are operating in the formerly inaccessible area. At the Zamfara dam, the local communities see the proposed dam as a better future with access to schools, clinics, roads and employment opportunities.

This analysis shows that impoverished rural communities at the dam sites are experiencing the negative impacts of the dams by a reduced *availability and affordability* of resource access due to declines or losses of livelihoods, threats to food security, loss of traditional lifestyles, and in the case of Cambodia lack of affordable energy access for all. Moreover, the benefits are mainly with dams' builders, national governments and urban dwellers who receive electricity and therefore the economic benefits from the dams resulting in *intragenerational inequality* of costs and benefits distribution.

The next section shows how power relations influence the way in which state and corporate actors engage with host communities around project sites and therefore the *transparency and accountability* of the decision making process of the dams under study.

4.3. Recognition and restoration of dam impacts and the energy justice principles of transparency and accountability of the decision making process

The energy justice principles of *transparency and accountability* refer to the availability of information about energy decisions and a condition of participation and informed consent by those affected by the realization of energy projects. They therefore refer to the notion of participatory governance as a way of including all stakeholders in the decision making process in all stages of the energy process, from planning and formulation to siting, operation and monitoring [19]. According to Heffron and McCauley [24] *restorative justice* which aims to repair the harm done to society and nature by energy decisions, can be seen as a way to ensure energy justice is applied in practice. In the case of energy infrastructures this can be achieved for instance with the implementation of Environmental Impact Assessments and the post-acceptance monitoring phase.

Most countries around the world have legislated to ensure that for projects such as large dams with the potential for very significant environmental and social impacts an Environmental Impact Assessment (EIA) or an Environmental and Social Impact Assessment (ESIA) is conducted and approved by national authorities (such as the Ministry of Environment or the Ministry of Energy if these two are separated), before construction starts. According to international guidelines such assessments should evaluate the potential environmental and social risks and impacts; examine project alternatives; identify ways of improving project selection, siting, planning, design and implementation in order to mitigate adverse environmental and social impacts and seek opportunities to enhance positive impacts [85]. For large dams specific requirements will usually include a resettlement planning framework including compensation to be provided to the affected communities. Moreover, according to international guidelines and standards, affected communities should be consulted and actively involved in the assessments and subsequent decision making from the beginning of the planning and then construction process [9]. However, in the case studies analysed we found various shortcomings in the preparation of the EIAs/ESIAs, consultation and participation of the local affected people, as well as the implementation of social and environmental mitigation and safeguard measures, as specified hereafter.

The EIA for the Bui dam was commissioned before the construction of the dam by the Ghanaian Ministry of Energy and carried out by the UK firm ERM [86,77]. A new local authority – the Bui Power Authority (BPA) – created by the Ghanaian government, was made responsible for the implementation of the Environmental and Social Management Plan (ESMP) which was prepared as a standalone document as part of the EIA recommendations. Even though environmental regulations and standards in Ghana are relatively strong and reflect international standards, particularly those developed by the World Bank, and standards of the International Organisation for Standardisation (ISO) [78], there were major shortcomings in the implementation of the ESMP, particularly with regard to proposed alternative livelihood schemes. Key informants emphasized 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 infrastructures, such as irrigation technologies, to support existing livelihoods [65]. For this case failures in the implementation of national environmental regulations and the project EIA are illustrative of how failings by national government may compromise intended best practice.

In the case of Kamchay dam, the Cambodian Ministry of Environment (MoE) is primarily responsible for organising the realization of the EIA, reviewing the report and monitoring compliance with environmental legislation [79]. However at the Kamchay dam, the full EIA was approved only after the dam construction was completed and in operation, while the consultation process before the dam construction was patchy and ad-hoc with little local participation. According to our interviews village chiefs were involved in the consultation process but given little opportunities to actively participate and have a say during meetings. In addition, the Environmental Management Plan (EMP) which aims to implement impacts mitigation measures was not in place until the late stages of the dam construction. It is also being reported that dam builder, in this case Sinohydro, did not implement any mitigation measures [83,80]. High-ranking officials at the provincial Department for the Environment and the EIA reported the lack of implementation of the mitigation plan:

> *"…we are not preparing the implementation of the Environmental Management Plan mentioned in the ESIA because the money from the Company [Sinohydro] is not available. The budget is divided into: planting forest (4 million US$), fisheries restoration (800 thousand US $), and socio-economic restoration (570.000 US$). We cannot use the money, because the Provincial Department of Environment is not daring to discuss with the Company [Sinohydro]."* (Interview with Kampot Department of Environment, 2013).

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. This case illustrates failure in capacity and political will on the part of the national government in the form of the Cambodian ministries, and most specifically with regard to ensuring that the dam developer fulfils its commitments for environmental and social impact mitigation. A weak state is likely to be most in need of the more accessible international development finance and technical assistance available for dam projects from overseas dam developers, and less resistant to strategic 'soft power' [87]. The domestic political economy of a weak state may also be more vulnerable to capture by elite interests, content that dam developers do not seek to impose stronger supervision and conditionality for project implementation.

In the case of the Bakun dam, one of the most important environmental requirements is the preparation of the EIA which after completion needs to be approved by the Malaysian Director General of Environmental Quality. The Handbook of Environmental Impact Assessment Guidelines [88] also states that public participation should be included in the preparation of the assessments and copies should be made available to the public to comment on within a reasonable period of time [89]. 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 Malaysian state departments, without the direct participation of community members. Moreover, according to interviews resulting recommendations from village leaders about resettlement were never taken into consideration by the government: *"The suggestions given from villagers to the government were from the 15 village leaders that were involved. They gave suggestions to the government about resettlements, allocation of lands and compensation, but sadly suggestions were not included in the EIA and the mitigation plan"* (quote from village man in Uma Juman longhouse).

In the case of the planned Zamfara dam, one of the main reasons we found for the failed dam was that the negotiation process for the construction of the Zamfara dam was not opened to the federal regulatory body for dam construction in Nigeria (the Federal Ministry of Water Resources – FMWR) as stipulated by the existing legislation. The FMWR was not involved in the negotiation between the contractor company and the Zamfara state government. Though the federal government is presently encouraging the construction of hydropower dams of various sizes in the country, project proponents are expected to apply for a licence to embark on such projects from the ministry. The Zamfara state government did not seek for a licence from the federal government. According to a top government official in the Zamfara State Ministry of Agriculture and Water Resources, "*the negotiation was actually between the former Governor of Zamfara State, his close aides, few ministry officials and the China Geo-Engineering Corporation officials"*. According to the state government official interviewed,

> "*The communities were informed that some of them would be relocated. Aerial survey commenced in early 2008 with 50 percent of the money for the EIA paid to a consultancy company. Budgetary allocation has been kept open over these years. That means the idea of the project has not been totally foreclosed*".

Linking this back to the energy justice conceptual framework, in all the case studies there has been at various degrees some disregarding of national legislations and international standards for large dam development. In the Cambodian case foreigner investors and dam-builders exert a high level of power over national Cambodian authorities, even to a degree where the altered power relationship caused by dam-builders led to an over-ruling and disregarding of Cambodian legislation and Cambodian government authorities in terms of consultation and impacts' mitigation. In the case of Bakun dam in Malaysia, consultation were conducted only with few village leaders and recommendations resulting from local participation were not included in the resettlement and compensation plans. In the case of Bui dam even though the consultation process involved all the affected communities and transparency was fulfilled, some mitigation plans have not been implemented. In the Zamfara case lack of transparency in the negotiation process between different authorities at the national and state levels resulted in the failure of the dam construction. Therefore, even though EIAs and post-construction mitigation plans have been prepared in most of the cases, this doesn't assure automatically that *restorative justice and transparency and accountability* principles are satisfied. In the case of large dams development the realization of EIA and the implementation of costly mitigation measures need to be constantly monitored and enforced by national governments to ensure that the energy justice principles of transparency and accountability are actively put in practice in all phases of the decision making process, especially in situations where high environmental and social risks are involved.

5. Conclusions

This paper has showed that large energy infrastructures should be analysed as socio-technical systems and from an energy justice perspective and therefore not only in economic and technical terms but as a highly political decision, involving the satisfaction of competing preferences and needs in society. To this end, this paper has proposed *The Energy Justice Framework for Dam Decision-Making* which brings together the energy justice principles proposed by Sovacool et al. [19,21] and the most recent studies on dams' social impacts evaluation [20]. This framework can be used to look not only at the negative and positive impacts of energy projects on society but also to inform energy decisions on infrastructure development based on energy justice. From a socio-technical perspective the proposed framework brings together technical aspects such as infrastructure siting, purpose of the dam and energy generation with energy justice concerns of distribution, procedure and restoration, as well as the energy justice principles of availability, affordability, intragenerational equity, responsibility, resistance, transparency and accountability [19,21]. It is therefore a decision-making tool that can assist energy planners to make more informed, just and inclusive decisions on dams' development in the planning and design phase and at the same time to analyse and compare the decision making process and impacts of dams already in operation.

In this paper the above mentioned framework has been applied to compare the decision making process and the expected impacts of a large dam located in Nigeria and the post-construction social and environmental impacts of three different large dams located in Africa and Asia, Ghana, Malaysia and Cambodia. The analysis has showed that by ignoring energy justice principles in the decision making process of large dams development, policy makers fail to capture some of the key aspects of investment decisions on hydropower that help determine whether the implementation of these projects achieve their objectives of improving energy access and at the same time promoting a socially-just development at the local and national levels. While the dams analysed have resulted in positive outcomes such as improved energy access at the national level, especially in urban areas, and access to school and clinics, local communities directly affected by dam construction have also suffered from a decline of the availability of natural resources resulting in a decreased food self-sufficiency, reduced land fertility, reduced access to land and water, and in some cases lack of energy access and problems of affordability of energy services. These 'trade-offs' demonstrate the uneven distribution of positive development impacts on the different segments of population based on their geographical location and livelihood options. Moreover, restoration of the post-construction impacts have not been put in place, and the decision making processes have violated the energy justice principles of responsibility toward environmental and social threats by building the dams in indigenous peoples land and in national parks, as well as accountability and transparency with poor consultation with affected communities.

Although we are well aware of the fact that the negative impacts of dams and differential outcomes on various countries identified in this paper are not a novelty in the current literature on large dams, this paper offers for the first time a broad framework that can help conceptualize the comprehensive issues involved with dam construction from a socio-technical and energy justice perspective. The inclusion of energy justice principles in the decision making process and impact evaluation of large dams could be instrumental to reconcile the divergence between international, national and local developmental needs attached to large hydropower development in the global South. In addition, this paper teases out the energy injustice between various stakeholders such as dam builders, financiers, local dwellers and local governments in the locating a hydropower project and acknowledges the importance of questioning "energy (justice) for whom?". Moreover, this research demonstrates those differential outcomes of negatively affected communities are exacerbated by power relations and the differences in people's ability to afford energy and theirs experience of distributional inequality and related post-construction issues. The move towards energy justice and inclusive development for all stakeholder groups must ultimately address the issue of power and participation in these dam sites. Finally, we believe the framework proposed in this paper will be useful to guide future empirical research on energy justice and renewable energy projects development, both for researchers in academia, policy makers and international donors, such as the World

Bank. The World Bank group for instance has committed itself to the implementation of the World Commission on Dam's recommendations (WCD) to support dams that are not only economically well justified but also environmentally and socially sound [90]. This paper has shown how the WCD's recommendations which include the core values of equity, participation, sustainability and accountability can be implemented in practice by evaluating and comparing energy projects from an energy justice perspective for the achievement of a more socially-just future energy decision-making.

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