**Framing hydropower as green energy: Assessing drivers, risks and tensions in the Eastern Himalayas**

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The culturally and ecologically diverse region of the Eastern Himalayas is the target of ambitious hydropower development plans. Policy discourses at national and international levels position this development as synergistically positive: it combines the production of clean energy to fuel economic growth at regional and national levels with initiatives to lift poor mountain communities out of poverty. Different from hydropower development in the 20th century in which development agencies and banks were important players, contemporary initiatives importantly rely on the involvement of private actors, with a prominent role of the private finance sector. This implies that hydropower development is not only financially viable but also understood as highly profitable. This paper examines the new development of hydropower in the Eastern Himalaya of Nepal and India. It questions its framing as green energy, interrogates its links with climate change, and examines its potential for investment and capital accumulation. To do this, we also review the evidence on the extent to which its construction and operation may modify existing hydrogeological processes and ecosystems, as well as its impacts on the livelihoods of diverse groups of people that depend on these. The paper concludes that hydropower development in the region is characterised by inherent contentions and uncertainties, refuting the idea that dams constitute development projects whose impacts can be simply predicted, controlled and mitigated. Indeed, in a highly complex geological, ecological, cultural and political context that is widely regarded to be especially vulnerable to the effects of climate change, hydropower as a development strategy makes for a toxic cocktail.

## 1. Introduction

Often called the Water Towers of Asia, the Himalayan region represents both the connection and collision of two processes emblematic for the early 21st century. The first is the surge of interest for hydropower development. While different figures abound, near to 200 new dams are planned in the Himalayas for the generation of more than 150,000 MW[1] of electricity (Dharmadhikary, 2008; Pomeranz, 2009, IR 2014). The second is the recognition of, and debate over, climate change. Although data are limited and contested, there is significant scientific consensus that the Himalayas are particularly vulnerable to the effects of global climate change. How the effects of hydropower development will intersect with the impacts of climate change is a source of serious concern as the inflexibility of hydropower construction is incongruent with growing insights on climate variability. First estimates suggest that increased uncertainties of river flows (Shah, 2013) may render baseline data used for infrastructure design unreliable, suggesting that climate change will exacerbate the impacts of hydropower in altering river flows and the hydrological variability of springs (Bawa et al., 2010; Dharmadhikary, 2008; Moore et al., 2010), especially when several installations are constructed in sequence on the same river (see for example Fig 1 below).

Paradoxically, climate change awareness has increased the popularity of hydropower[2], now presented as renewable and clean energy that can replace fossil fuels as well as fulfil growing energy demands in Asia and elsewhere. As such, hydropower projects qualify for top-up funding through the Clean Development Mechanism (CDM). They comprise the second largest type of project receiving CDM financing (Makinen and Khan 2010). China and India, respectively, make up the bulk of CDM financed projects in Asia, accounting for 45 per cent of the projects and 65 per cent of the total investment (UN 2012). Most of these investments are for hydropower projects planned and located in the Himalayan region.

At national and regional levels, hydropower development is pursued not so much as a climate change mitigation strategy, but as a way to meet objectives of economic growth and energy demand of downstream industries, cities and commercial farmers (Asif and Muneer 2007; Marslen 2014[3]). Regardless of the objectives, hydropower is popularly presented as an economically beneficial certainty, even though there is a systematic absence of empirical evidence on how dams affect poverty and livelihoods (Dufflo and Pande, 2007) and whether potential benefits outweigh the social and environment costs incurred (Ansar et. al. 2013). Hydropower projects present opportunities for economies that seek much needed foreign exchange as in the case of Nepal and Bhutan, and allow others to become power brokers in the region, as in the case of India and China. The emphasis given to hydropower development during the first official visits of the recently elected Prime Minister of India to Bhutan and Nepal are telling in this regard. Different from hydropower development in the 20th century when International Financial Institutions (IFIs) played an important role, current hydropower dynamics include a wide range of global and regional financiers, due to the deregulation of the energy sector and processes of global financialization. Rather than

[1] Exact data of how much is planned that is specific for the Eastern Himalayan region and up to date in 2014 are not available, as projects are planned, cancelled, under revision, etc. Furthermore, exact data on Chinese activities were not accessible.
2 In a similar fashion nuclear power has once again become more popular as a source of energy with low GHG emissions.
3 http://www.futuredirections.org.au/files/sap/FDI_Strategic_Analysis_Paper_-_Nepal_Hydropower_and_Geopolitics.pdf

being concerned with either climate change or regional or national development, these new players see hydropower development as investment opportunity and are primarily interested in potential returns. For example, more than 70 leading commercial banks and financial institutions have adopted the Equator Principles, a project of the World Bank's International Finance Corporation (IFC) to guide finance investments in the hydropower sector. It is assumed that guiding infrastructure investments to meet the IFC's Performance Standards will improve their environmental and social risk management. Corporate social responsibility (CSR) is said to be enhanced by a number of such protocols that when signed can facilitate access to projects, however, lack of transparency and corruption often overshadow good intentions (cf, Middelton 2009, Wright 2012, and Merme et al 2014).

The current enthusiasm for hydropower development, and the strong alliances that support it, suggest that the controversies that among others led to the World Commission on Dams have either disappeared or can now be dealt with more effectively. But is there reason to expect that the current resurgence, fuelled by claims of renewable energy to mitigate climate change, will cause less controversy, problems and damage? In this paper, we examine this for the Eastern Himalayan region of Nepal and North Bengal in India[4]. This is a region that is not only geologically and ecologically unique, but also politically fragile, with ethnic and cultural tensions and faults corresponding to the region's international and national boundaries. Furthermore, the seismic activity in the region makes it disproportionally precarious and adds a particular urgency to questions about the kind of development that can best be pursued and where, who will benefit, and who will bear the costs. Our purpose is here is not to argue against hydropower per se, but rather stimulate and broaden the discussion of it by inviting other stakeholders and disciplines to contribute, in order to determine more precisely and more inter-disciplinarily the dynamics that are inherent to hydropower development.

Hydropower development demonstrates the complex synergies and tensions that climate change provokes. Our analytical frame regards the hydraulic structures built to produce hydropower as active agents of change in landscapes that are produced by the interaction of social, biophysical and technological dynamics (Ahlers 2011, Bury et al. 2013, Meehan 2013). Changes produced not only material but also semiotic: discourses that recycle hydropower as clean energy, warn of immanent climate risks and use economic development to justify and enact far-reaching modifications that reconfigure territory by redirecting flows and sediments, and along with it reorder its organisation institutionally, politically, economically (Ahlers et al 2014).. These waterscapes, in turn, can be read as historical outcomes of contestations over the meaning and direction of development (Ahlers et al 2014, Budds and Hinojosa, 2012; Swyngedouw et al. 2002, Zwarteveen et al., 2005). We use this analytical approach to examine the content of the three most important discourses mobilized to legitimize the construction of hydropower complexes (be they run-of-the-river or not) in the Eastern Himalayas: climate change, clean energy, and economic development.

4 For details see http://www.icimod.org/?q=3598.

In the section that follows this introduction, we outline the characteristics of the Himalayan region and discuss the scale of planned hydropower development there. This is followed by a presentation of debates over climate change and hydropower as clean energy, and their mobilization within this region in order to show what kind of development is envisioned and what kinds of benefits are expected to arise. By including the financial sector and its emerging actors in the analysis, we demonstrate that the benefits and risks are spatially and temporally highly disconnected, with potential impacts that cannot be simply predicted, controlled or mitigated.

## 2. Hydropower development in the (Eastern-)Himalayas

With roughly 43,000MW of hydroelectric power already developed, recent figures for the region show plans to increase this with more than 215,000 MW, although this does not include any of the Chinese projects (Dharmadhikary, 2008; IPPAN and CII, 2006). If these plans are realised, it would make the region the highest dam-density area in the world (Dharmadhikary, 2008; Vidal, 2013). A telling illustration of the intensity of these development plans is provided in fig. 1, which shows the dams that are planned on the Teesta River in Sikkim, North-East India.

[Insert Fig 1 here]

In the coming decades, Nepal plans to construct 22,000 MW of hydropower infrastructure. This level of electricity production far exceeds national power requirements even if the country's significant and long-standing national power deficiencies are redressed and future increases in demand are considered implying that the bulk of projects are designed to produce electricity exports to India. In India, equally impressive plans are being launched. In 2003, the "50,000 MW initiative" was announced, preparing the ground to build 162 dams. A significant number of these dams are planned in Sikkim. In 2014, 11 of these were installed, 10 were still under construction (primarily in Sikkim), 50 had been prepared for approval, and seven have been approved (Vagholikar and Das 2010). The full development of the expected hydropower expansion requires a substantial amount of capital. For Nepal, the most likely projects to be achieved in the near future have been estimated to cost roughly US$ 4.2 billion, concentrated in 11 large dams. For India, the 50,000 MW expansion is estimated at a cost of US$ 60 billion. These estimations do not include (systemic) cost and schedule overruns (see for example Ansar et al., 2013 for mega projects) or costs involved from installing expensive transmission lines given the remote locations of these projects (Dharmadhikary, 2008).

## 3. Clean energy and Clean Development Mechanism:

The increasing recognition of the need for alternative, non-fossil energy sources in a context of increasing energy demand has prompted the framing[5] of hydropower as an alternative, or clean and green, low carbon source of energy (Imhof and Lanza, 2010; Käkönen and Kaisti, 2012; Kim, 2010). The International Hydropower Association (IHA) thus argues that "the

[5] Framing is a discursive strategy of getting a particular message across by linking or assigning a particular trait or perspective to a concept so as to persuade the other.

growing fleet of hydropower stations, if developed sustainably, will help offset [greenhouse gas] emissions as well as contribute to green growth" (Pyper, 2013[6]). The World Bank's IFC[7] has begun projects that focus on providing training and capacity building to key stakeholders, including investors as a means to ensuring sustainable and commercially viable hydropower, which ensures that the environment is protected and that local people have access to the water resources they depend on. In the words of the Bank's Vice President for Sustainable Development "[l]arge hydropower facilities have become a key milestone for green growth" (Grenier, 2012).

Yet, repackaging hydropower infrastructure as clean energy is confusing the resource with the instrument: water is renewable, yet dams are not (McCully, 1996). It also ignores widely available knowledge on greenhouse gasses (GHG) emitted by reservoirs, not to speak of the less studied but substantial amount emitted during the process of construction and subsequent land use changes ( Fearnside, 2014, Fletcher, 2010, Lima et al 2008, IPCC 2011[8], Mäkinen and Khan 2010, , , Pittock 2010, and Kim 2010). According to the WCD (2000), large dams' reservoirs could contribute between 1% and 28% of the global warming potential of GHG emissions. In certain circumstances, gross GHG emissions from large dams can be potentially higher that thermal alternatives in tropical and boreal regions (McCully, 2004; WCD, 2000; Yumnam, 2012). Since 2011, the International Hydropower Association has recognised the problem and is undertaking research with UNESCO-IHP on GHG emissions and monitoring.[9]

In line with the clean energy discourse, hydropower development in low-income countries is eligible for top-up funding through the Clean Development Mechanism (CDM) and can generate Certified Emission Reduction certificates (CERs, or carbon credits) (ADB, 2007; Newell et al., 2011). The CDM was established under the UNFCC Kyoto Protocol with ambitious expectations to reduce GHG emissions, and became popular for hydropower development. While in 2004 only 3% of newly installed small hydropower projects applied for the CDM, this grew to 45% in 2007. In that year, China for example, applied for CDM registration for almost all of its new hydropower plants. Both India and China have applied for CDM for large and small scale hydropower installations (Spalding-Fetcher et al 2012), whereas the Nepalese government even instituted a special taskforce to maximize access to CDM related funds. In 2012, 1000 hydropower projects were registered under the CDM and 700 more were applying for registration. These projects are primarily located in Brazil, China and India, while CER purchasers are mainly in Japan, The Netherlands, United Kingdom and Germany. Of the projects registered under the CDM, most are located in the Himalayas (CDM Watch, 2012; IHA, 2010; Erlewein and Nusser 2011). In this way, the CDM becomes an enabler of hydropower financing as promoted by the World Bank. To scale-up dam financing and "maximize the strategic value of hydropower", the World Bank pushes for "measures to improve the environment for private sector participation and getting access to

[6] http://www.eenews.net/stories/1059981973 accessed 12th March, 2013.
[7]http://www.ifc.org/wps/wcm/connect/ff1b33804d9724098cecbd48b49f4568/IFC+Promotes+Sustainability+of+the+Hydropower+Sector+in+Lao+PDR.pdf?MOD=AJPERES
[8] In 2007, IPCC promoted the potential of hydropower to reduce net GHG emissions as a mitigation instrument eligible under the CDM. However, in the same chapter, they also discuss the emissions from reservoirs, yet promote hydropower as having a net benefit compared to other sources of energy.

carbon credits" (WB, 2009; WB, 2012, p.59). Carbon finance is thus sold as a key instrument to mitigate climate change and provide indispensable funds through instruments that leverage private capital. Nevertheless, "the combination of the high share of the market applying for the CDM, the favourable economics of hydropower in most countries and the small impact of carbon revenue on profitability has led to wide criticism of hydropower projects as not being additional" (Spalding-Fecher et al 2012: 94 ).

In North East India, public and private companies (National Hydroelectric Power Corporation (NHPC), Athena Power Private Limited, Lanco Energy Private Limited, Teesta Urja Limited Delhi, among others) seek carbon credits on the pretext of their efforts to mitigate climate change. In this way, carbon credits could be perceived to subsidize the hydropower industry rather than mitigate climate change (Yumnam, 2012). It remains too early to identify how strong or decisive a driver CDM is, and/or whether the IFC projects and Equator principles can foster sustainable and economically viable hydropower development. In India, the review of the 2013 June flooding in the Central Himalayas by a fact-finding committee identified an urgent need to improve the environment governance of hydropower projects, and outlined that 23 of the 24 proposed Hydropower Projects (HEPs) in the Central Himalayan region, would have significant irreversible impacts on biodiversity values (SANDRP, 2014).

## 4. Climate change

Climate change is expected to affect profoundly the hydrogeological dynamics of the Himalayan region, having a significant impact on geology, biodiversity and livelihoods (Agrawala, 2003; Bawa et al, 2010; Gyawali, 2004; Tse-Ring et al., 2010). Over the last thirty years, average temperatures have increased more than the global average and precipitation patterns have become more erratic. In Nepal, average annual precipitation and discharge of major basins are decreasing (Tse-Ring et al., 2010; WECS, 2011). Rising temperatures will likely precipitate glacier[9] and snow melt, thereby modifying river regimes and increasing risks of flooding (Agrawala et al., 2003; Dixit, 2012; Sharma et al., 2009; Shrestha et al., 2012). These physical shifts amplify other processes, producing a cascade of effects, including reduced snowfall, variable precipitation, formation and expansion of glacial lakes, cyclic run-off disruption, accelerated erosion (landslides, slope failures)[10], and associated risks (floods, drought)[11]. Unfortunately, insufficient data, especially for high altitude areas, prevents a more precise understanding and prediction of the evolution of these phenomena (Shrestha et al., 2012). Nevertheless, the tangible impacts of climate change argued by scientists are largely confirmed by local farmer and pastoralist communities who experience the consequences (Bawa et al, 2010; WECS, 2011).

While hydropower is framed as a climate change mitigator, explicit attention to climate risks is hardly acknowledged in national government and donor strategies with regard to the

[9]However, some observations indicate that among the thousands of glaciers in the Himalayas some are growing (Bawa et al., 2010).
[10] Being young mountains, the Himalayas have a very high rate of erosion.
[11] In Nepal, floods are triggered by five main types of mechanism: continuous rainfall and cloudburst, glacial lake outburst flood, landslide dam outburst flood, infrastructure failure and sheet flooding in lowland plains (WECS, 2011).

impact of infrastructure construction (Agrawala et al., 2003:28; Dharmadhikary, 2008; IR, 2011; Bawa et al 2010). In the case of North East India, revenue from hydropower is presented as facilitating social development programmes[12]. The discourse driving hydropower here concerns development and modernization, rather than sustainability or resilience to climate change (IPPAN, 2006; Dixit and Gyawali, 2010), although we suggest that climate change is mobilized to enhance its promotion where convenient. A report commissioned by the OECD warns about the high projected impacts of climate change on water resources and hydropower production in the Himalayas, in terms of certainty, timing and severity (Agrawala et al., 2003). Climate change is likely to affect both the safety and productivity of hydraulic infrastructure in a number of ways (IPCC 2014). On the one hand, siltation and unpredictable water flows might impact directly the expected power production, threatening the economic viability of a dam. For instance, cases have been reported of power turbines becoming dysfunctional after massive siltation in reservoir or run-of-the-river projects. On the other hand, the security of the infrastructure itself is at risk. The Himalayas is an active seismic region, characterized by landslides, flash floods, and changing geomorphologies of river and lake beds. Furthermore, the glacial lakes of the Himalaya are expanding as they are fed by melting ice and snow, with the risk of outburst floods. In sum, substantial concerns question the suitability of widespread dam building in a region that is highly vulnerable to both climatic changes and seismic activity (Baruah, 2012; Shah, 2013; Totten et al., 2010; WECS, 2011).

That hydropower development will be necessary in the Himalayas and that countries such as Nepal perceive it a welcome generator of external revenue demands not only a critical and interdisciplinary analysis of the scale, location, technology and purpose of the installations, but as well as concerted and inclusive decision-making around the priorities and distributionary implications of generated benefits and costs. In this analysis it has to be made clear what the composite of drivers behind hydropower development are.

## 5. Financialization

Recent research shows that hydropower development has attracted the attention of not only power hungry nations, but also global and regional financial actors (Hildyard, 2012; Merme et al 2014). Large infrastructure projects that have productive potential allow both the absorption of surplus capital as well as the incorporation of a myriad of financial instruments. The IFIs previously involved in the hydropower sector, such as multilateral and bilateral banks, state-owned agencies or ECAs, have ceded ground to new regional and global commercial actors: primarily investment banks, funds, and corporations who provide less conditioned and more readily available capital injections. The IFIs still facilitate the process as impact mitigators, while the new actors make use of cutting-edge financial instruments under private, and thus more obscure, constructions. Merme et al (2014: 26) explain how neoliberal policy reform facilitated this:

> "To stimulate large-scale infrastructure development, such as large dams, the new power sector reforms provided new financial avenues, constellations for capital accumulation and new financial instruments that also reduce risks for

[12] See Chandy et al 2012 for details on how this is argued in Sikkim.

> investors. These included political risk guarantees, credit insurance, credit enhancement such as partial risk guarantees, bond insurance and the Clean Development Mechanism".

As such, the financialization of the energy sector is a result of the relatively recent deregulation and liberalization of power markets. To understand what financialization implies, it is necessary to look at financial markets with some hindsight. Over the past decades, the growth and size of international financial markets has far exceeded the growth of the global GDP based on active assets, increasingly so since the last 2008 financial crisis. In 2013, the size of the derivatives economy was about ten times larger than the actual real economy, accounting for US$ 710 trillion[13] compared to US$ 75 trillion.[14]. A financial consultant explains in the New York Times (2014) [15]

> "A derivative, put simply, is a contract between two parties whose value is determined by changes in the value of an underlying asset. Those assets could be bonds, equities, commodities or currencies. The majority of contracts are traded over the counter, where details about pricing, risk measurement and collateral, if any, are not available to the public"(New York Times, 2014).

Even though the full implications of these processes are still unclear, the impact of financialization on hydropower development demands urgent attention because of the dominance of the financial industry in the economy, the ascendance of shareholder power in the influence of corporate business strategies (March and Purcell (2014), and because the private character of the investments inhibits public scrutiny (Merme et al 2014). Both Hildyard (2012) and Lapavitsas (2013) show how financial gains are made without the need to produce anything. In other words: the hydropower installations may not need to be productive for them to be financially attractive, which can explain the interest of private financiers in hydropower development, specifically under the risky and uncertain conditions of climate change. Lohman and Hildyard (2014) explain this as the increasing commodification of uncertainty through hedging mechanisms as a means of estimating the cost of risks.. Sanda et al. (2013) revealed in a study of twelve Norway hydropower utilities that their hedging policy strategies were a source of significant profit. In other words, higher risks generate higher potential profits, rather than benefits.

The Himalayas are currently also witnessing a much more prominent role of private investors in hydropower development (Dixit and Gyawali, 2010, Hildyard 2012). The still evolving new institutional landscape around hydropower development is inhabited by private developer corporations, private commercial banks, domestic capital markets, special-purpose state corporations, and public financial institutions such as the Power Finance Corporation (Choudhury, 2013). Already in the early 1990s, the Indian power sector started opening up to private sector participation. Several incentives to attract private capital were developed (debt/equity ratio raised to 4:1 and 100% foreign equity participation permitted,

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[13] From http://www.bis.org/publ/otc_hy1405.htm, consulted August 8, 2014.
[14] From http://data.worldbank.org/, consulted August 8, 2014.
[15] From http://dealbook.nytimes.com/2014/05/13/derivatives-markets-growing-again-with-few-new-protections/?_php=true&_type=blogs&_php=true&_type=blogs&_r=1, consulted August 8, 2014.

hydrological risks compensation, favourable tariff formulation, survey of potential dam sites, environmental clearance procedures, creation of power trading, creation of public regional hydropower corporations, longer period for loan repayment from public bodies, and hydropower purchase obligations). Despite such reforms, private participation did not take off as expected due to a number of barriers: high risks, no long-term debt financing, uncertain creditworthiness of utilities that would purchase power, provision of free or subsidised electricity, front-end tariffs. The 2003 Electricity Act (which instituted trading, open access, stand-alone systems, exemption of a power generating company to obtain a license, mandatory share for renewable and the development of the national power grid) and the 2008 Integrated Energy Policy [16] together with state-level initiatives, have finally succeeded in encouraging private financiers to invest in hydropower, through IPP (Independent Power Producer) and PPP (Public Private partnership) arrangements (ADB, 2007; Choudhury, 2013).

In Sikkim, the Government established a comprehensive hydropower policy in 1998 to attract investments to the state. Consequently, the Teesta dams were granted environmental clearance in 1999, and in 2002, 26 companies were approved to sign agreements with the Government of Sikkim to start the projects (McDuie-Ra, 2011). Ten years later, Sikkim's rivers seem to have been carefully divided among power companies (Yumnam, 2012). In addition, the state government established the Sikkim Power Development Corporation Ltd (SPDCL) to facilitate a joint venture between private developers and national bodies. Through contractual arrangements, a share of the power produced is given freely to the Sikkim state government (around 12%); while private developers are allowed to either sell the remaining power generated directly to other states or through power trading agencies. Nonetheless, the government has experienced difficulties in reaching financial closure of planned projects, as financiers insist on investment safeguard mechanisms such as purchase agreements or national financial guarantees (ADB, 2007).

Nepal has also introduced structural power reforms in order to foster investment in hydropower (tariffs schemes, storage plants and contracts) (Gyawali, 2013). The Government of India nominated the Power Trading Corporation (PTC) as the nodal agency to deal with matters relating to power exchange with Nepal in July 2001. PTC is also the sole agency from the Indian side for finalizing all commercial and technical arrangements and systems with the Nepal Electricity Authority (NEA) and coordinating with associated Indian agencies (ADB, 2007, p.24). As India has comparatively more developed capital markets than other South Asian countries, power projects in Nepal driven by private sector actors take advantage of the Indian capital markets in securing equity, debt and other financial services (insurance and other risk management etc) for their hydropower projects.

Underlying the above-mentioned processes are two factors of concern. The first are the power asymmetries across borders, with Bhutan and Nepal being in a weaker a position to negotiate than India or China. With regard to Nepal this means that produced energy flows primarily to the Indian market at low tariffs. The geopolitical tensions between India and

[16] http://www.indianenergysector.com/overview/integrated-energy-policy-2008-of-india

China have led to a lack of cooperation between the two in terms of sharing information or forming transboundary agreements, although some research cooperation and collaborative monitoring of glacier melt do exist (Baruah 2012, Bawa et al., 2010, Dunghel and Pun, 2009, Pomeranz, 2009). Some posit that these countries' ambitions for regional power results in a race to construct dams in certain transboundary basins in the Eastern Himalaya (Pomeranz, 2009, Vidal, 2013). The second factor of concern is the opaque and problematic financial arrangements between private developers and local governments that include corrupt practices, irregularities, lack of transparency or accountability[17]. In India, this is reported to have resulted in speedy approvals of projects without adequate clearances, environmental impact assessments or public consultations (Asia Foundation, 2013).

## 6. Conclusion

The current expansion of hydropower projects in the Eastern Himalaya is presented as fulfilling urgent energy needs in ways that also mitigate the effects of climate change. Hydropower may indeed be the only or best source of energy available for a substantive part of the Himalayas. Certainly for Nepal, hydropower development may be one of few sources of badly needed external revenue. Rather than discount hydropower altogether, this paper argues that such a presentation carries a number of important contradictions. First, hydropower development is promoted as an instrument for climate change mitigation while construction and reservoirs produce potentially high GHG emissions. While hydropower may be renewable, the waterscape is often irreversible changed by the processes of generating hydropower. Using clean development and climate change to legitimize hydropower development dangerously obscures the many environmental and social impacts that hydropower development will have. Second, the uncertainties implied by climate variability, particularly in the Himalayan region, raise major concerns about future projections of hydropower production and/or flood control, and their associated risks. Third, while the financial viability of hydropower may be quite satisfactory or even highly profitable, viable hydropower production is far from guaranteed: substantial amounts of hydro dollars can be earned without much electricity being produced. Fourth, producing power for growing urban centres and industries, as well as for new financial agents, at the expense of mountain livelihoods and landscapes implies great unevenness in the distribution of costs and benefits. If ecosystem integrity is not safeguarded, it also brings in danger future use of these resources. Fifth, hydropower development, operation, and maintenance demand new and sophisticated forms of management and regulation given their spatial and temporal dimensions: to date far too little attention has been paid to the governance arrangements needed to manage these infrastructure projects and their implications. This includes several dimensions, such as aligning up and downstream multiple uses and users of water, transboundary basin agreements, and risk management.

The potential to mitigate climate change is presented as a legitimate driver of the current phase of hydropower development in the Eastern Himalaya. However, this discursive framing conveniently overlooks the wider and worrying links between climate change and

[17] For details on Sikkim see: http://indiatogether.org/articles/sikkim-s-2400-crore-hydro-power-scam-states and : http://www.internationalrivers.org/campaigns/teesta-river.

new hydropower constructions. Moreover,  it provides a mechanism through which a much broader set of financial and geopolitical drivers and interests are pursued, with few convincing benefits in terms of development for the mountain communities in whose landscapes these new dams are installed. Greater awareness of the intersections between hydropower development and climate change is not simply necessary to assess the physical viability and impacts of dams, but also fundamentally extends to the fair distribution of the social and financial benefits and costs among the stakeholders involved.  To date, we contend, far too much emphasis has been placed on the former, and far too little on the latter.

In sum, our purpose in this paper is to analyse the rather opportunistic framing of hydropower as clean, green or easy energy, or as self-evident motor of development in the face of generalized climate challenges. Instead we encourage a discussion in which  the political drivers, distributional assumptions and consequences of the intersections between hydropower development and climate change are taken seriously, with a localised understanding generated by a robust and detailed analysis of the benefits and risks involved at scale. In particular, detailed analysis of where and what kind of hydropower would be useful or disastrous  would take us beyond  opportunistic and ill informed notions that situates climate change as a “natural problem” affecting “us all” and easy win-win solutions to mediating change.

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Fig.01 Hydropower Development in the Teesta River Basin, Sikkim.