The hydropower myth

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Abstract

Hydropower has come to be treated as synonymous with sustainable economic development by many in the development arena. This is despite the adverse ecological and sociological impacts being widely recognised by those outside of decision-making. The prevalence of this ‘hydropower myth’ simplifies the complex trade-offs involved within hydropower development and often leads to inequitable situations and ecological damage. The Mekong River is used to demonstrate the strength of the hydropower myth—the disconnect with the social and ecological realities of the basin, and emerging and potential negative consequences. The attractiveness of the hydropower myth to decision-makers and developers is shown to lie largely in its political utility in bolstering national power and legitimacy as well as its ability to channel economic benefits towards states and developers.

Keywords Hydropower · Sustainable development · Mekong · Energy · Narratives · Water resources

Introduction: the hydropower myth

Hydropower development has long been framed positively as a vehicle for development and poverty alleviation as well as a provider of clean and renewable energy resources. Hydropower projects have become synonymous with modernity and have even been likened to ‘modern temples’ (Nehru 2015). More recently, they have become a vital component in many countries fight against climate change as they are considered to provide an abundance of clean energy. Thanks to this ‘hydropower myth’, hydropower projects have become an essential component of water resources and energy development policies.

Water management, particularly in the developing world, is often characterised by a belief that water needs to be controlled and harnessed for human use. This entails major hydraulic infrastructure projects at the state level (Wester 2008; Mirumachi 2015). However, this ignores the negative social and ecological externalities associated with large hydropower projects, particularly those at local levels (Bakker 1999).

While these negative impacts are recognised by those such as academia and civil society, governments, developers and hydropower proponents such as the World Bank, continue to uphold large hydropower projects as a panacea for sustainable development. The Mekong River exemplifies the persistence of the hydropower myth within national and transboundary water management, as well as the social and ecological dangers of perpetuating such a perception.

The hydropower development narrative

The formulation of development and management strategies involves the distillation of often highly complex issues into manageable problems. This is an interpretative exercise that requires problem definition and problem solving (Litfin 1994; Hajer 1995). Development occurs through actors and their actions as they converge around narratives or storylines (Bakker 1999).

Storylines are social reality narratives that contain a set of ideas, which provide an account of an interpretation of a physical and social phenomenon (Hajer 1995). They unite actors in a certain way and shape how they discuss, think and produce knowledge on a certain issue (Bakker 1999). The phenomenon is, therefore, presented as uncontroversial and the problem is simplified (Hajer 1995; Molle 2008). The ‘hydropower myth’ is one such storyline. By uttering a certain element of the storyline, the whole can be invoked. As such, hydropower development has come to be simplified as a prime vehicle for

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sustainable, clean economic development. In doing so, negative externalities are glossed over and so the complex cost-benefit analysis involved in hydropower decision-making is skewed. The strength and maintenance of this narrative, therefore, has significant implications for how rivers and development are perceived.

Hydropower and the Mekong River

Hydropower entered the development agenda of the Mekong River in the 1950s. Prior to this, the political and development agenda had been preoccupied with navigational uses (Cooper 2011). The outbreak of the Second World War and the increasing demand for energy shifted political focus to non-navigational uses (Salman 2007).

In 1952, UNECAFE released the first Mekong basin wide development plan and the Mekong Commission was formed in 1957 to promote, coordinate, supervise and control the planning and investigation of water resources development projects (Molle et al. 2009a). The Mekong Commission oversaw the construction of tributary dams and the river was described as underutilised and prime for development (Cooper 2011).

While the Mekong Commission was not able to realise its plans for mainstream dams, they remain on the political agenda and the Mekong is now one of the world's most active regions for hydropower development (MRC n.d.). In 2008, the total dam storage capacity of the total flow across the Mekong River was less than 2%, making the river one of the least regulated large river systems in the world. This could increase to 20% by 2030; however, this prediction does not take into account developments in China on the upper stretches of the river (Middleton and Allouche 2016; Hecht et al. 2019).

Upstream, China is constructing mainstream dam cascades on the Mekong (known as the Lancang-Jiang in China). The lower cascade consists of six dams and was considered a fait accompli in March 2011. A large dam has been constructed on the upper portion of the river and 20 more large projects are planned or under construction (Räsänen et al. 2017; Magee 2012). Downstream, the Xayaburi dam in Laos was the first mainstream project and plans for a second, the Don Sahong project, are well underway. Chinese financing is also entering the region through the Lancang-Mekong Cooperative Mechanism and state-backed Chinese hydropower companies. It is thought that these developments have opened the floodgates for mainstream projects. Currently, there are over 58 large dams (height > 15 m) in the basin and 101 more are in the planning stages. This has implications for a large proportion of the 70 million people living in the basin, who rely on the river's ecological productivity for their livelihoods and food security (Räsänen et al. 2017).

Hydropower for development and poverty alleviation

Hydropower is often posited as a driver of development, lifting households out of poverty and catalysing economic growth. This sentiment is found in national statements of the Mekong countries as well as in statements originating from institutions such as the Greater Mekong Subregion (GMS). Given that 20% of the Mekong's population is estimated to be without energy and the high levels of poverty, it is understandable that economic development is a priority on the political agenda (GIZ 2014). This is particularly as hydropower has been attributed by the IPCC as “a catalyst for economic and social development” (Kumar et al. 2011 p.144).

For example, the World Bank and Asian Development Bank funded the Nam Theun 2 hydroelectric project in Laos and the project is justified on the grounds of poverty alleviation and economic development (GMS 2017). The Prime Minister of Laos echoed these sentiments by stating that hydropower development is a ‘key force driving economic growth’ (LMOFA 2016). Laos perceives itself as resource rich, but with a large proportion of its population suffering from poverty, and so hydropower is considered a solution to this problem (LMOEM 2017). Nam Theun 2 has also been associated with environmental benefits through the provision of revenue as it allows increased state control of the region. Essentially, this will protect the areas' biodiversity from exploitive local practices by creating a protected area and providing funds for alternative incomes (Bakker 1999).

Hydropower is viewed by developing states as source of generating large-scale foreign exchange and often receives the support of institutions such as the World Bank and the Asian Development Bank. Cooperation over cross-border electricity trade is, therefore, viewed particularly favourably. In the Mekong region, cross-border electricity trade forms a core component of the GMS and contributes to incentivising countries such as Laos to develop their hydropower potential for trade (Kuenzer et al. 2012; Bakker 1999). The Xayaburi dam was justified on the grounds that it would aid energy security in Thailand while cross-border foreign direct investment and revenue from the project would further development in Laos (Middleton 2014).

According to the Mekong River Commission (MRC), if all 12 planned mainstream hydropower projects in Laos are realised, the government could receive US\$2.6 billion a year from export revenue. Similarly, Cambodia could gain US\$1.2 billion a year and both countries could see foreign direct investment of US\$25 billion (GIZ 2014). Hydropower projects are also held to provide jobs, improve flood control, increase dry season flows and provide irrigation options (Kuenzer et al. 2012).

Further, China upholds that its dam cascade on the upper Mekong reduce floods and droughts, while increasing the viability of downstream hydropower projects and so aid

development downstream. This is as these upstream dams contribute to regulating the river's flow by reducing wet season flow and increasing the water available in the dry season (Magee 2012; Räsänen et al. 2017).

Hydropower for sustainable development

Global efforts to reduce the social and ecological impacts of dam development in the 1990s cumulated in the establishment of the World Commission on Dams in 1998. The Commission released a report detailing strategic priorities and guidelines to guide dam development (WCD 2000). This cumulated in the development of best practice standards and guidelines across the industry, resulting in the perception of sustainable hydropower (Bosshard 2010). More recently, the hydropower myth has incorporated narratives of clean energy alongside sustainable development, with hydropower projects being considered a vital tool in mitigating climate change. Consequently, an IPCC report has since heralded hydropower as being “proven, mature, predictable and typically price-competitive technology” (Kumar et al. 2011, p.144).

The Brundtland Report (1987) introduced the concept of sustainable development into global discourse, and it has since been taken up by institutions such as the MRC and the World Bank and applied to hydropower construction (MRC 2008). The increasing prominence of the global discourse on climate change has served to compound hydropower's role in sustainable development as it is positioned as a sustainable energy resource, being described by the MRC as the “Mekong's indigenous renewable energy resource” (MRC n.d., para 1).

Hydropower as part of a low-carbon economy is also widely upheld at the national and regional levels. China is demonstrative of this as it legitimises its hydropower projects on the grounds that they reduce the country's carbon emissions and so reduce the regional impacts of climate change (Magee 2012). Similarly, Laos holds that hydropower will provide resilience against climate change and that hydropower exports to its neighbours will aid their sustainable development (MRC 2016), contributing to “regional sustainable solutions” (WREA 2010, p.8).

This aspect of the hydropower myth promotes hydropower as an unlimited and locally available energy resource, which provides electricity with minimal carbon emissions at a competitive price. Hydropower, therefore, can provide cheap electricity that contributes to raising the standard of living and attracts foreign investment, which drives local economic growth. Hydropower does not possess the issues associated with fossil fuels and is, often, cheaper than solar or wind power equivalents (Eylar and Wetherby 2017).

Debunking the hydropower myth: socio-ecological realities

The negative impacts of large-scale hydropower, both in general and for the Mekong have already been detailed elsewhere (e.g. Molle et al. 2009a; International Rivers 2011; Öjendal et al. 2012). Therefore, focus is on the key elements that comprise the hydropower myth, hydropower as a driver of economic development and provider of clean energy. It is notable that in the Mekong situation that the cumulative impacts of multiple hydropower developments are more likely to have a significant impact on the river and local livelihoods than any individual project. However, the hydropower myth tends to treat hydropower developments on an individual project basis, and so has a narrow focus.

Economic development: who benefits?

Hydropower is often described as harnessing ‘free energy’ from rivers and so taking advantage of an underutilised resource, a concept which is especially prominent in the Mekong case. However, this overlooks local level use and users (Pearse-Smith 2014). The construction of large-scale hydropower thus re-allocates the benefits of water use away from the local level (Bakker 1999). Over 83% of the economically active population in the lower Mekong basin are involved in water resource related activities as their principal occupation. This local dependence is frequently overlooked in hydropower decision-making, particularly as these decisions are often based on overestimated energy demand and growth forecasts (Pearse-Smith 2014). Budgets for hydropower projects are found to be systematically biased below the actual cost of the project. One study found that actual costs of projects were, on average, 96% higher than estimated costs (Ansar et al. 2014).

As a result, the majority of the negative social and environmental costs are born by local users. Large areas of land are often flooded or seized by the state in the construction of hydropower, and there are often issues with information and compensation to those impacted (Bakker 1999). As a consequence, the loss of land in these circumstances is often synonymous with the loss of livelihoods. Energy from the project is often exported across borders and the revenue generated goes to states and developers. Alternatively, as in Yunnan, China, hydropower is promoted as part of the strategy for poverty alleviation and to generate local employment. In reality, the power generated benefits distant industrial and urban areas (Magee 2006). Consequently, despite hydropower development, rural electrification in the Mekong region is still extremely low (Pearse-Smith 2014).

The dominance of international experts, consultants, engineering firms and public and private capital often results in hydropower decision-making being an opaque process

(Bakker 1999). In such circumstances, corrupt practices are often rife. In Laos corruption can enable decision-makers and private firms to push through projects that may not meet international standards or regulations. It is estimated that corruption in Laos accounts for 5–10% of hydropower construction costs. Construction of the Xayaburi dam is estimated to have cost US\$3.8 billion; therefore, a conservative estimate of US\$190 million of the construction cost went into the pockets of powerful elite actors (Matthews 2012).

Of more significance is the fact that in economic terms, the overall impact of hydropower development on the Mekong is arguably negative. This is due to the loss of fisheries, sedimentation and other ecosystem services outweighing the, often inflated, economic benefits. Fisheries are a vital component of the diet of people along the Mekong, providing a key source of protein. Therefore, the impact to the region's food security is expected to be particularly devastating (Intralawan et al. 2017; Rujivanarom 2017) and has been suggested to reduce the average GDP growth potential for the lower Mekong countries by up to US\$29 billion (Rujivanarom 2017).

The negative economic impact is compounded by the fact that hydropower investment can leave countries in debt. Hydropower projects are hugely capital intensive; therefore, in developing countries, loans are often relied on to realise hydropower ambitions. As a result, a large part of developing countries financial resources are lost to these projects and the repayment of loans can cause significant debt (Sovacool and Walter 2018). There are concerns that the downstream Mekong countries will struggle to repay the recent influx of Chinese finance pouring into the region. For example, in Laos, the Pak Lay hydropower project is financed by a US\$1.7 billion loan from China and Sinohydro, China's largest state-owned hydropower enterprise, is involved in dam projects that are backed by a further US\$2 billion of Chinese loans. Laos' increasing debt to China is largely due to hydropower projects (Macan-Marker 2018). Therefore, it has been put forth that Chinese hydropower investment in the region is a way of increasing its geopolitical influence in the Mekong basin (Middleton and Allouche 2016; Williams 2018).

Ecological impacts and climate change

Another core component of the hydropower myth is its ability to provide clean energy resources. Evidence is, however, emerging that hydropower may produce emissions that rival those of fossil fuels. On the Mekong, nearly 20% of hydropower reservoirs were found to have higher emissions than other renewable energy sources and several of these reservoirs had emissions that equalled those from fossil fuels (Räsänen et al. 2018). Hydropower projects can also contribute to climate change as they result in the drainage of wetlands and flooding of forests that would otherwise act as carbon sinks, their

construction is highly energy intensive and they are the largest single human source of methane (International Rivers 2011). Emissions from hydropower are currently thought to be around 15 million tonnes of CO₂e per year and are predicted to grow as more hydropower projects are built (Räsänen et al. 2018).

Developers also tend to overlook climate change considerations as they increase costs and reduce benefits. Consequently, hydropower projects may be constructed without adequate adaptive capacity, which places the safety and longevity of the project at risk (International Rivers 2011). In Laos, there exists an inverse relationship between the cost of avoiding or mitigating ecological and social impacts and potential profits (Usher 1997). By minimising costs of the projects, greater rates of returns can be generated (Bakker 1999). However, failures of large-scale projects often have devastating consequences, as shown in the 2018 collapse of the Xe-Pian Xe-Namnoy hydroelectric project in Laos, and many failures are due to inadequate or misleading forecasts (Hall 1982).

On the Mekong, the construction of hydropower cascades upstream in Yunnan is altering the river's hydrology by averaging out the wet and dry season flows. This is highly problematic as it disrupts the ecological flow of the ecosystem and so places species and sensitive areas at risk (Räsänen et al. 2017; Li et al. 2017). This also has implications for food security due to disrupted fish migratory patterns, saline intrusion in the delta regions and loss of soil fertility from decreased sediment loads. The more hydropower projects are constructed on the Mekong, the more pronounced the impact to the river's flow regime and the greater the cost to the regions food security and ecology. This is also problematic as it is found that risks associated with hydraulic infrastructure in the Mekong tend to be lower when water uses are adapted to the ecological conditions and the variability of natural flow regimes (Käkönen 2008). Hydropower's ability to rewrite flow regimes represents an increasing bleak situation in this respect, with the possibility of unpredictable externalities.

Best practice standards and guidelines, such as those recommended by the World Commission on Dams, are not binding or consistent across developers. There is also unwillingness within some developers to commit to such standards (Cooper 2011). Technological measures, such as those to aid migratory fish passages are also currently inadequate in the Mekong context. About 70% of the total fish catch of the lower Mekong basin relies on long-distance migratory fish species (Dugan 2008). Dams present barriers to fish migration, which could result in a loss of 495,000–792,000 t of wild caught fish a year if the proposed 88 dams are developed on the Mekong (ICEM 2010). This represents a loss of about 37.8% of the fish protein available to the lower Mekong basin's population (Orr et al. 2012). The fish passage facilities currently in existence cannot cope with the large fish migrations and high species diversity found in the Mekong (Dugan 2008).

Therefore, it is dubious whether dams can be considered part of ‘sustainable development’ in this context. While definitions vary as to what exactly sustainable development entails, the concept is recognised as possessing several core elements. These include the integration of environmental protection and economic development, the right to development, sustainable utilisation and conservation of natural resources, inter-generational equity, intra-generational equity and procedural practices such as environmental impact assessments and public participation in decision-making (Birnie et al. 2009). Hydropower does provide economic and developmental benefits through energy production and revenue generated; however, the damage to the Mekong’s fisheries and the social and environmental cost of their construction are demonstrated to violate many of these elements of sustainable development.

Interests behind the hydropower myth

The hydropower myth is argued to persist for several reasons, mainly, due to its political role in state development and the centralisation of power (Molle et al. 2009b). Large infrastructure projects are forms of propaganda, providing visible evidence of government actions towards the wellbeing of its people (Richards 2002). They also are physical signs of political legitimacy and the establishment of the power of one faction over another or in shoring up a powerful regime (Crow-Miller 2015). Legitimacy is paramount for states as it is essential for stability and power (Mukerji 2003).

Many powerful actors have vested interests in the continued construction of large hydropower projects (Molle et al. 2009b). States and technical agencies require such projects to safeguard their budgets and maintain professional legitimacy. Infrastructure projects provide a reliable income and business for private construction and consulting firms. Development banks and cooperation agencies also have an interest in maximising the distribution of funds. Development banks find such projects attractive as they assure material and large-scale change while minimising project management costs (Molle 2009; Molle et al. 2009b). States and developers are able to reap the economic benefits of such projects, while the environmental and social costs are born elsewhere (Pearse-Smith 2014). In Myanmar and Thailand, for example, hydropower projects have enabled state elites to capture public resources for their own benefit. This can include capturing sites reserved for indigenous people or wildlife (Sovacool and Walter 2018).

Hydropower’s role in compounding state power and involvement of vested interests can create a situation where water scarcity and climate change challenges are artificially generated. This ensures continued calls for development and creates a reinforcing situation (Molle 2009) as can be seen in China placing the blame for the recent Mekong droughts and

floods on climate change variations. By placing the blame on climate change, this deflects from any impacts’ China’s upstream projects may have on the river’s hydrology. Ironically, at the same time, these upstream hydropower projects are framed as being able to mitigate climate change (Earle et al. 2015).

Hydropower also has a geopolitical role in the Mekong region. It is a mechanism through which a state can impose dominance on its neighbours (Zeitoun and Warner 2006). In Laos, private- and state-backed actors from Thailand, Laos and more recently, China are looking to profit from Laos’ hydropower resources. Hydropower allows countries such as China and Thailand to gain access to the benefits from a resource beyond their borders (Matthews 2012). Internationally, cooperative rhetoric such as that Thailand is “helping its neighbour make the best use of its resource” (World Bank 2007, para 3.) omit that these powerful actors are actually involved in ‘water grabbing’ resources away from the local level for their own profit (Matthews 2012).

The concept of sustainable development is effectively harnessed by those subscribing to the hydropower myth. This is possible as sustainable development has become an essentially contested concept. The discourse has become a prominent international meta-discourse and is constantly reaffirmed by states, industries and environmentalists as a way of integrating environmental, social and development objectives. However, the concept of sustainable development is contested, and weakly implemented. Its normative nature has become embedded but it has no set meaning and so it has become a political struggle to fix meaning. This has led to a struggle between different forms of knowledge, interests, responsibilities and constructions of subjectivity. As a result, hegemonic neoliberal discourse has co-opted aspects of sustainable development. It uses its language to frame neoliberal objectives and interests, while maintaining legitimacy and weakening challenging discourses (Christoff 2013).

This is seen to occur in the Mekong region where sustainable development is co-opted into narratives to justify the construction of hydropower projects and further the interests of certain powerful groups. Sustainable development, therefore, provides a facade for decision-makers to legitimise hydropower construction on normative grounds, while the social and environmental costs are hidden (Williams 2018).

Implications and conclusions

The presentation of hydropower as desirable due to its ability to deliver sustainable socio-economic development has resulted in the hydropower myth pervading perceptions in water resources decision-making. The myth is not uncontested, civil society protests and damming scientific and academic evidence have frequently attempted to expose the complexity of

hydropower decision-making. However, the attractiveness of hydropower for politicians, engineering firms and others with vested interests in the projects has contributed to the resilience of the hydropower myth within the development arena.

Hydropower is just one of multiple uses of water resources, and so, it is only one dimension of the debate surrounding development (Hirsch 1996). Hydropower projects are highly visible and often a contentious component of development, both on a national and transboundary scale (Bakker 1999; Grafton et al. 2012; De Stefano et al. 2010). They involve shifting power and re-negotiating costs and benefits of water use across different spatial and temporal scales (Bakker 1999). The global debate surrounding hydropower is considered to encapsulate the desire to increase access to energy services without inflicting significant environmental degradation and so providing sustainable development (Sovacool and Walter 2018).

As such, the hydropower myth, and the projects themselves, have a symbolic role in water management debates. These may, therefore, be representative of larger development perspectives as they are a visible manifestation of a global shift in the geopolitics of resource exploitation (Bakker 1999). These capture the manner, whereby sustainable development becomes a process of trade-offs between economic growth and environmental destruction, without the trade-off process themselves being scrutinised (Jacobs 1994; Bryant and Parnwell 1996). As such, this glosses over the complexities and negative externalities of hydropower development and simplifies the debate. The hydropower myth allows social and ecological externalities to be mitigated through adherence to best practice standards or technological measures, without proper scrutiny of the appropriateness or implementation of these standards or measures. This has significant implications as the current investment in hydropower is setting the energy, and so environmental, trajectories for future generations (Sovacool and Walter 2018).

The power of the hydropower myth is evident in its ability to meet and adapt to challenges. The myth adapted to increased social and ecological sensitivity at the global level, encapsulated in the World Commission on Dams' report, by incorporating rhetoric of best practice standards and new technology, which shifted the debate from the negatives of dams to one regarding standards (Cooper 2011). The growth of sustainable development and environmental concerns globally saw the hydropower myth shift to emphasise the sustainability of hydropower due to the production of clean energy. The political utility of the hydropower myth has further compounded the myth's position. Hydropower's symbolic role in enforcing state legitimacy and dominance can be considered by the political elite to justify the pernicious trade-offs that result in negative environmental or social externalities.

In the Mekong region, the riparian countries are embarking on a developmental pathway that will have a lasting impact on

future generations. Hydropower apportioned the river's resources to a certain group of users for a particular use(s) for decades. The economic attractiveness of the hydropower myth is currently dominating the development agenda and new sources of finance, mostly from China, are only compounding the myth's utility for the political elite. It has been put forth elsewhere that more sustainable management of the Mekong would be achieved through emphasising pro-poor solutions. This is as local dependence on the river is often overlooked at the upper political levels. Through diversifying local livelihoods a more sustainable and equity outcome could be achieved (Käkönen 2008). However, centralised large-scale water management responsible for decisions regarding hydropower make action at local level difficult due to the mismatch between decision-making levels and a lack of flexibility.

Therefore, while it is likely that hydropower projects will remain a core component of development, it is important that increased recognition is given to the social and ecological externalities of such projects, particularly the impacts at the local levels. This will aid better acknowledgement of the complexity and trade-offs involved with large-scale hydropower and hopefully serve to dispel the hydropower myth. While the complex socio-economic dynamics of the Mekong mean that there are no easy solutions, opening up the hydropower debate allows for more equitable and sustainable alternatives to be considered.

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