Financial risks and FutureDAMS

Judith Plummer Braeckman from the University of Cambridge Institute for Sustainability Leadership, and **Jamie Skinner** from the International Institute for Environment and Development, introduce the FutureDAMS research partnership and ask who should carry the financial risks in large private sector financed hydropower projects?

Above: **Who should carry the financial risks in large private sector financed hydropower projects?**

Below: **The risks in hydropower construction are substantial and projects are well known to overrun by an average of 25% despite all the risk mitigation measures taken, the authors say**

LARGE HYDROPOWER PROJECTS CAN cost more than a billion dollars to build. For the private sector, to whom governments are increasingly turning for infrastructure finance, this represents a significant financial risk in the context of developing countries with weak governance, regulation and institutions.

As the world seeks a zero-carbon future, more and more solar and wind technology is being built – low carbon certainly, but intermittent as neither sun nor wind is available 24/7. This begs the question of which low carbon technology can provide grid energy when the sun doesn't shine and the wind doesn't blow.

If 2050 global temperature change targets are to be met, the energy intensity of electricity needs to decline by a massive 95%, reducing grid intensity from an average of 400-500g CO_2/Kwh to levels of nearer 50g/Kwh. Many planners are banking on sustainable hydropower to play this role, by managing the known social and environmental impacts and ensuring an economically productive use of natural resources for growth and development.

Global investment in clean technologies reached US$437B in 2015, with 68% of that investment provided by the private sector. Developed countries committed US$100B annually to address adaptation and mitigation needs in developing countries. So far climate funds have shown resistance to fund hydropower, due to the social and environmental risks; rainfall and hydrological uncertainty; and the perception that hydropower is not "transformational", which is a requirement for financing. In addition, the costs of hydroelectricity are seen as quite high compared to that from solar or wind which has dropped consistently over the last five years and is now as low as 4-5c/KWh in many country auctions.

FutureDAMS research

If private sector investments in sustainable hydropower were to increase in the future, what could this look like? This was the question addressed at a roundtable meeting recently held by the Cambridge institute for Sustainability Leadership and the International Institute for Environment and Development (IIED) under the FutureDAMs research project led by the University of Manchester.

The participants, drawn from engineering companies, lenders and developers, discussed the management of risks, which are significant in all hydropower projects. They range from geotechnical risk through to foreign exchange risks, hydrological risks (e.g. climate change or more irrigation upstream) or the risks that government may change and will impose revised contractual arrangements for energy purchase or new regulations. A wide range of risks were identified and discussed. For each risk a range of mitigation measure were discussed and the impact on private financiers was highlighted.

Participants stressed the role of sustainable hydropower as more than just a provider of kWh. It has the capacity to provide grid strengthening services which are vital to the management of electricity supply. While this has long been an undervalued benefit of storage hydropower, it becomes increasingly important as grids include more and more intermittent renewables, and less thermal power. Sustainable hydropower within a grid also provides opportunities for storing any excess energy (e.g. reservoir or pumped storage), as well as rapid ramping and despatch, avoiding the need to keep thermal power stations idling and ready to meet fluctuating demand. Although the cost of Lithium-ion batteries is declining, sustainably developed pump storage remains competitive as a large-scale storage option in many countries, particularly over the long term.

In future, hydropower with storage flexibility could ultimately become remunerated largely for its grid management potential rather than as a source of KWh. This would, if well structured, lower the hydrological risk associated with some hydropower plants and encourage better use of their full potential.

Cost remains a substantial barrier to hydropower investment. Contributors to the round table explained that one reason why hydropower is often more expensive than alternatives (per KWh) is that the risks are extensively analysed, quantified, and then compounded through the life of the project. As they are not usually capped, they weigh heavily in the financial assessments, and if they are all crystallised at the outset the costs of offsetting them can constitute as much as 60% of the total cost of the project. Governments tend to expect the private sector to accept all of the risk in a privately led project, but in doing so they are paying a very high risk premium that is incorporated into the construction bids and ultimately the price of electricity. Participants discussed whether models exist that might allow the risks not to be fully crystallised, and for risk management to be dealt with differently.

The risks in hydropower construction are substantial and projects are well known to overrun by an average of 25% despite all the risk mitigation measures taken. This is partly because the costs increase for each risk which occurs, but do not decrease for known risks which do not occur. Currently, as many risks as possible are costed and mitigated (eg through insurance) even though only 10-20% of them may arise in any one project.

One possible option is the FELT (Finance, Engineer, Lease and Transfer) model proposed by Mike McWilliams. In countries where there could be many ongoing private sector projects, could the risks (and therefore the costs) be distributed differently as a probability of their occurrence? Governments would essentially spread the risk over four or five projects and carry the risk themselves, rather than expecting the private sector to bear it on a case by case basis.

From the developer's perspective the identification and management of risk is essential in designing and delivering a viable investment. Abandoned hydropower projects in Chile, Myanmar and Brazil have each reportedly cost more than US$100M to their private sector developers so the costs of getting this wrong can be significant. Every country, and every project carries a different risk profile, and a different energy mix in the grid. If we are genuinely to meet the requirement for 50 g CO_2/Kwh average emission in energy grids to meet the global change targets, then what role for the private sector and what role for the international climate funds in managing the risks inherent in sustainable hydropower?

This research will continue by further refining the analysis of risk, particularly considering which risks can be mitigated to the satisfaction of the financiers and which are the risks that will always cause financiers simply to walk away. The quantum of funds available from climate finance is, to date, relatively small. The research will consider how such funds could be used to address significant barriers to the private financing of sustainable hydropower. ●

The team would be keen to hear from anyone with finance experience who would like to contribute to the ongoing research. Please email info@cisl.cam.ac.uk

Introducing FutureDAMS

The FutureDAMS research and capacity development partnership unites academics, practitioners and policy makers to improve the planning and governance of dams. Supported by the UKRI Global Challenges Research Fund Grant ES/P011373/1, it is developing the knowledge base, tools and approach to enable dam projects to support resilient and sustainable development.

The project aims to co-develop, with institutional and case-study partners, an approach and toolset to help design and plan better human interventions in complex human-engineered natural resource systems, with a focus on developing countries. Dams and systems of dams are conceptualised and assessed as water-energy-food-ecology system interventions that must deliver economic, social and environmental benefits and resilience under a range of plausible futures.

Inter- and cross-disciplinary research assessments will identify what has worked well historically and what needs improvement. A new framework for dam system decision-making will seek to enable the effective negotiated design of these complex systems. The proposed approach will use innovative and appropriate climate and hydrological science, engineering, economic, governance, political-science and social analytical methods to assist in the development of water-energy-food-ecology interventions that have high social and economic value.

A state-of-the art model-based multi-criteria assessment and optimisation of alternative water-energy infrastructure system designs will be delivered as part of the project. Factors to be explored include hydropower dam locations, size, operations, and their link to wider regional energy, food production, economic, ecological, political and social systems. An online analytical and training toolbox will allow collaborative working between diverse groups such as local and regional stakeholder and sectoral groups, investors, planners, consultants and academics.

The dams decision-making framework and analytical toolset will be developed in partnership with key stakeholders in Myanmar, the West Africa Volta basin, and the East African Nile river basin.

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