An academic view of large hydropower projects – is it consistent with reality?

A report recently published by members of Oxford University's Said Business School[1] has sought to challenge the viability of modern mega-dams with the following conclusions:

1. they are too costly, often overrun budget and are rarely operational on time;
2. as a result, there is a risk to the economic viability of developing nations; and
3. governments and companies should pursue smaller-scale hydropower projects or alternative sources of renewable energy altogether.

In this article, we consider these points to determine whether or not the academic view of large hydropower projects is a fair and accurate analysis in the context of Sub-Saharan Africa (**SSA**).

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COST & TIMING

The report draws upon a significant amount of empirical data to support its assertions regarding cost and time overrun. In relation to cost, the statistics include:

- three of every four large dams suffer a cost overrun; and
- actual costs are more than double forecasts for two in ten large dams and more than *triple* for one in ten.

So far as time is concerned, the report concludes that construction periods are too long and even then, are often subject to delay. For example, a large hydropower project is said to take 8.6 years from the start of construction through to commercial operations, and eight of every ten projects suffer an overrun with average delays being by 44% (or 2.3 years) against budget.

This data clearly highlights the inefficiencies of large hydropower projects and potential obstacles to their future development. However, aside from potential flaws in the data gathering process,[2] the following two key observations can be made as a counter to these findings:

Other Project Types

Most project types suffer some cost or time increase and the underlying causes often have nothing to do with technology. There may be political instability, conflict, corruption or logistical obstacles – these issues are common to all project types. The impact may indeed be felt more in the case of larger projects where potential investment, and therefore, potential loss, is greater but again, the type of technology is on the whole, not relevant.

Industry Advances

The report relies on historical information - researchers studied 245 large dams built between 1937 and 2007. It fails to acknowledge the numerous lessons learnt in the sector over time - Richard Taylor, executive director of the International Hydropower Association, recently said "*the scope of expectation around project development, the knowledge and understanding that exists today, is way in advance of what it was in the [20th century]. It would be really erroneous to imply that no learning has taken place*".[3]

[1] March 2014, 'Should we build more large dams? The actual costs of hydropower megaproject development', Ansar, Flyvberg, Budzier and Lunn.

[2] First, the report makes a strict binary comparison between initial construction estimates and eventual project costs and time taken (and fails to take into account the operating life of a project and evolution into a more accurate model). Second, the report makes global generalisations based predominantly on an analysis of information collected in relation to parts of Asia and the Americas – it does not consider in detail experiences of other regions such as Africa.

[3] 10 March 2014, 'Mega-dams economically unviable – Oxford report', Thomson Reuters Foundation.

This opinion is also evident in a recent World Bank Appraisal[4] regarding the planned Inga III project in the Democratic Republic of Congo. This appraisal purports that the project has "*benefited from a rich menu of lessons learned from hydropower operations in Africa and beyond*", including:

- better negotiation of contracts with investors and power offtakers;
- the necessity of the allocation of sufficient resources and time for the preparation of feasibility studies and associated safeguard instruments;
- comprehensive technical assistance provided for project preparation; and
- adequate coordination among stakeholders.

These lessons, together with technological innovation, advances in project management during the planning, construction and operation phases of a project, and significant improvements in relation to competition, transparency and risk allocation (improvements in their own right but also major contributors to better cost and time management), mean that the process has clearly developed for the better since the time of the projects considered in the report.

IS THERE A RISK TO THE ECONOMIC VIABILITY OF DEVELOPING NATIONS?

The consequence of time and cost overrun for sponsors and lenders is obvious – risk of delay or non-completion leads to concern about a project's potential return and therefore, the decision to invest.

There is also an impact on the local economic environment. A government may commit significant political support, resources and time towards a project. If it is ultimately unsuccessful, slow-delivering or costly, there may be consequences for the local economy (in particular, where the government's focus has been drawn to such opportunity at the expense of alternative and more feasible options).

This risk is exacerbated by the increasing scale of hydropower projects with the report stating that such is the enormity of some modern large dam projects there is the potential to threaten "*the economic viability of [a] country as a whole*".

However, if one is to highlight increased risks based on scale, there should also be consideration of the related benefits. The potential for greater returns attracts stronger, larger and more sophisticated investors who have the experience and expertise to take such projects through to a successful completion.

In addition, larger projects may in fact be necessary for the future sustainability and economic viability of regions such as SSA – households and businesses should benefit from regular, stable, less-expensive and, of course, cleaner energy.

Inga III promises to realise these objectives and if the wider "Grand Inga" strategy to bring 40,000MW on-line is successful then more than 500 million people in SSA could benefit – such a bold vision has to be considered when looking at the future of large hydropower plants.

SHOULD WE CONSIDER SMALLER HYDROPOWER PROJECTS OR ALTERNATIVE ENERGY SOURCES?

The report states that smaller, more flexible projects should replace the role of large dams, owing to their efficiency and lower costs. In the same way as we cannot just write off large hydropower projects, there is no single optimal approach. An energy mix (in terms of project type and size) is the solution to developing more rapidly and to achieving levels of output which can make a difference. Smaller projects can help address regional security of supply concerns whilst the larger projects should lead to fundamental change.

How this is implemented will depend upon the demands, infrastructure and range and availability of energy sources of a particular region. The consequence for SSA is that, whilst there is potential for alternative power generation to fulfil the required energy mix, large hydropower is likely to assume a major role, as illustrated below:

Energy Infrastructure: The region suffers from an under-developed transmission and interconnection system, a chronic energy shortage and limited off-grid opportunity. These three items are detrimental to the idea of a market based entirely on small, alternative power generation.

The key issue is infrastructure – large centralised projects are more likely to attract the necessary investment to realise the need for integrating communities into national grids and an interconnected regional system. Once established, there will then be a platform for smaller programmes.

[4] 5 March 2014, 'International Development Association Project Appraisal Document on a Proposed Grant to the Democratic Republic of Congo for an Inga 3 Basse Chute and Mid-Size Hydropower Development Technical Assistance Project', World Bank (Report No: 77420-ZR).

The sector's association bodies (such as the International Hydropower Association, in its most recent global outlook), governments[5] and institutional investors all recognise this issue with a resulting, and significant, increase in private and public funding being devoted towards the concurrent development of the energy infrastructure and large hydropower projects.

Abundance of Hydro Opportunity: The potential for hydropower in Africa is huge, perhaps more so than any other energy source, and has the ability to transform SSA's energy market – it is estimated that only 5% of SSA's hydropower potential is currently harnessed.

Political Will: It is often the case that an enabling environment and project flow follows political will. In 2012, African Heads of State endorsed a set of energy projects to be implemented by 2020 as part of the Programme for Infrastructure Development for Africa (PIDA) which focusses on major hydroelectric projects and interconnections between power pools. Nine hydro projects, including Inga III, were agreed with a combined projected output of more than 50GW, representing approximately 40% of Africa's energy capacity.

On this basis, it is difficult to see a divergence away from large hydropower projects – especially when one looks at the relative success of previous large hydropower plants[6] - but at the same time, we should not discount alternative viable options and the overall objective of a sustainable and productive energy mix.

SUMMARY

The reality is that all projects are subject to cost and time overrun, irrespective of the energy source and type of project. Further, it is clear that for large hydropower projects (and indeed, other project types), through lessons learnt and advances made, the situation is not as negative as the report may lead us to believe.

Of course, there are potential consequences for a poorly managed scheme and these may be worse for larger scale projects. However, we should not lose sight of the potential upside of such projects and with this in mind, the programme of large hydropower project development must continue but as part of a wider portfolio – combining projects of different types and capacities to ensure that regional demands are met fully, and in a timely manner.

[5] See UN World Water Development Report, 'Managing Water under Uncertainty and Risk' (12 March 2012).

[6] For example, the Grand Ethiopian Renaissance Dam (6000 MW), the Gilgel Gibe III Dam (1870 MW), the Batoka Gorge Hydroelectric Power Station (1600 MW), the Mphanda Nkuwa Hydropower Plant (1500 MW) and the Merowe Dam (1250 MW).