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Right Priorities for Africa's Power Sector

AN EVALUATION OF DAMS UNDER THE PROGRAMME OF INFRASTRUCTURE DEVELOPMENT FOR AFRICA (PIDA)

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INTERNATIONAL RIVERS
people • water • life

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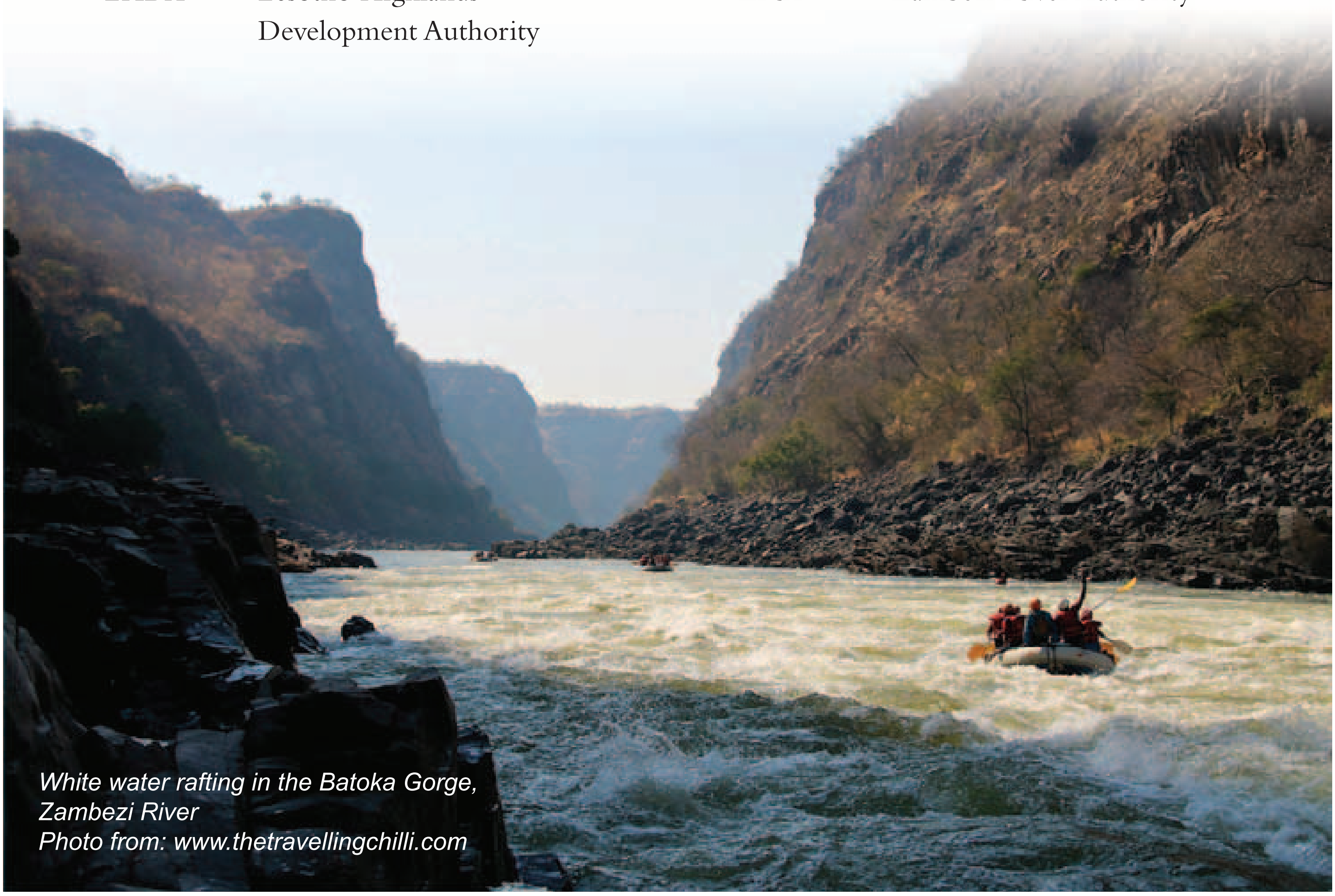
List of Acronyms

AfDB	African Development Bank
AUC	African Union Commission
BOOT	Build-Own-Operate-Transfer
CAPEX	Capital Expenditure
cfs	cubic feet per second
COTECO	Informatica Internacional, S.L. is a firm specializing in consultancy services for Communications and Information Technologies
CPI	Corruption Perception Index
DFS	Dakar Financing Summit
DRC	The Democratic Republic of Congo
ESIA	Environmental and Social Impact Assessment
HBF	Heinrich Boell Foundation
HIV/AIDS	Human Immuno Deficiency Virus Infection and Acquired Immune Deficiency Syndrome
IEA	International Energy Agency
LHDA	Lesotho Highlands Development Authority
MIT	Massachusetts Institute of Technology
MW	Megawatts
MWh	Megawatt hours
NEPAD	New Partnership for Africa's Development
NPV	Net Present Value
OMVG	Organisation pour la Mise en Valeur du fleuve Gambie
PAP	Priority Action Plan
PIDA	Programme for Infrastructure Development in Africa
RAMSAR	The Ramsar Convention is an international treaty on Wetlands of International Importance, especially as Waterfowl Habitat
SITHE IPS	Global Industrial Promotion Service Kenya
SNEL	Société Nationale d'Electricité
ZRA	Zambezi River Authority



White water rafting in the Batoka Gorge, Zambezi River
Photo from: www.thetravellingchilli.com

Executive Summary

In 2012, African heads of state launched the Programme for Infrastructure Development in Africa (PIDA), an ambitious infrastructure blueprint intended to spur development on the continent by addressing persistent infrastructure gaps. In the face of low energy generation and access rates, PIDA proposes a number of new power plants and transmission lines spanning the continent. The cornerstone of these plans is a suite of 13 large dams identified in the PIDA Priority Action Plan to be undertaken by 2020. These priority projects include the Inga 3 Dam on the mighty Congo River, the Grand Renaissance Dam on Ethiopia's Blue Nile, and the Mphanda Nkuwa and Batoka Gorge Dams on the Zambezi. PIDA's materials claim that these 13 dams would add a combined 15 GW of power to the continent by 2020.

If realized, these projects have the potential to address a critical need on the continent. However, it's important to review these projects' potential benefits in light of the mixed track record of large dams on the continent. In the year 2000, President Nelson Mandela launched the final report of the World Commission on Dams (WCD), a years-long process that analyzed the impacts, both positive and negative, of large dams globally. The WCD's key findings, and additional studies since, demonstrate that the purported benefits of large dams are regularly undermined by cost overruns and delays, while most dams, particularly in Africa, underperform. The WCD also found that the cost borne by affected communities is extremely high, and that displacement-induced poverty lasts for generations. Considering the colossal price tag of PIDA dams - conservatively estimated at over $30 billion - it is important to assess each project for its prospects for success.

This study aims to assess the proposed PIDA dams and their prospects for success, and to inform discussions about how best to allocate scarce development funds. We analyzed each PIDA project against against a set of ten indicators designed to capture, among other things, a project's economic viability, its development impact, and its environmental, social and financial risks. The assessment tool uses a combination of known standards from the World Commission on Dams and the Hydropower Association's Sustainability Assessment Protocol (HSAP). The results of the analysis are summarised in a table on page 13.

Some of the key findings of our analysis include:

Laudable development rationale, but benefits overstated and skewed

The PIDA dams all have a stated aim of addressing critical needs, mostly (but not exclusively) for hydropower generation. The Kaleta Dam in Guinea, for example, would add approximately 168 MW to a national grid currently producing only 436 MW. For others, the development rationale is less clear. The estimated 4800 MW to be produced by the Inga 3 Dam in the Democratic Republic of Congo (DRC) is intended mainly for mining companies in the country's east and for export to South Africa, while project promoters tout the remaining 1000 MW allocated to address shortfalls in DRC's capital, Kinshasa. However, even World Bank estimates note that Kinshasa's off-take could be as low as 100 MW during low production periods. Apart from that, the project is not intended to deliver power to the 90 % of Congolese who lack electricity, but who could be on the hook for massive loans for the estimated $14 billion project.

Risks outweigh the rewards

The assessment showed that for most PIDA projects, the financial risks were too high to merit the significant investments required, particularly considering other pressing development needs. The Gourbassi Dam Hydropower project, for example, is difficult to justify when the cost per MWh is $760, or 15 times the African average for hydropower. Indeed, nine PIDA projects assessed were found to have a negative net present value, even under best-case scenarios. In addition, several projects, including Batoka Gorge Dam, are planned for development under public-private partnerships (PPPs), for which the public typically ends up bearing the risk if companies are unable to recoup their investment and turn a profit.

High cost to communities and environment

Another key finding is that the suite of proposed dams could have significant impacts on the river systems and the communities who depend on them for fishing, irrigation and recession agriculture. The Fomi Dam, proposed in the highlands of Guinea, would completely alter the hydrology of the Niger River, devastating the Inner Niger Delta wetlands downstream in Mali that serve as a lifeline for millions who rely on its seasonal floods to sustain fisheries, water grazing lands, and grow rice along its banks. Meanwhile, over 100,000 people would have to be moved to make way for reservoirs that would be filled behind the PIDA dams. The social disruption that dam-induced resettlement has engendered is long-lasting and multi-generational, and track records have unfortunately little improved over time.

Not based on robust assessment of options

The majority of the dams proposed under the PIDA framework have been on the shelf for more than two decades, and PIDA adopted them with no effort to modernize or improve the projects' original approach and design. Meanwhile, significant changes have occurred in the energy sector, which has seen the development of several clean energy technologies with lower socioeconomic and environmental impacts. In this context, a comprehensive comparative assessment of available and potential energy sources is a prerequisite for planning for the future energy and electricity facilities, and should be done by each country. A comprehensive assessment would identify the expected electricity demand and best options that are available to meet these demands. It will also look at ways of optimizing the supply options, and take into consideration the environmental and social impacts, length of construction, costs and skills requirements. Such an assessment would enable a timely and thoughtful response to shifts in energy demands.


Photo: Gus Greenstein

Key recommendations

Based on these findings, our key recommendations seek to ensure that the PIDA power projects are compatible with the goals of increasing energy access for Africans, helping to create an economy that lifts all boats, and help reduce climate risk. In summary, we recommend the following:

- Projects need to be designed so that they prioritize local needs, rather than placing costs on communities and favoring export or extractive industries.
- Project costs and the cost of generated electricity should be assessed based on robust energy sector planning, in order to ensure that projects are competitive and will be able to provide affordable services to people when they become operational. To this end a variety of renewable energy sources (solar, gas, geothermal and wind) may suit some of the countries better, costing less in capital

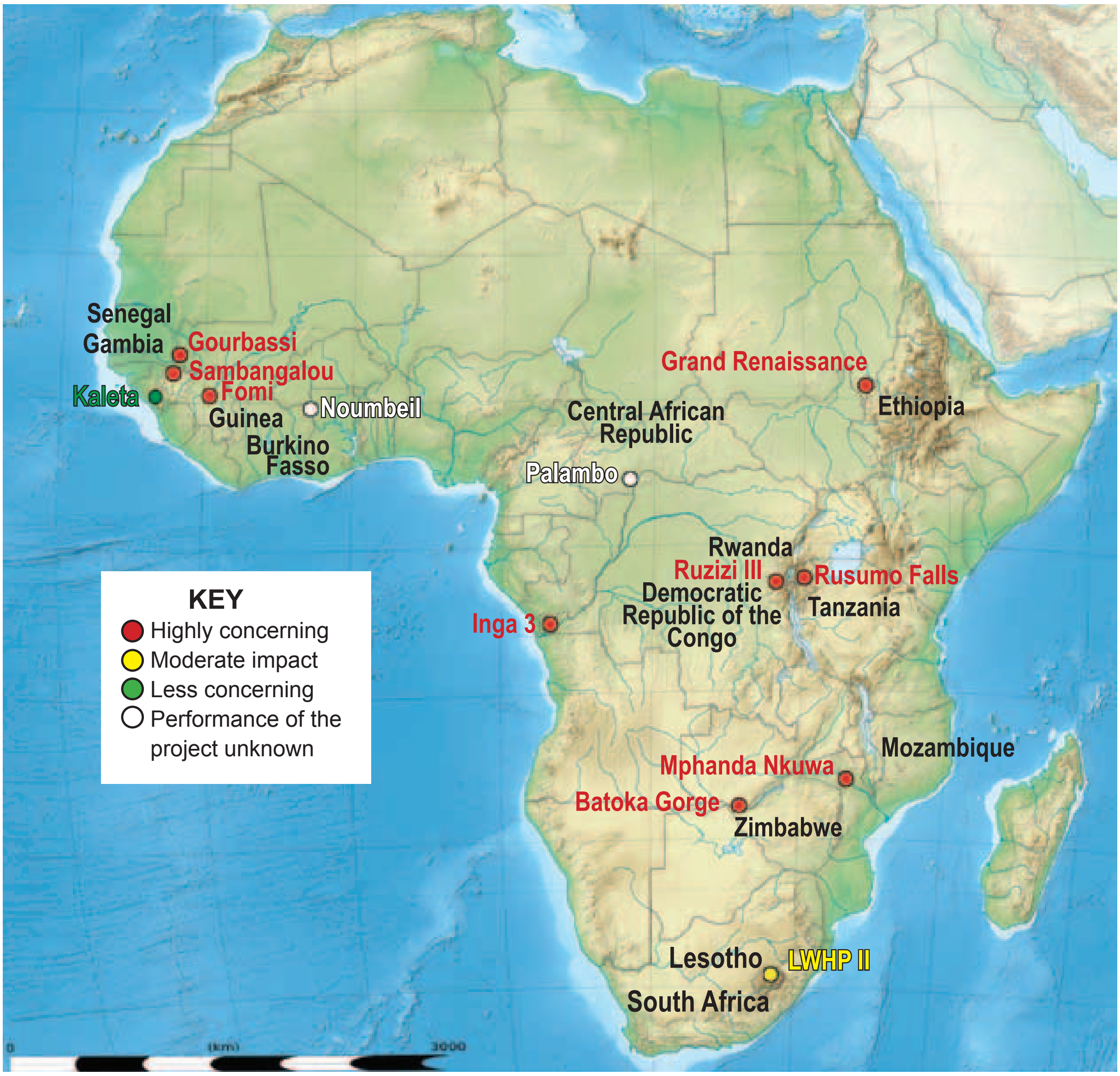
Right: Batoka Gorge, Zambezi River

investments and producing electricity in locations close to consumers.

- Climate change impacts are real and are causing huge economic losses to Sub-Saharan African countries. Designs, projections and costs need to factor in climate risks and mitigate against its social and economic losses. The Nile, the Zambezi and the Senegal rivers are particularly vulnerable to climate change impacts, and are critical to the livelihoods of millions of people. Integrated resource planning for energy and water in these watersheds will be critical to improve adaptation for these basins. Any transformational project should provide benefits that visibly improve the lives of affected communities and the nation at large. Affected communities should be involved in the development of the project and be afforded choices regarding compensation and resettlement plans. It is critical that compensation processes and resettlement are completed before the project construction commences.
- As much as possible, projects that displace large numbers of people should be avoided, as it is very difficult to completely restore lost livelihoods.

The above recommendations form key elements that will assist PIDA to achieve transformational outcomes in bridging the energy infrastructure services gap on the continent. Clearly large dams have many negative impacts that outweigh the proposed benefits.

Figure 1. Map of Africa showing the location of the dams in the PIDA Report



Introduction and Background

The Programme for Infrastructure Development in Africa (PIDA)

Under the auspices of the African Union, in 2012 African heads of state adopted and endorsed the Programme for Infrastructure Development in Africa (PIDA) as the blueprint for the continent's infrastructure development agenda. PIDA – which is governed by the African Development Bank, the African Union Commission and NEPAD – is not a financing mechanism in its own right, but rather is intended to act as a vehicle to attract support for an ambitious suite of cross-border infrastructure mega-projects. These projects are valued at a colossal $360 billion up to 2040 and integrate energy, transportation, and water development on a continental scale.

PIDA was launched to address persistent financing gaps in infrastructure on the continent, which continues to significantly lag behind other regions. PIDA promoters cited an underdeveloped energy sector in particular as a barrier to unlocking latent economic capacity and alleviating poverty on the continent. Currently, some 620 million people (two-thirds of the continent's population) in sub-Saharan Africa lack access to modern energy and 750 million people lack access to clean and modern methods of cooking (IEA, 2014). The cost of addressing Africa's infrastructure gap is estimated to be approximately $90 billion per year over the next decade, with spending needed for new investments as well as for operating and maintaining infrastructure that's already in place.

PIDA developed a Priority Action Plan, which lists 51 near-term priority infrastructure projects and programs to be implemented through 2020 at an estimated cost of $68 billion. The criteria used to select these projects were "readiness for implementation; contribution to regional integration, environmental sustainability; synergy with other infrastructure sectors and whether the project could be implemented by 2020." Critics point out that the PIDA projects focus too much on large-scale infrastructure targeted on extractive industries and geared towards import and export of commodities and manufactured goods, thus continuing the development trajectory of removing resources from Africa. This belief is based on the distribution of the projects that focuses on major production and consumption centres, and links these to ports.

In order to help finance these projects, the African Development Bank launched the Africa50 Infrastructure Fund in 2014, which hopes to raise $100 billion of local and global capital to finance and develop PIDA and related projects by the end of 2017. The Africa50 Infrastructure Fund would target a variety of finance sources including private African pension funds, the private sector through PPPs, donors and development banks – to support the PIDA projects.

PIDA Transboundary Water and Energy Projects

Citing the potential to power African economies and spur industrial agriculture, the portfolio of 51 PIDA priority projects includes 13 large dams, (Table 1) among them 10 purely hydroelectric projects and three "multi-purpose" projects planned for both hydroelectricity and irrigation. Several of these dams would be built on the continent's major river basins, including: Southern Africa's Zambezi River (Mphanda Nkuwa and Batoka Gorge); the mighty Congo River (Inga 3); the Nile River (Grand Ethiopian Renaissance Dam); and the headwaters of West Africa's Niger River (Fomi Dam in Guinea). Combined, the 13 projects would have a purported generation capacity of over 15 GW compared to the current 147 GW and an estimated price tag of over $30 billion. An additional undisclosed number of energy projects will be rolled out in the medium term (2030) and the long term (2040) to increase energy access from 39% to 70%, according to PIDA.

As mentioned previously, the PIDA water and energy projects rely heavily on large dams. While dams have the potential to bring important societal benefits, their track record globally – and on the African continent in particular – has been poor overall. Most large dam projects have been plagued by:

- cost overruns and delays
- huge corruption incidences
- displacement of local communities
- loss of vital services that rivers provide
- biodiversity losses and
- a variety of negative environmental and social impacts.

Furthermore, developers frequently sell these projects with unrealistic numbers, overstating benefits and offering unrealistic projections for how much power a project will generate, for example the case with the Grand Renaissance dam.

Given this experience and the renewed interest in large dams as a solution to address energy supply shortfalls, spur irrigation, and mitigate climate change, questions arise about the efficacy of the PIDA dams. This report describes the PIDA hydropower projects, discusses their development objectives, and assesses each project[1] against key criteria, examining factors such as economic effectiveness, social impact and potential development benefits. Two of the projects – Inga 3 and Mphanda Nkuwa – are presented as in-depth case studies.

[1] Noumbiel and Palambo were excluded due to lack of information

Table 1. The list of large dam projects under PIDA

PROJECT	COUNTRY LOCATION	INSTALLED CAPACITY (MW)	COST ($ MIL)	RESERVOIR AREA (HA)	NO. OF PEOPLE DISPLACED	HECTARES FLOODED PER MW	STATUS
Batoka	Zambia, Zimbabwe	1600	4000	Not confimed	Not confirmed	Not confirmed	SEIA report pending
Fomi	Guinea	102	384	50,000	48000	490	SEIA to be updated
Grand Renaissance	Ethiopia	6000	4800	168,000	20000	28	Under construction
Gourbassi	Senegal	18	301	34,200	4933	1900	To secure funding
Inga 3 Basse-Chute	DRC	4755	14,000	1627	10,000	0	SEIA not yet done
Kaleta	Guinea	240	526	596	900	2	Completed
Lesotho Highlands 2	Lesotho	1200	1546	1125	2547	1	Construction Scheduled
Mphanda Nkuwa	Mozambique	1300	3000	10,000	7000	8	Funding not yet secured
Rusumo Falls	Tanzania	80	486	31,300	1910	391	EIA completed- seeking funding
Ruzizi 3	DRC, Rwanda	145	644	20	45	0	Construction Scheduled
Sambangalou	Senegal, Guinea	120	454	18,500	1320	154	Yet to secure funding
Noumbiel	Burkina Faso	60	Unknown	Unknown	Unknown	Unknown	Proposed
Palambo	DRC, CAR	30	155	Unknown	Unknown	Unknown	Proposed

Assessments of Pida Dam Projects

Criteria for Evaluation

To assess the efficacy of each of the selected hydropower projects, a quasi-quantitative and qualitative evaluation scheme was devised, based on best known standards for hydropower projects informed by the World Commission on Dams (WCD – see Box 1) and the Hydropower Sustainability Assessment Protocol (HSAP).

An indicator system with ten categories (Table 2) was created to capture critical factors that determine the sustainability of a dam project. A more detailed explanation of the criteria used in the analyses is given in Annex 2.

The categories used for the analysis are as follows:

A. Overall development effectiveness
B. Distribution of benefits
C. Economic /cost effectiveness
D. Comparative value
E. Environmental impacts
F. Negative social Impacts
G. Financial/performance risks
H. Social and environmental risks
I. Transboundary risk
J. Adherence to WCD Strategic options a, c and g (see Box 1)

Box 1.

WCD Strategic Priorities

The WCD proposed an approach to guide future planning and decision-making based on recognition of rights and assessment of risks, in particular all rights at risk. Building on this, the Commission identified seven strategic priorities and corresponding policy principles to guide water and energy planning and decision-making. These priorities are listed below and a table is provided in Annex 1 detailing the key message for each priority.

a. Gaining public acceptance
b. Comprehensive options assessment
c. Addressing existing dams
d. Sustaining rivers and livelihoods
e. Recognizing entitlements and sharing benefits
f. Ensuring compliance
g. Sharing rivers for peace, development and security


Photo: Gus Greenstein

Table 2. Explanation of the categories used in the dam assessment

	CATEGORY	EXPLANATION
A	**Overall Development Effectiveness**	A measure of overall project benefits, including electricity (its size in terms of MW relative to the country's installed capacity); irrigation; flood control; employment opportunities for locals and affected communities; any other development plans near the project area such as school, hospitals, etc., relative to pre-existing abundance of these services in each country.
B	**Distribution of Benefits**	A measure of how well overall benefits (electricity, job creation, business opportunities) will be distributed across socio-economic lines. Projects promising to allocate most of their benefits to those who most need them fare best here.
C	**Economic Cost Effectiveness**	A measure of the project's net present value (NPV), taking into account things such as financial fixed costs, variable financial costs, and likely constraints on planned benefits, such as performance deficiencies and time and cost overruns. It excludes social and environmental costs. The NPV is derived from the Conservation Strategy Fund's HydroCalculator (see Box 2).
D	**Comparative Value**	A measure of the favorability of the project relative to the country's other options for generating similar benefits. Price competitiveness, in terms of cost per MWh of the project in comparison to the cost per MWh of alternatives. Projects pursued in the absence of a comprehensive options assessment and with a price above $100 per MWh rated lower here.[2]
E	**Environmental Impacts**	A measure of environmental impacts such as greenhouse gas emissions due to reservoir flooding; consequences for biodiversity; the impacts of construction of the transmission lines; and other basin-wide environmental impacts including hydrological impacts, relative to project benefits.
F	**Social Impacts**	A measure of social impacts such as population displacement and livelihood/sociocultural interference, relative to project benefits.
G	**Financial / Performance Risks**	A measure of the significance of factors likely to negatively impact project benefits. Taken into account are factors such as reservoir sedimentation risk, climate change vulnerability, countries' previous experience with similar projects, and corruption factors.
H	**Social / Environmental Risk**	A measure of the significance of factors likely to cause social-environmental consequences beyond those which will definitely occur. Taken most highly into account are level of public acceptance, strength of project social-environmental safeguards, and enforceability of safeguard-adherence agreements.
I	**Transboundary Risk**	A measure of the risk of the project causing international dispute. Based on quality of host country's consultation with countries whose water supplies would be affected by the project.
J	**Adherence to World Commission on Dams Recommendations**	A measure of the project's adherence to the main criteria recommended by the World Commission on Dams for successful dam planning, with a strong emphasis on the options assessment and planning processes (See Box 1).

[2] The East African average levelized cost of hydropower is $59 per MWh. The levelized cost of generating hydropower in high-cost regions such as Southern and Western Africa is even higher, put at $104 and $130 per MWh respectively (Mckinsey, 2014).

For each of these categories, the assessment assigned 1 of 4 performance classes:

Highly concerning/unsuitable
Moderate impact
Less concerning/suitable
Not applicable

The overall project rating is an average of the score for each category and is assigned the relevant colour coding.

This study attempts to illuminate concerns over various project aspects in a more comprehensive way than a limited amount of text can convey. This evaluation does not recommend any project over another, as this would risk oversimplifying highly complex situations. Beyond the description provided in Annex 1, details on the indicators, rating criteria and weight justifications are available upon request.

Box 2.
The HydroCalculator

The HydroCalculator ((http://conservation-strategy.org/en/hydrocalculator-analyses) is a tool that calculates the Net Present Value (NPV) of hydropower dams based on cost and benefits over a 50-year period. The tool assumes the following:

- Although dams may last longer than 50 years, their NPV is not significantly influenced by cash flow in the distant future.
- The dam becomes operational in the first year after construction is complete
- Annual operation and maintenance costs are calculated at 4% of the construction costs.
- No reinvestment included once the dam is operational

The tool also calculates the carbon dioxide emissions based on global average content for different vegetation type. It also calculates the net greenhouse gas emissions, which is equal to the dam's emission minus greenhouse gas emissions from alternative sources (sources other than the dam in question, e.g. fossil fuel, etc). The carbon emissions were part of the analysis of the environmental impacts.

Photo: Gus Greenstein

PIDA Dams Analyses

Table 3 summarises the findings of the assessment for the 11 dam projects covered by this study. All dams were scored as highly concerning except for Kaleta in Senegal ("less concerning") and the Lesotho Highlands Water Project II, which was found to have relatively moderate impacts. This chapter discusses why each dam received the rating it got in more detail.

For discussion purposes, the categories were grouped into four broad areas:

- Development effectiveness (A & B)
- Economic viability (C, D & G)
- Social impacts (H & F)
- Environmental impacts (E)

Mphanda Nkuwa and the Inga 3 are discussed separately in greater detail as the two are being highly promoted for construction above others.

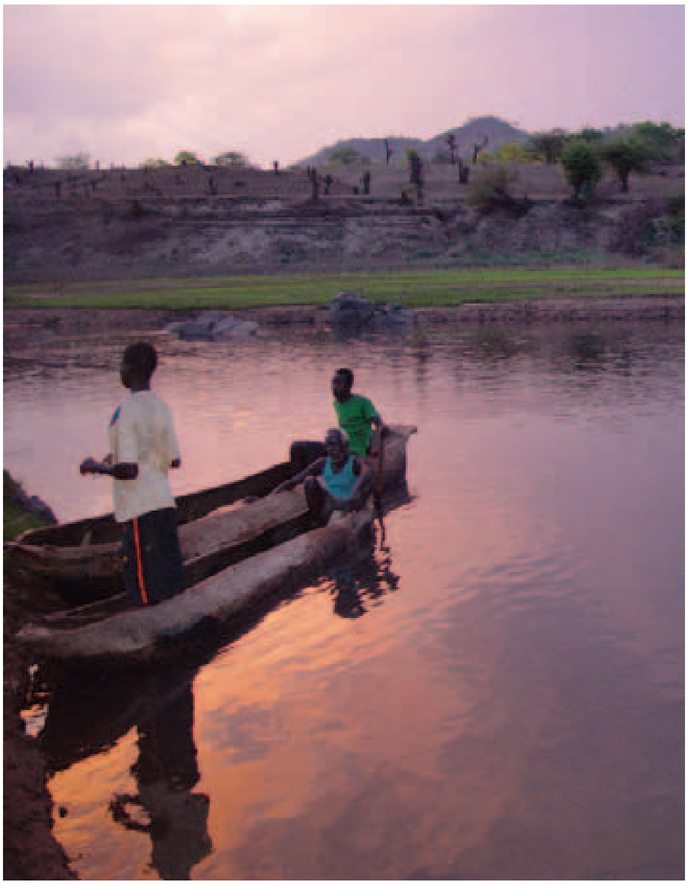


Table 3. Summary of scores of 11 PIDA dam projects

Scorecard Key

Highly concerning	Red
Moderate impact	Yellow
Less concerning	Green
Not applicable	Purple

		Overall develop-ment effectiveness	Distribution of benefits	Economic cost effectiveness	Comparative value	Definite environmental impact	Definite negative social impact	Financial/performa nce risks	Social environmental risk	Transboundary risk	Specific adherence to the WCD criteria	Overall score
	LEGEND	DVT	BEN	ECON	VALUE	ENV	SOC	FIN	RISKS	TRANS	WCD	OVR
Hydroelectricty Dams	***River***											
Inga 3	Congo	Yellow	Red	Red	Yellow	Yellow	Red	Red	Red	Purple	Red	Red
GERD	Nile	Yellow	Yellow	Red	Yellow	Red	Yellow	Red	Red	Red	Red	Red
Kaleta	Konkoure	Yellow	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Purple	Green	Green
Batoka	Zambezi	Yellow	Red	Red	Red	Yellow	Yellow	Red	Red	Red	Red	Red
Mpanda Nkuwa	Zambezi	Yellow	Yellow	Red	Red	Yellow	Yellow	Red	Red	Red	Red	Red
Ruzizi III	Ruzizi	Yellow	Red	Red	Red	Yellow	Green	Red	Yellow	Green	Red	Red
Rusumo	Kagera	Yellow	Yellow	Red	Red	Yellow	Red	Yellow	Red	Green	Yellow	Red
Multipurpose dams												
Gourbassi	Faleme	Green	Yellow	Red	Red	Red	Red	Yellow	Red	Green	Yellow	Red
Lesotho Highlands	Orange	Yellow	Yellow	Green	Green	Yellow	Yellow	Yellow	Yellow	Green	Red	Yellow
Fomi	Niger	Red	Yellow	Red	Red	Red	Red	Red	Red	Red	Yellow	Red
Sambangalou	Gambia	Yellow	Red	Red	Red	Red	Red	Yellow	Yellow	Green	Yellow	Red

1. Mphanda Nkuwa Hydropower Project - Case Study 1

DVT	BEN	ECON	VALUE	ENV	SOC	FIN	RISKS	TRANS	WCD	OVR

Map showing the location of the Mphanda Nkuwa Hydropower Project *Google Maps*

The Mphanda Nkuwa hydroelectric dam is planned for a stretch of the Zambezi River 40 km upstream of Tete City, Mozambique. The dam would add an additional 1,300 megawatts (MW) to the country's electricity generation capacity, a 53% increase over 2010 generation levels. Delivered through a 1400km high-voltage transmission line, the $2.3 billion project would supply power mainly for export to South Africa (an addition to the Southern African Power Pool (SAPP) grid) and the rest to energy-intensive industries such as aluminium smelting, steel milling and coal mining in Mozambique.

The dam's value as a project, however, is darkly clouded by questions of benefit distribution and high social, environmental and financial risks. This is reflected in a 16-year construction delay, a planning process entirely at odds with the recommendations of the World Commission on Dams and a very poor effort at consultation and transparency.

Financing, Contracting and Status

Since its inception in 2001, Mphanda Nkuwa has undergone a convoluted contracting and financing history. Initial strong support from China[3] has apparently vanished, and the World Bank once a backer of the project in its entirety- has downsized its participation, to support only the dam's associated transmission infrastructure. However, the AfDB has listed the project among those it would support in its Country Strategy paper. Today, Hidroelétrica de Mphanda Nkuwa, a public-private partnership consisting of Camargo Correa (a Brazilian construction company), Insitec (a multinational consultant), and Electricidade de Moçambique (a public power utility), is the advertised developer. It is unknown if or from

[3] In May 2006, the country's Export-Import Bank pledged a $2.3 billion loan, and Synohydro, a Chinese firm, had signed on as the lone developer.

whom replacement funding has been secured; as will be discussed, much of the dam's planning process has occurred behind closed doors. Construction has yet to commence, and there is currently no publicized construction target date, though many have been announced and withdrawn in the last 15 years.

Development Effectiveness

Proponents argue that Mphanda Nkuwa fits well into the country's short- and long-term development goals. They say it would help build toward the 2 338 MW forecasters predict non-industry users will demand by 2030[4] and provide a new source of government revenue, and that it will also attract foreign investment. Moreover, they add, the project will support other important development projects, such as the Central-South transmission line, which is a key infrastructure piece in the country's electrification process.

It is unclear how this electricity increase will benefit the average Mozambican, in a country in which 60% of the population lacks electricity access and per capita income is among the lowest in the world[5]. Only 20% of Mphanda Nkuwa's electricity will be used within the country's borders and none of its power has been earmarked for rural communities. The project is expected to create only 35 permanent jobs; few, if any, are likely go to the less-skilled Mozambicans most in need of employment.

Social and Environmental Issues

Most of the dam's negative impacts will be felt by communities that live downstream of the proposed Mphanda Nkuwa. Some experts consider that the 2011 EIA understated most of the downstream impacts on communities, including concerns regarding flow manipulation and de-sedimentation. According to the project's feasibility study, the dam's turbines will operate only intermittently, causing a large daily variation in flow that would reconfigure the river channel. The dam's removal of river sediment will exacerbate erosion and reduce the productivity of downstream agricultural land whose fertility depends on the influx of nutrients brought on by seasonal floods. The extent of impacts on recession agriculture and aquatic ecosystems will depend on the dam's operating regime. However, the peak-production scenario would destroy river gardens, a fundamental piece of dry-season livelihood strategies. The exact magnitude of these impacts remains uncertain and was not comprehensively modelled in the EIA.

The same downstream communities lost agricultural productivity from recession farming 40 years earlier as a result of the construction of Cahora Bassa, a mega-dam built 70 km upstream of the planned site for Mphanda Nkuwa. By restricting river flows below the level required to maintain the basin ecosystem's health, Cahora Bassa parched critical wetlands and removed enough nutrients from the water to cause a 60% drop in delta prawns that support a million dollar industry. Mphanda Nkuwa would not only render futile recent efforts to ameliorate these impacts through a reconfiguration of Cahora Bassa's turbine operation mechanism, it would exacerbate the consequences in the Zambezi delta.

The 1,400 people that Mphanda Nkuwa would forcibly displace - including communities situated in the upstream reservoir area and those just downstream from the planned spillway - will lose their river-based livelihoods. They also risk contracting HIV/AIDS and face the disintegration of their social fabric when outside construction workers move into the area.

In theory, the economic impacts of relocation, and social ones to a lesser extent, could be mitigated through a thoughtfully designed and implemented resettlement and compensation program. But there is no indication that developers intend to achieve this ideal. Questionable treatment of the communities facing displacement - not to mention complete neglect of those who would be impacted downstream - dates back to the project's inception: they were not consulted prior to approval and only learned of the project when an NGO came

[4] Mozambique's production potential for both industry and non-industry was 2,428 MW in 2010.
5 In 2013, the IMF measured Mozambique's per-capita income; it was the sixth-lowest of 187 countries considered.


Photo: Gus Greenstein

to see whether they had been consulted. And in the time since, they have received little, if any, information from non-NGO actors on how the dam will impact the environment from which they draw their sustenance. For instance, a March 2015 field visit by Justiça Ambiental revealed communities' persisting obliviousness to the fact that the dam will impact fisheries; some even reported having been told by the developer that the dam would have no such impact.

A draft resettlement plan has yet to materialize, and there is substantial reason to be concerned about what's coming. Despite the developer's stated commitments to community participation, as of March 2015, displaced communities had been given little, if any real, opportunity to share their concerns regarding relocation and livelihood restoration. The interaction that has occurred is worrisome. In at least two recent meetings, company officials asked local leaders to sign agreements without any legal support present. It is uncertain whether the communities fully comprehended the contents of the agreements. One thing is very clear about the program, however: the displaced communities will not receive any electricity subsidy. If they would like access, they will need to pay the full cost.

Performance Risks

Mphanda Nkuwa does not only represent a questionable development strategy because of its potential negative consequences. Uncertainty also looms large over whether it will be able to deliver the benefits promised.

Since the departure of the Portuguese, political instability has fostered persistent corruption that has continually allowed private profit to take priority over development effectiveness in the context of large infrastructure projects. Signs indicate that Mphanda Nkuwa is already firmly within corruption's grasp. In March 2015, top executives from Camargo Correa, the Brazilian construction firm advertised as one of the project's three developers, admitted (while in custody for a scandal involving that country's national oil company) to paying $30 million in bribes to the Brazilian government in exchange for construction contracts for the infamous Belo Monte dam. As far as International Rivers

[6] Grand Inga, the 39,000 MW hydroelectric dam planned for DRC's Congo River, would, on its own, glut the SAPP market.

can tell, project planning on Mphanda Nkuwa involved no review of corruption-related risks, and there is no task force to monitor corruption in the project. Negotiations regarding the power-purchase agreement, funding, and mitigation responsibilities have taken place behind closed doors. Furthermore, with largely toothless anti-corruption laws, Mozambican civil society finds itself powerless to monitor procedural integrity.

Uncertainty in the Southern African electricity market also abounds. 80% of the dam's electricity is bound for South African power utility Eskom, yet the company is embroiled in a number of difficulties, and with several other SAPP-feeding megaprojects[6] also in the pipeline such as Inga 3, it remains unclear whether the exported surplus will fetch a stable economic price. Mozambique knows the reality of the threat of a glutted market all too well: in 2003, the country was forced to sell Cahora Bassa's surplus power at a price three times less than the market value of electricity.

Climate change and local seismicity provide significant additional reasons to worry. For much of the first decade of the century, basin-wide drought restricted Zambezi's upstream Kariba Dam from performing at optimal capacity. Such production inconsistencies, along with flood severity, are expected to increase as rainfall becomes less regular, heightening the risk to hydropower generation in the region. Seismicity, and the potential impact of the weight of the dam's reservoir on the earth's surface, has not received the attention it warrants. Mphanda Nkuwa would be located just 200 km from the heart of the Shire Trough fault zone, which recent activity suggests may be becoming active again. Poor record keeping makes it difficult to know how strong of a tremor the dam may face one day.

[7] The "options assessment" component of the dam's feasibility study included only hydro-power projects.

Alternatives and Recommendations

In the dam's highly exclusive planning process, the Mozambican government failed to consider a range of alternative options for power production. According to a 2009 study led by Africa-focused renewable energy expert Mark Hankins, Mozambique is endowed with the longest coastline in southern Africa and one of the world's sunniest climates, and has abundant, cost-competitive wind and solar generation potential. Other viable yet so far under-invested options include biomass cogeneration and micro-hydroelectricity. Geothermal potential, which preliminary research indicates may be promising throughout the Rift Valley, is largely unexplored. On the other hand, the country has yet to make any serious effort at improving energy efficiency, a strategy that has been shown to close supply-demand gaps much more cheaply than production expansion. According to Hankins, the alternative expansion options could be harnessed in ways that grant equal consideration to rural electrification and power for industry growth and revenue generation. These pathways would relax demand for corruption-fostering megaprojects, help insure the country's hydro-dependent electricity sector against impending climate change risks, and create more jobs for a wider demographic.

Photo: Gus Greenstein

2. The Inga 3 Project - Case Study 2

DVT	BEN	ECON	VALUE	ENV	SOC	FIN	RISKS	TRANS	WCD	OVR

Map showing the location of the the Inga 3 Project on the lower stretches of the Congo River

Google Maps

Harnessing the Inga Falls on the lower stretches of the mighty Congo River in the Democratic Republic of Congo (DRC) has been a dream of officials, planners and development partners since colonial times. Proponents cite the vast hydroelectric potential of the Grand Inga hydroelectric scheme – estimated at a colossal 40,000 MW – as a development imperative, given the low rates of electrification and generation in sub-Saharan Africa. The Inga 3 hydropower project, currently under preparation with support from the World Bank and African Development Bank, would serve as the first of seven phases in the construction of Grand Inga. The Inga 3 project itself would have two phases, the first of which – Inga 3 "Basse Chute" (BC) – is estimated to have a generation capacity of 4800 MW. The total construction cost for Inga 3 BC is estimated at $14 billion, including $4.3 billion for the construction of an 1850 km-long transmission line serving mining companies in DRC's principal mining province, Katanga; plus the 3367 km transmission line from Katanga to South Africa. Inga 3 would be located just upstream of two existing hydroelectric dams, Inga 1 and 2, which were commissioned in 1972 and 1982 respectively.

Barring further delays, construction of Inga 3 BC is set to begin in 2017, and is expected to take five to six years without taking into account delays and the filling of the reservoir. Recent delays have stemmed from issues of securing finance, the creation of requisite governance structures, and delays in starting the environmental and social impact studies. The government of the DRC plans to develop the project as a private-public partnership, and a private consortium will be selected to develop and operate the power station and transmission lines.

Development Effectiveness

The existing dams along the Congo River, Inga 1 and 2, have failed dismally to meet the energy needs of DRC's 70 million inhabitants. Despite promises to the contrary, Inga 3 BC has little hope of meaningfully addressing low access rates. Power from Inga 3 BC would be sold first and foremost to South Africa (2500 MW), with an additional 1300 MW allocated to the mines in Katanga, and the remaining 100-1000 MW would be sold to the state utility, Société Nationale d'Electricité (SNEL), for distribution in Kinshasa. This would fall far short of the 3000 MW energy gap needed to serve the 91% of Congolese who lack electricity, over 70% of whom live in rural areas.

Given that the bulk of the electricity would be used for export and sale to mining companies, the development benefit within DRC relies almost exclusively on harnessing revenues for public services. However, there is no clear evidence that the proceeds from Inga 3 BC will be invested to improve the lives of citizens of the DRC. Furthermore, the DRC government has not shared details about how it will collect and account for its share of revenue from the project. Though the profits made from the sale of electricity should be used by the state for development, it is highly unlikely that will occur. The DRC struggles with a legacy of entrenched corruption and a lack of transparency, ranking 154th out of 175 countries on the 2015 Transparency International Corruption Perception Index. Despite high revenue collected from the mining sector, accounting for nearly for half of the government's budget, DRC remains one of the poorest countries in the world, with nearly 70% of the population earning less than $1.25 a day.

The government of DRC expects to generate enough revenue from this project to pay off the debts and invest in national electrification projects. It estimates that 6000 to 7000 jobs would be created during the construction phase of Inga 3 and an additional 600 during the operation phase of the dam. However, the number of jobs that would be allocated to locals is uncertain.

Economic Viability

Based on current estimates, the cost of electricity from Inga 3 is fairly competitive. Inga 3's estimated cost of $80/MWh (our calculation) is lower in comparison to an average cost of $100/MWh for assessed alternatives but higher than the average $50/MWh cost of hydropower in Africa (IEA, 2014). Nevertheless the $80/MWh figure excludes cost overruns, which are almost guaranteed in a project of this size and complexity. Inga 1 and 2 rehabilitation has already cost $1,1 billion far above the projected $250 million and is 8 years beyond its estimated completion time. With a cost overrun as low as 30%, the cost per MWh of Inga 3 BC would escalate to $104. The figure is much higher than a World Bank estimate of $33-$35/MWh for the cost of Inga 3 BC (World Bank, 2012). The cost of the transmission line was not included in their estimate[8].

According to the Hydro-calculator, the net present value of Inga 3 is negative, at an assumed discount rate of 10%, meaning the cost far exceeds the revenue over the lifetime of the dam. Assuming a lifetime of 50 years for the dam, the present net value will remain negative, rendering the dam not economically viable.

The DRC has abundant potential sources for renewable energy, including wind, geothermal in eastern Congo, and solar, which have been overlooked. Small hydro – of which there are 27 installations across the country – could also be constructed at much lower costs and deliver power locally across the country. Most of the existing plants are not working at full capacity, and investing in their rehabilitation could increase generating capacity by 400 MW. Exploiting other renewable options would further increase available electricity and help to distribute power within the vast country, particularly to communities outside of large urban centres, for whom traditional grid access would be prohibitively expensive.

Environmental Impacts

The Inga Falls on the Lower Congo River are about 50 km from the Congo estuary, where

[8] Minimum interest rate set by National/Federal bank for lending to other banks

Inga 1 Hydroelectric Dam on the Congo River

the river empties into the Atlantic Ocean. The discharge of particulate, dissolved carbon and nutrients has a major impact on the biological process of the continental margin, creating the Congo Plume, one of the largest carbon sinks in the world (Hopkins et al., 2013).

Inga 3 BC is located in a vulnerable area and will hold back upstream sediments. The Congo Plume is a globally significant phenomenon, and disrupting it could have globally significant impact on climate change as well as marine ecosystem services. In addition the reservoir, would divert nearly one-sixth of the river flow – a volume equivalent to that of the Danube River – and submerge the Bundi Valley and five other rivers along the way. The diversion for the Inga 3 will create a major global river in its own right, with a stream flow that's higher than the discharge of the Niger, the Nile and the Sangha rivers, among others. Even though some of the water will later return to the river 30 km downstream, diversion will reduce water passing over the Inga Falls and alter the hydrology downstream.

The Inga 3 BC will necessitate the construction of 3367 km of transmission lines. While at the time of writing, the transmission line route outside the DRC is not resolved, a great deal of land would be appropriated and cleared for the corridor. This would negatively impact biodiversity and other land uses.

Social Impacts

DRC has a sad legacy with resettlement. There are unresolved compensation issues with Inga 1 and 2 affected communities, who were left without adequate housing. Customary landowners lost rights to their land, and some were forced to live in Camp Kinshasa.

Inga 3 BC will force the relocation of thousands of community members who were displaced without compensation by Inga 1 and 2, as well as workers on those projects and their families. This community of between 8770 and 10,000 people lives within the confines of the old workers camp, called Camp Kinshasa, and most were impoverished by their first relocation and continue to live in egregious conditions. This troubling track record, and the government's continued refusal to compensate for these legacy issues, is a major cause for concern because of the large number of residents facing eviction.

Over and above this number, other communities will be affected downstream and upstream of the site, especially by the flooding of the Bundi Valley, an agricultural hub for many in the region. The fishing activities of about five villages downstream of the Inga 3 dam could be disrupted. As a result, communities are insisting that their rights be respected, and they submitted a petition to the World Bank and DRC government in 2014 expressing their concerns, including the right to information and consultation.

Financial and Performance Risks

DRC has performed very poorly in the past when handling and completing similar projects and even smaller-scale projects. In the case of the Inga 1 and 2 dams, mismanagement, delays and huge cost overruns saw their initial budgets quadruple, and yet to date Inga 1 and 2 operate at less than 40% of their installed capacity. Its track record has improved little, with on-going efforts to rehabilitate the turbines at Inga 1 and 2 suffering significant delays and cost overruns. To date, only 55 MW of the targeted 860 MW have been rehabilitated, despite promises this power would come online by 2007.

Given that DRC struggles with a legacy of entrenched corruption and the susceptibility of large infrastructure projects to corruption, there is a strong possibility that costs will balloon further.

The generation capacity of Inga 1 and 2 have suffered from sediment accumulation in the reservoir, which has significantly reduced water storage and blocked intakes into the turbines. The inability to address this issue has decreased the storage capacity and lifespan of these projects, necessitating costly upgrades. Combined with mismanagement and the lack of maintenance, these factors have contributed to poor operational performance of the two earlier dams. While flow levels are typically very high in the Congo River, in 2015 low levels affected generation capacity and further exacerbated load shedding in the city of Kinshasa, according to the authorities.

Adherence to WCD Principles

Inga 3 fails to align itself to the principles of the WCD. Issues include: stakeholders are not invited to participate in decision-making; longstanding social issues with Inga 1 and 2 remain unresolved; and to date, the project lacks a benefit-sharing program. At the same time, social and environmental considerations have not been given equal weight to economic and financial factors; Inga 3 is considered a priority project in the absence of an ESIA.

Conclusion

Inga 3 BC is a very high-risk project. The high capital costs are likely to push the DRC into a huge national debt, which will impoverish the citizens. There are serious potential environmental risks with this project that can only be addressed by carrying out a comprehensive and cumulative impact assessment that covers all the subsequent phases as well as the estuary and Congo Plume. There are questions about how the sediment load will be addressed, how the social impacts will be mitigated and what mechanisms will be put in place to ensure that benefits are shared and corruption is minimized. Historical events lend very little faith in this project's success.

Local people use the Congo River as a means of transport

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3. Ruzizi III Hydropower Project

DVT	BEN	ECON	VALUE	ENV	SOC	FIN	RISKS	TRANS	WCD	OVR

Map showing the location of the Ruzizi III Hydropower Project between Rwanda and the DRC
Google Maps

Rationale

Ruzizi III is an 82 MW run-off-the-river hydroelectric plant whose power will be shared equally between Rwanda, the DRC and Burundi. The project has two fundamental goals: the promotion of peace and stability as well as the supply of sustainable electricity in the Great Lakes Region (www.addisababa.mfa.ir). It is not clear how these goals will be achieved, considering that the region is generally socio-politically unstable. The most recent examples include an attempted coup in Burundi (BBC, 2015) and protests over a proposed "third presidential term" in the DRC (News24, 2015). In addition to the above, the sustainability of the project will depend on factors such as maintenance, costs and climate change. Due to these uncertainties, the project was rated unsuitable in this category.

Due to its geographic position in the tropics the SEIA predicted that Ruzizi III would have high CO_2 emissions. The high GHG emissions and sedimentation risks are likely to reduce the dam's average energy yield from 10 to 20% (Sofreco, 2012). These impacts will not only affect the environment but also the dam's financial and economic viability.

While Ruzizi III will displace just 60 people from the DRC and Rwanda, a total of approximately 4500 people (Sofreco, 2012) will bear most of the negative socio-economic costs. These include the loss of agricultural land and access to the river. According to the ESIA (Sofreco, 2012), the affected populations were consulted and participated in the identification of alternative resettlement locations and the drafting of the resettlement plan. Notwithstanding these efforts, unless mechanisms are put in place to ensure compliance with the agreed plans, the promises

Key facts

Location:	Ruzizi River, between Rwanda and DRC
Co-ordinates:	2.50919,28.87558
Purpose:	Hydropower (est. 148 MW)
Firm capacity:	82 MW
Riparian countries:	Burundi, DRC and Rwanda
Estimated Cost:	$600 million
NPV:	-$408.1 million
Model:	Regional PPP (BOOT concession for 25 years)
Status:	Construction scheduled
Investors:	WB, AfDB, the 3 governments, SITHE Global, Kenya Industrial Promotion Service
Estimated cost of electricity:	$213 per MWh

may not be fulfilled. The political climate in the countries tends to be intolerant of criticism and dissidence. There are limited opportunities for civil society to advocate for the compensation and rights of affected communities.

Evaluation

Ruzizi III is Africa's first hydroelectric project devised as a regional public-private partnership (PPP) project. Its objective - to share the resource for peace and development - is noble, but it's doubtful whether it will be achieved. The cost of electricity is far higher than renewable energy options, and the bulk of the populations may not afford it. This works against efforts to increase energy access for all. Ruzizi III project was ranked as "highly concerning".

Below: The Ruzizi River separates two countries, Rwanda and the DRC. Photo: Wikimedia

4. Grand Ethiopian Renaissance Dam (GERD)

DVT	BEN	ECON	VALUE	ENV	SOC	FIN	RISKS	TRANS	WCD	OVR

Map showing the location of the Grand Ethiopian Renaissance Dam. *Google Maps*

Development Effectiveness

GERD's 6000 MW capacity would increase Ethiopia's installed generation capacity by 176% - from 2167 MW to 8167 MW (IRENA, 2014). But independent experts consider the 6000 MW to be an overestimate and put the average generation at 2800 MW based on the Nile flow rate which is 2350 mcs (Bayene, 2013). Of these 2800 MW, 200, 500 and 200 MW respectively will be exported to Sudan, Kenya and Djibouti. Thus in the instance of GERD's reduced generation capacity, only 1900 MW would be available for Ethiopia.

Currently, only 12% of Ethiopians have access to electricity. Of these, 2% are in rural areas, while 86% dwell in urban areas. Furthermore, 99% of Ethiopian households use biomass for cooking, while 70% of the general population uses kerosene for lighting purposes (Energypedia, 2015: IRENA, 2014). Given these consumption patterns and the potential high cost of electricity in local currency, it will be difficult to grant 88% of the population access to electricity.

Ethiopia suffers from a high prevalence of corruption, as well. In 2014, the country ranked 110 out of 175 according to the Transparency International's corruption perception index. Corruption could thus directly and indirectly affect GERD's potential to actualize development in Ethiopia. The GERD is the only PIDA dam that is self-financed by its government. This is likely to lock up resources that could be used for other infrastructure services as the government tries to meet the cost of the project.

Economic Viability

It is claimed that 12,000 jobs will be created during construction. However, these are mostly temporary, and employment will diminish after dam construction is completed. A negative

Key facts

Location:	Blue Nile River, Ethiopia
Co-ordinates:	11.2142° N, 35.0931° E
Purpose:	Hydropower (6000 MW)
Firm capacity:	1980 MW
Riparian countries:	Egypt, Sudan
Estimated Cost:	$4.8 billion
NPV:	- $640 million
Financing:	Ethiopian nationals
Status:	Under construction
Estimated cost of electricity:	$32 per MWh

NPV has also been registered for the dam. In addition, sedimentation risks and climate change could decrease the productivity and longevity of the GERD, negatively affecting prospects for recouping investments in the dam and consequently increasing national debt. The propensity of the dam to hold back sediments can also lead to reduced fertility of downstream floodplains, reducing the economic viability of agricultural production in Sudan.

Environmental Impacts

No ESIA report related to the GERD has been made public. Nevertheless, the dam will flood a total of 168,000 Ha while emitting 200 tonnes CO_2 per MWh. The area to be flooded contains forests and scrubland which are integral to supporting Ethiopia's high biodiversity (International Rivers, 2014). Further habitat loss and changes in fisheries, including the disruption of 12% to 15% of the Nile's flow, may also occur.

Changes in the Nile flow will impact Egypt and Sudan downstream, which is a highly controversial impact. In March 2015, Ethiopia, Egypt and Sudan signed a "declaration of principle" binding Ethiopia to account for any such impacts, but the agreement failed to take into account the interests and demands of potentially affected communities (The Guardian, 2015). This agreement has given the project some form of regional legitimacy, yet a recent report from the International Non-partisan Eastern Nile Working Group called out two significant issues related to the dam's transboundary impacts that urgently need to be addressed. Firstly, GERD would need to coordinate its operation with the Aswan High Dam in Egypt. Secondly, the project must address potential downstream impacts on Egypt and Sudan, particularly on agriculture dependent on water from the Nile River (MIT: 2015).

Social and Human Impacts

The project will displace an estimated 20,000 people. Further displacements will occur when transmission lines are constructed from Ethiopia to Kenya and Djibouti (Schoeters M., 2013). Of these displacements, women and children will bear the most impacts. It's also likely that most community members will be forced to replace age-old farming practices with agricultural employment, and other forms of wage labour, to earn an income.

Additional transboundary socio-economic and cultural effects will result as the filling of the dam's reservoir drastically reduces Egypt's water supply for a few years, affecting the livelihoods of Egyptians who depend on the river.

Finally, Ethiopia has exhibited a very poor human rights record. Ethiopians do not enjoy press freedom, civil liberties or political rights. Incidences of suppression and intolerance of dissidence related to the GERD project were in fact reported in 2014 (Freedom House, 2014). Two journalists were arrested for voicing concerns on the project (Opride, 2013). In addition, the government has compelled many Ethiopians living abroad and those dwelling within Ethiopia to purchase "GERD bonds" to fund the project. In some instances, significant portions of public servants' salaries were paid in these bonds without their consent (Temesgen et. al., 2013). Further human rights infringements are expected to occur as a result of inadequate resettlement plans and sub-optimal reparations. In addition to the irreversible damage to the Nile River's hydrology, human rights issues are a major concern.

5. Sambangalou Hydropower Project

DVT	BEN	ECON	VALUE	ENV	SOC	FIN	RISKS	TRANS	WCD	OVR

Map showing the location of the Sambangalou Hydropower Project *Google Maps*

Photo: Jason Florio

The assessment score for Sambangalou was also highly concerning in six categories. The project scored lowest on the transboundary risk, and received a "moderate" score for the "development effectiveness, performance and social risks" criteria. Furthermore, the dam fulfils very few of the WCD priorities.

Development Rationale

Sambangalou forms part of a regional project to increase electricity access and diversify the energy mix for OMVG member states, thus reducing reliance on thermal generation. According to COTECO (2006), 3000 permanent jobs will be created during the construction phase and 1400 when the dam becomes operational. However, there is no guarantee that the affected communities will form part of the employed labour force.

All in all, operating a multipurpose dam will pose challenges in balancing competing needs such as flood control, irrigation and electricity generation, especially during times of low river flows. Furthermore, the price of hydropower from the dam is hardly competitive and is way above the estimated $100 per MWh for alternatives such as solar PV.

Social and Environmental Impacts

River Gambia is a significant regional river and an essential source of biodiversity. It flows through the Niokolo Koba National Park in Senegal, while its mouth lies near the Kunta Kinteh Island, a UNESCO World Heritage Site (COTECO, 2006). There is a high risk of loss of biodiversity from these protected sites due to reduced flows, especially considering Senegal and Guinea's poor records of mitigating social and environmental impacts. Furthermore, flooding of the reservoir area (18500 Ha) may cause irreversible damage to

Key facts

Location:	Gambia River (Senegal and Guinea)
Co-ordinates:	12°24'N 12°30'W
Purpose:	Irrigation, Flood control and hydropower (128 MW)
Firm capacity:	50 MW
Riparian countries:	Senegal and Guinea
Beneficiaries:	Gambia, Guinea, Guinea Bissau and Senegal
Cost:	$1108 million including $572 for transmission line)
NPV:	- $ 561 million
Status:	Construction scheduled
Promoter:	Gambia River Basin Development Organization (OMVG)
Funder:	Possible China Exim Bank
Estimated cost of electricity:	$368 per MWh

biodiversity and the ecosystem (COTECO, 2006). Environmental and resettlement action plans have been prepared to compensate the 1320 people who will be displaced, including the mitigation of negative impacts on the environment caused by the dam and its transmission lines. Affected communities were engaged and participated in the process of preparing for resettlement and conducting inventory and community asset mapping. A reasonable budget of €9 million was set aside for all compensation. However the legal system has flaws; there is no standardized procedures for the expropriation of customary and state land for public purposes. There's also a lack of clarity about how to compensate for land that's expropriated.

Below: The Gambia River *Photo: Wikimedia*

6. Batoka Gorge Hydropower Project

DVT	BEN	ECON	VALUE	ENV	SOC	FIN	RISKS	TRANS	WCD	OVR

Map showing the location of the Batoka Gorge Hydropower Project *Google Maps*

The overall evaluation of the Batoka Gorge project was highly concerning. While the development effectiveness and social impacts of the dam are considered "moderate," other criteria remain highly concerning.

Development Rationale

Batoka's electricity production will increase Zimbabwe's total generation capacity from 1900MW to 2700MW, and Zambia's from 1845 MW to 2645 MW assuming that the dam operates at full capacity (SAPP, 2013). These increases might reduce power rationing, but will not necessarily lead to gains in electricity access due to inadequate electrification infrastructure to reach rural areas where the bulk of the population without access dwells. Furthermore, the cost of grid electricity may be unaffordable to the majority of these rural communities. Given the above the prospect of exporting electricity to South Africa and possibly Botswana is seen as more financially lucrative than supplying rural populations at subsidized costs.

Economic Viability

NPV estimates indicate that the Batoka Dam is not financially viable. Climate change impacts on the Zambezi make generating electricity from the river additionally risky. For instance, a climate risk study commissioned by International Rivers in 2012 predicted a decrease in rainfall in the Zambezi basin of 10-15% in the next decade, including a loss of 26-40% of water as a result of evaporation due to increased temperatures (Beilfuss, 2012). At the time of writing, the Zambezi River Authority (ZRA) has warned that less-than-normal rainfall in the 2014-15 season would affect the generating capacity of existing hydroelectric dams on the Zambezi throughout 2015. Climate change is making hydropower

Key facts

Location:	Zambezi River, 50 km downstream of Victoria Falls
Co-ordinates:	17°56'S 26°06'E
Country:	Zimbabwe and Zambia
Purpose:	Hydropower (1600 MW)
Firm capacity:	1312 MW
Cost:	$4 billion
Status:	Proposed project
Promoter:	WB supplied money for feasibility and updating of SEIA
NPV:	-$1.29 million

generation from the already massively dammed Zambezi increasingly risky.

Social and Environmental Impacts

The Zambezi River has experienced severe hydrological changes for decades due to existing large dams on the mainstem (Kariba and the Cahora Bassa dams) and several on its tributaries. The addition of Batoka Gorge Dam will magnify hydrological changes affecting downstream ecosystems, fisheries and wildlife in the Zambezi Delta in Mozambique. Furthermore, due to the massive damming of the Zambezi basin, experts have recommended that operations of the existing dams need to be optimised and coordinated to ensure environmental flows downstream from Cahora Bassa.

Current designs of the dam's reservoir show that the reservoir will be confined to the gorge and therefore no villages will be inundated. Nonetheless, despite consistent claims by project developers that Batoka will not result in displacement, 13 river communities inhabiting the project area will be displaced due to the construction of transmission lines, roads and worker camps (Andersson and Svensson, 2015). More precisely, the Ngandu village in the Zambia's Kazungula district and some villages in Zimbabwe's Hwange Rural District may be negatively impacted by the project (ERM et al., 2014).

Project proponents claim that the project will create 6,000 permanent jobs per annum during construction, and 1200 during the operation phase (split equally between both countries). The validity of these claims remains to be tested. It's not certain whether such employment will benefit local communities. More concerning is the fact that Batoka Gorge, a spectacular site providing prime white-water rafting that generates substantial income from tourism, will be lost forever, taking with it direct and indirect employment from kayaking and rafting.

In addition, neither the Zimbabwean nor Zambian government is known for its exemplary human rights record. It has been reported that communities were not openly invited to meetings during the SEIA consultations and claims (not substantiated) have been made that one chief on the Zambian side dissuaded communities from speaking out against Batoka. Furthermore, given the general intolerance of dissidence (in particular by the current Zimbabwean government), campaigns by civil society for adequate compensation of affected communities are at danger of being suppressed. In Zambia, a villager demanding compensation was arrested (Andersson, & Svensson, 2015).

Below: White water rafting on the Zambezi River below Victoria falls in the Batoka Gorge
Photo from: www.thetravellingchilli.com

7. Gourbassi

DVT	BEN	ECON	VALUE	ENV	SOC	FIN	RISKS	TRANS	WCD	OVR

Map showing the location of Gourbassi on the Faleme River *Google Maps*

Overall, the Gourbassi Dam project was rated highly concerning. It failed mainly in terms of cost effectiveness, social and environmental impacts, and potential risks. However, its development effectiveness and transboundary nature were least concerning.

Development Rationale

Gourbassi's generating capacity is only 18 MW, but its value lies in the fact that, together with Sambangalou, the two dams can increase the share of hydroelectricity in the Senegal's total energy mix. The regulation of water flow will improve navigability, facilitating the movement of people and improving local trade between Mali and Senegal. But in terms of our analysis (excluding these potential positive externalities), the cost of the project – $778 per MWh – far outweighs its benefits. Moreover, there is a risk of cost overruns if there are delays in implementing the project.

Environmental Impacts

A feasibility study of the project has been conducted, but a full SEIA is still outstanding. Notwithstanding, studies show that the reservoir will flood 34 200 Ha, submerging forest and cultivated land (Diakite, 2014). Other definite negative impacts include loss of biodiversity in the area, the modification of Faleme and Senegal River hydrological regimes, and the permanent flooding of land with mineral potential. These environmental impacts are worsened by Senegal and Mali's historically poor performance mitigating social and environmental impacts. For example, 12000 Ha of forest was destroyed during construction of the Manantali Dam, yet no recorded mitigation measures replaced the lost forest.

Key facts

Location:	Faleme River, a tributary of Senegal River
Purpose:	Hydropower (18 MW), flood control and navigation
Firm capacity:	8 MW
Riparian countries:	Senegal and Mali
Beneficiaries:	Senegal, Mali, Mauritania and Guinea
Cost:	$301.6 million
NPV:	-$245 million USD
Cost of electricity:	$778 per MWh
Length of construction:	4,5-5 years
Status:	Construction scheduled
Project Authority:	Senegal River Basin Management Agency (OMVS)

Social Impacts

A total of 4933 people will have to be relocated to clear way for the dam and its reservoir. Communities' livelihoods and culture will thus be affected through the loss of agricultural land and the loss of income from gold mining. Relocation will additionally create a disconnection between the Malian and Senegalese communities, who have lived together for decades. Women are mostly at risk of unfair compensation.

Below: The Faleme River Photo: Warren McCleland

8. Kaleta Hydropower Dam

DVT	BEN	ECON	VALUE	ENV	SOC	FIN	RISKS	TRANS	WCD	OVR

Map showing the location of Gourbassi on the Faleme River *Google Maps*

Kaleta is the only one among the 11 dams assessed that has "least concerning" scores for all criteria. None of the criteria in the scores was found to be highly concerning.

Development Effectiveness

Currently (in 2015), Guinea's installed capacity is 436 MW. However only 20% of the population has access to electricity (World Bank Indicators, 2010). Power generated from Kaleta should alleviate the energy crisis in Guinea, but whether the project will benefit domestic users or the growing mining sector remains to be seen – there are no details on how electricity from Kaleta will be distributed between domestic and industrial users. It has nevertheless been claimed that affected communities will benefit from upgraded health centres and the provision of water points and a school. Furthermore, potentially affected communities and the government are drawing up a local immigration policy to ensure that locals are prioritized in employment and business opportunities deriving from the hydropower project. This provision is a major positive aspect of the Kaleta scheme.

Kaleta is considered financially viable due to the reasonable cost of electricity. Its NPV is positive, and it has an internal rate of return of 26%. This project was completed on-time, despite labour disruptions during the Ebola virus outbreak in late 2014 and early 2015.

Social and Environmental Impacts

Kaleta is a run-of-the-river scheme with a small reservoir of 596 Ha. Furthermore, the dam site is on a narrow gorge far from protected areas. For these reasons, negative environmental impacts are projected to be limited, except for possible deterioration in the quality of water during

Key facts

Location:	Konkoure River, in Guinea
Co-ordinates:	10°27’N 13°16’W
Purpose:	Hydropower (240 MW)
Firm capacity:	115-160MW
Beneficiaries:	OMVG Gambia, Guinea, Guinea-Bissau and Senegal with Guinea getting 70% of the share.
Cost:	$301.6million
NPV:	$368 million cascade with proposed Souapiti dam
Status:	Completed
Estimated cost of electricity:	$58 and $106
Contractor:	The China Water and Electricity

construction. This will be compensated for by clean drinking water that will be supplied to riparian villages. In addition, the dam will not affect other countries’ water supplies.

Overall the project will displace 900 people: eight villages will be relocated and an additional six will need compensation for lost land. Additional displacements may occur as a result of the construction of transmission lines. Using participatory techniques and gender awareness approaches, a resettlement action plan was drafted with the involvement of communities that specifies arrangements for compensation. An inventory of communal property was created in 2006. All these initiatives do not, however, eliminate the risk that vulnerable groups, such as women without customary or official land titles, will not be compensated. This also does not eliminate the possibility that resettlement plans could be affected by corruption.

Below: The Konkoure River   Photo: Jordi Valbuena

9. Rusumo Falls

DVT	BEN	ECON	VALUE	ENV	SOC	FIN	RISKS	TRANS	WCD	OVR

Map showing the location of Rusumo falls on the Kagera River *Google Maps*

Rusumo was found to have the least concerns on the transboundary aspects and moderate impacts in five categories: "developmental effectiveness, distribution of benefits, environmental impacts financial performance risks and the incorporation of some of the WCD principles. But major concerns about the costs and social impacts remain.

Development Effectiveness

Only 14%, 16% and 5% of the populations of Tanzania, Rwanda and Burundi respectively have access to electricity (Energypedia, 2015). As of 2015, the total installed capacity of these three countries was extremely low: Tanzania has just 1583 MW installed; Rwanda has 110 MW; and Burundi has 52 MW (Mem.go.tz, 2015; CNBCA Africa, 2014; Gigawattglobal 2015). Hydroelectricity from the proposed Rusumo Dam will therefore increase these countries' generational capacity by 2%, 25% and 52%, respectively.

Tanzania, Rwanda and Burundi are some of the poorest countries in Africa and an investment of $340 million is quite significant with respect to the gross domestic products of these countries. The high cost of the Rusumo Falls project is likely to create an additional debt burden for the three countries. Furthermore, the cost of the electricity is projected to be well above average prices in the region. Delays that are already occurring will drive the cost of power above projections, and costs may also increase because of the very high chance of corruption and poor governance. Political instability could also reduce the governments' ability to reap all the promised benefits.

Environmental Impacts

As much as 31,300 hectares of land will be flooded by Rusumo's reservoir, including a total of 61 hectares of natural terrestrial vegetation and

Key facts

Location:	Kagera River (Rwanda and Tanzania)
Co-ordinates:	2°22'S 30°47'E
Use:	Hydropower (80 MW)
Firm capacity:	44 MW
Riparian countries:	Burundi, Tanzania and Rwanda
Estimated Cost:	$340 million
NPV:	-$420 million
Status:	Proposed Project
Promoter:	World Bank
Estimated cost of electricity:	$316 per MWh

114 hectares of banana plantations. Due to the vegetation that will be drowned, the dam will emit 11723 metric tonnes of CO_2 per MWh. Furthermore, the operation of the dam will also permanently affect natural water flow regimes and sediment movement downstream from the dam (NBI, 2013).

Social Impacts and Human Rights

In total, Rusumo Falls Dam will displace 3155 people (NBI, 2013). In addition just over 106 people in the three countries will lose agricultural land, livelihood activities and access to resources.

There are plans to carry out comprehensive consultations with the affected communities in order to come out with resettlement plans (NBI, 2013). However, there is still the risk of failed resettlement, especially when the past history of resettlement in the three countries is considered. Limited civil and political liberties in the three countries may also thwart affected communities' attempts to advocate for adequate resettlement.

Below: The Confluence of the Kagera and the Ruvubu Rivers near Rusumo Falls Photo: Wikipedia

10. Fomi Dam

DVT	BEN	ECON	VALUE	ENV	SOC	FIN	RISKS	TRANS	WCD	OVR

Map showing the location of Fomi Dam
Google Maps

The Fomi Dam is billed as a multi-purpose project capable of harnessing West Africa's longest river, the Niger, for power generation in Guinea and irrigation in Mali. Yet Fomi's vast water storage potential could drastically impact one million Malians downstream, whose livelihoods depend on the Niger's annual flood to sustain verdant wetlands.

Rationale

The Fomi Dam has the potential to add as much as 90 MW of much-needed electricity to Guinea's grid, where generation currently stands at just 436 MW and only 20% of Guineans have access to electricity. In Mali, the Fomi Dam is being promoted in part for its ability to increase year-round navigation on the Niger River, but principally for its promise to significantly expand land under cultivation in the Office du Niger irrigation zone. However, foreign investors have been allocated most of these lands, and local communities do not stand to benefit. At the same time, any economic gains from power and irrigation will be seriously undercut by costs incurred by communities downstream whose lives and livelihoods depend on fishing, grazing and recession agriculture.

Environmental Impacts

Construction of the Fomi Dam would cause irreversible damage to the region's fragile environment by drastically reducing downstream flows, particularly Mali's Inner Niger Delta. The Inner Niger Delta, a Ramsar site, is one of Africa's largest wetlands and serves as a vital nesting area for migratory water birds, as well as an important breeding ground for many fish species (Wetlands International). The impacts on the natural environment, and those who depend on it, would be especially severe in years of drought, which are

Key facts

Location:	Niandan River tributary of the Niger River, Guinea
Coordinates:	10.51411, 9.69872. (Google friendly coordinates)
Purpose:	Hydropower (102 MW) and irrigation (210,000 ha)
Firm capacity:	42 MW
Riparian countries:	Guinea, Mali, Niger and Nigeria
Estimated Cost:	$384 million
NPV:	-$222 million
Status:	Proposed project
Estimated cost of electricity:	$ 269 per MWh

becoming increasingly frequent with the onset of climate change.

Social Impacts and Human rights

At least 48,000 people in Guinea would need to be relocated to make way for the dam and reservoir. Despite initiatives for benefit sharing for these communities, the lack of fertile replacement land for communities living along the river raises major red flags about the ability to properly resettle such a large number of people. The resettlement challenge is dwarfed by the social impacts that would stem from impacts on the Inner Niger Delta. Over one million people in neighbouring Mali who depend on its bounty for recession agriculture, pastureland for herds during the dry season, and fishing (International Rivers, 2015) will be affected. Although other groups may benefit from the Fomi through electricity supply and irrigated land, the affected communities living in the Inner Niger Delta will not.

Right: People that depend on the Niger River DeltaPhotos: From Flickr

11. Lesotho Highlands Water Project LHWP II

DVT	BEN	ECON	VALUE	ENV	SOC	FIN	RISKS	TRANS	WCD	OVR

Map showing the location of LHWP II

Google Maps


Photo: Gus Greenstein

The LHWP II was ranked as having moderate impacts. The two categories that were found highly concerning were the social impacts and the adherence to the WCD principles.

Development Effectiveness

The Kingdom of Lesotho will benefit from the generation of revenue from water royalties and the sale of electricity to South Africa. Water from the dams on the Lesotho Highlands Water Project is transferred through a connecting tunnel to the Vaal River in South Africa. The Department of Water Affairs in South Africa reported that six of the country's nine provinces, as well as the country's mining sector (including major parastatals such as Sasol and Eskom), were benefitting from the improved water security provided by the Vaal River, of which 40% is from the Orange/Senqu River. In similar fashion to Phase 1, Lesotho will also gain additional infrastructure services in terms of access roads and bridges that will be developed for Phase 2.

Welfare gains in South Africa are not so apparent. For instance, who will borrow the funding for Phase 2 from financial markets? Loan repayments will be levied through water tariffs that have been on the increase ever since the LHWP project started. The cost of water has been increasing throughout the project life – for instance, the percentage of bulk-water costs that Rand Water pays for the LHWP tariff rose from 8% in 1991 to more than 30% in 1999. In 2004, water rates were increased by more than 6% because of the high cost of LHWP water (International River 2005). In addition, the Lesotho Highlands Water Project agreement requires South Africa to continue importing water from Lesotho even if local dams in South Africa are full. Rising costs could make it more difficult to get water supply to

Key facts

Location:	Senqu River (Orange River) (Lesotho)
Co-ordinates:	29°40'S 28°46'E
Purpose:	Water transfer to SA & Hydropower (1200 MW)
Riparian countries:	South Africa
Cost:	$1 billion (including transmission lines)
NPV:	$3,090 Million
Status:	SEIA underway. Phase1 completed in 2001
Status:	Construction scheduled
Estimated cost of electricity:	$28 per MWh

poor communities in townships in South Africa. Electricity costs have also been on the rise, and tariffs are likely to continue rising in order to pay for the investment. However the current estimated costs for LHWP II are very competitive and so is its NPV. But dam sedimentation and delays in implementing the project can later affect the NPV.

Social impacts and Human Rights

The Polihali's reservoir will displace 2,547 people (which equates to 534 households or 17 villages). An additional, 16,560 people living around the Senqu and Khubelu Rivers will lose a total of 1125 hectares of grazing and cultivation land, as well as access to resources and facilities (LHDA, n.d.). These impacts are particularly significant, given that people in Lesotho mainly depend on subsistence farming and animal husbandry for their livelihood, and because arable land is very limited in Lesotho.

A completed Public Health Impact Assessment further points to the fact that the construction of the Kobong hydropower station could lead to an increase in the prevalence of HIV/AIDS as a result of increased prostitution activity in the area (ILISO, 2012). Given that the disease already affects 17% of the Kingdom's population, the chances of infection are very high. Other potential risks include the increase in water-borne diseases. Thus, limited access to health care services, which characterizes Lesotho's public health system, will only worsen the situation (Freedom House, 2012).

In the past, Lesotho has proved to be inadequately equipped to ensure compliance with projects' resettlement and compensation plans, including adequate participation of affected communities in the drafting of such plans. The compensation of communities that were displaced by the Katse Dam is a good example: LHDA did not robustly respond to the needs of affected communities, especially in addressing lost livelihoods. At the time of writing, one of the communities was suing the LHDA for not paying out compensation. Therefore, it is highly probable that inadequate resettlement and compensation will be offered, which can lead to further impoverishment of affected communities.

Thus while Lesotho will gain from royalties derived from selling water to South Africa, the social impacts are very large, and the authorities should therefore put in place mechanisms for mitigating these broad negative impacts.

Left: Lesotho Highland Wetland Project I
Photo: Gus Greenstein

Summary of Findings and Recommendations

Summary

Our analysis shows that the major dams being planned under the PIDA framework are fraught with challenges. Too many of these projects are unlikely to bring about development in the way that is envisaged. PIDA represents a deeply flawed approach to increase power generation and address the energy crises. In addition, efforts to increase the generation capacity by focusing on large hydropower dams conflict with efforts to address climate change; rein in African debt and increase economic growth; and address resource and environmental rights.

A few common trends emerged from the analyses: Most of the projects were not cost effective, and social and financial risks are highly concerning for more than 50% of the dam projects. In addition, the developments paid very little regard to the WCD principles.

Development Benefits

For any infrastructure investment to be effective, it should provide tangible and positive impacts for the poor people and improve their quality of life. The PIDA dam projects are supposed to foster positive changes in their countries and regions by improving power generation, water provision, irrigation and other services. The development benefits must be considered alongside costs and risks posed by the dam. The score in this category was yellow (moderate) for all except Fomi and Gourbassi dams, which scored red and green respectively. Despite these findings, decades of experience show that large dam projects, particularly in Africa, routinely underperform and fail to meet the often-ambitious performance goals used to attract support. Multi-purpose dams designed to generate power and expand agriculture through irrigation have a particularly poor track record in sub-Saharan Africa (McCully 2001). Of the projects assessed, only Gourbassi was found to have a likelihood of achieving strong development benefits, while the Fomi Dam in Guinea is assessed to have the least development benefit, particularly considering the project's high financial and social cost.

In terms of the distribution of the projects' benefits, the analysis shows that most of the electricity and water services are designed to target major urban centres (Lesotho Highlands), mining operations (Inga 3, Mphanda Nkuwa), and foreign agribusiness firms (Fomi), or will be exported to wealthier neighbours who already enjoy higher rates of access (Inga 3, Mphanda Nkuwa, and Grand Renaissance) (see Table 4). The rural and affected communities who need these infrastructure services most are slated to benefit very little from the suite of PIDA dams, either through receiving a portion of revenues or subsidized electricity, though discussions are underway in the case of Fomi

Table 4. Purpose of the PIDA dams

Projects	Investors	Beneficiaries	Purpose of Project
Batoka	Not yet Known	Zambia and Zimbabwe	Hydropower for export and national use
Fomi	Not yet Known	West African Power Pool	Hydropower for regional use
GERD	Government of Ethiopia	Ethiopia	Hydropower for national use
Gourbassi	Not yet Known	Senegal, Mali, Mauritania and Guinea	Hydropower and irrigation for regional use
Inga 3 BC	Not yet Known	DRC and South Africa	Hydropower for export and mining
Kaleta	China water and electric company and Govt of Guinea	Gambia, Guinea, Guinea-Bissau and Senegal	Hydropower for national use
LHWP phase 2	Govt of South Africa	Lesotho and South Africa	Hydropower for export and water transfer
Mphanda Nkuwa	Not yet Known	Mozambique and South Africa	Hydropower for export
Rusumo Falls	WB, AfDB, EU-Africa Infrastructure Trust Fund	Tanzania	Hydropower for national use
Ruzizi 3	Govt of BUR, DRC and RWA Consortium of SITHE*, KENYA IPS*	Burundi, DRC and Rwanda	Hydropower for regional use
Sambangalou	China's Exim Bank	Gambia, Guinea, Guinea-Bissau and Senegal	Hydropower and irrigation for regional use

*Consortium of SITHE global power ventures LLC USA
*Industrial Promotion Services LTD IPS Kenya

for resettled communities to secure a benefit-sharing agreement. It is concerning that most of the planned energy projects will increase the generation capacity in order to bridge the "industrial energy gap" but are not designed to increase energy access for citizens.

Other benefits such as job creation are typically overstated. Most projects' available documentation did not elaborate the number of jobs that would be available to locals and at what level these jobs would be. This evaluation showed that only Kaleta in Guinea had made a positive attempt to ensure that jobs would be secured for the affected communities.

Financial and Performance Risks

Only two of the PIDA projects were deemed to be cost effective when assessed using available figures and the hydro calculator. Unlike other estimates, the hydro calculator takes into account the land and vegetation that will be inundated, including carbon emissions from the hydro dam projects. Kaleta and Lesotho Highlands Phase 2 were the only PIDA dams with a positive net present value (NPV)[9].

Comparative Costs

Figure 2 illustrates the cost of electricity from each of the dams based on our calculations. The estimated cost of the electricity from the GERD, Inga 3 BC, Kaleta, LHWP II and Mphanda Nkuwa would be less than $100 per MWh, making that competitive with the projected costs of electricity from solar PV in Africa. According to a 2014 Solar Technology Roadmap report, solar PV in a few years will become the least-expensive option for new generation capacity in most parts of Africa. Unlike hydropower plants, solar PV plants are quick to deploy. In addition, they play an integral part in diversifying the energy sources of a country, leading to an improved energy mix and decreasing reliance on imported fuel.

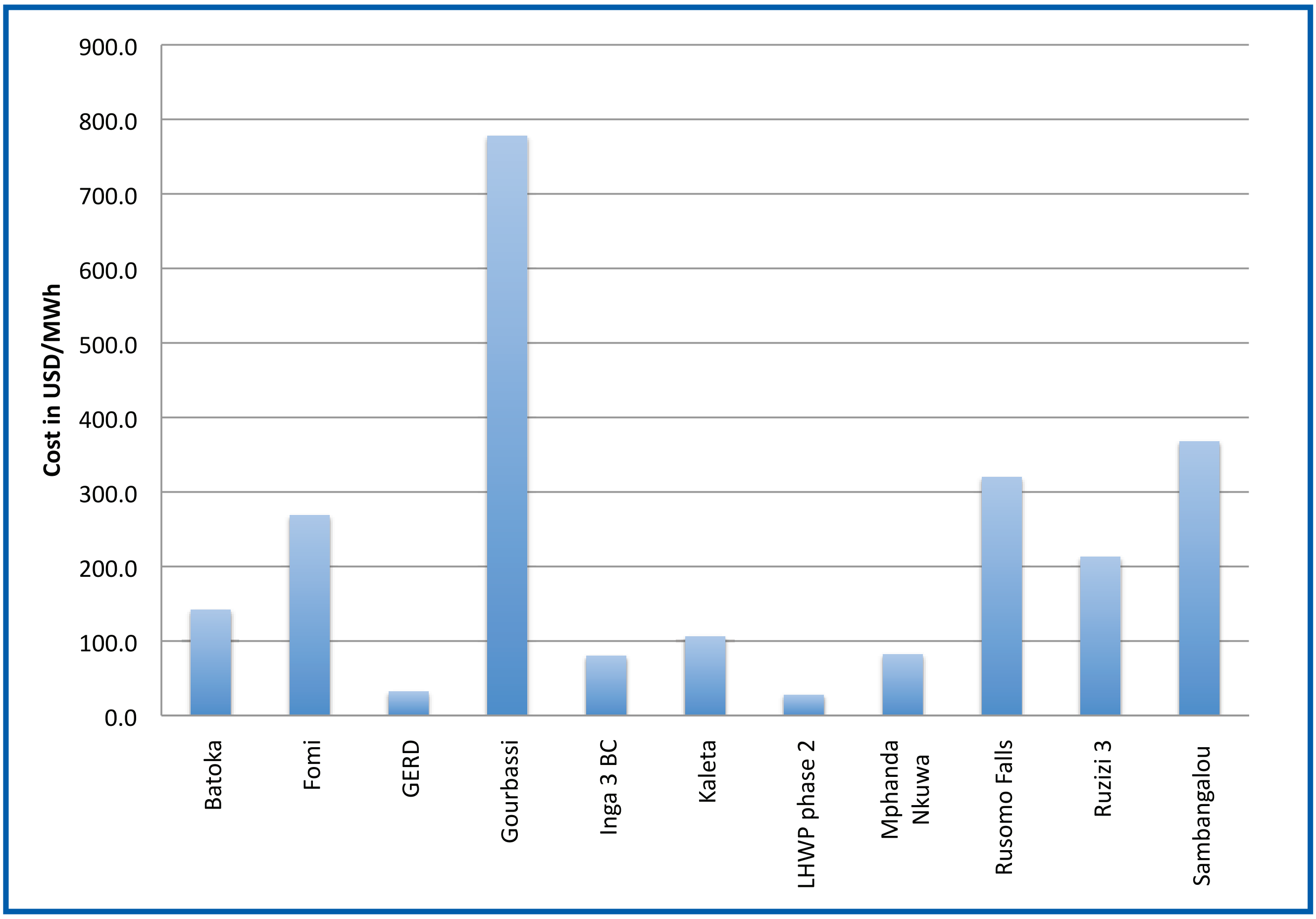
Economic Risks

The majority of the PIDA projects, including Inga 3 BC, Grand Renaissance, Batoka, Mphanda Nkuwa, Ruzizi III, and Fomi, were deemed to have high levels of financial and/or operational risks. For most countries, the project cost estimates were quite high as compared to Gross Domestic Product (GDP). In the case of DRC, a country that carries a high debt burden, the $14 billion price tag of Inga 3 BC nearly equals the country's annual GDP. Given the many competing demands for services in the vast country, Inga 3's construction costs and debt repayment would likely consume scarce public resources that could otherwise be used to deliver services to the Congolese people.

Furthermore, the Inga 3 BC, Ruzizi III and Batoka Gorge dams would be developed under

[9] The sum of the benefit and cost cash flows over a period of time.

Figure 2. Cost of the electricity generated from the PIDA dams



public-private partnerships using a build-operate-transfer (BOT) model wherein private companies are selected to construct and run a project for a certain number of years before transferring to government ownership. These projects often entail significant risk borne by governments who struggle to return a profit once a dam's useful lifetime is diminished. BOT ventures are primarily profit-driven and often fail to assess and manage issues regarding resettlement, environmental mitigation and transboundary concerns (International Rivers Benchmarking report 2015).

Corruption

Most of the countries hosting PIDA dams rate poorly on corruption indices and, given the high rates of corruption in large infrastructure projects such as dams, this raises the prospect that costs will be higher than anticipated, construction quality could be compromised, and revenues generated by hydro projects will not benefit citizens. The development rationale for Inga 3 BC is that selling power to mining companies and exporting electricity to South Africa will bring a windfall in government revenues, though the country's track record in converting mining revenues to development benefits is not encouraging.

Environmental and Social Risks

Environment

Dam infrastructure occupies a significant footprint in the natural environment, altering downstream water flows, transforming flooding patterns and changing water temperatures, sediment levels, and chemical properties. Four projects, namely Grand Renaissance, Gourbassi, Fomi and Sambangalou, were found to be highly concerning on environmental grounds; they will cause irreversible and significant environmental damage, flooding large areas of land and destroying habitats for birds and wildlife. Fomi, for example, would starve the Niger River of a major share of its volume, blunting the annual flood that sustains the Inner Niger Delta wetlands, which in turn sustain over one million people who rely on its bounty. The GERD would also significantly alter the hydrology of the Nile River basin, the consequences of which are expected to be severe. The potential impacts of Fomi and GERD are amplified because they are transboundary in nature, which adds a significant complicating factor. At the same time, the Sambangalou and Gourbassi in Senegal will affect world-renowned national parks and drown important cultural sites.

Resettlement

Meanwhile, the number of people expected to be displaced by these projects is also quite high. Based on available documentation, the eleven projects assessed in this study will displace between 90,000 and 100,000 people. The Fomi Dam will displace at least 48,000 people at the reservoir site alone, roughly the same as the other dams combined. Worldwide, the toll of development-induced displacement on communities has been extremely high, with many communities never recovering, much less seeing their lives improved as project developers typically promise. Even institutions like the World Bank, which has among the stronger resettlement policies and a great deal of expertise, has found it difficult to ensure that communities are not left worse off, particularly in large dam projects. Examples include the Bujugali Dam in Uganda, where fishermen have been ill equipped to recover after being relocated far from any river or lake. The first phase of the Lesotho Highlands Water Project has served as a cautionary tale of the difficulties and long-ranging consequences of resettlement failures. The same holds true for the Kariba Dam, which left a terrible legacy for the 57,000 people who are still suffering more than 50 years down the line. Of the assessed projects, only the Kaleta Dam appears to have put in place detailed provisions to ensure that the affected communities are fully involved with the resettlement plans and policies for sharing benefits. The Ruzizi III and Lesotho Highlands Water Phase 2 have also put in place plans for mitigating social impacts, yet studies have shown that on-the-ground implementation of these plans is poor.

Adherence to WCD principles

Our analysis considered the level of public acceptance of the project, the strength of project social and environmental safeguards, and the enforceability of safeguard adherence agreements. Kaleta is the only dam that has plausible social agreements with communities. The rest fall short. In more than half of the eleven dams, even basic project information is not available to communities or the broader public, and developers have not secured demonstrable public acceptance as enshrined in the WCD guidelines. In countries such as Ethiopia, DRC and Mozambique, state repression means affected people are afraid or unable to negotiate a fair and just compensation, and restrictive laws prevent the disclosure of project information.

Below: Camp Kinshasa in the DRC

Conclusions and Recommendations

Our analysis shows that the suite of dams proposed under the PIDA Priority Action Plan are ill-suited to address the pressing needs of the continent, including delivering energy access to those who lack it. By and large, the PIDA dams are not cost effective and, rather than sustaining the continent's economic growth, could jeopardize recent gains as delays and cost overruns are factored in. The PIDA dams largely repeat the flawed model of prioritizing generation and export to extractive companies or to wealthy neighbours at cut-rate tariffs, all too often sacrificing the natural environment and the millions of Africans who rely on rivers for their lives and livelihoods.

In the face of the findings from the study, the following recommendations are proposed to facilitate change that will bring development and increase the much needed energy access in African countries.

- Most of the countries planning huge projects lack the capacity to handle such projects, thus increasing the risk of failure. Proposed projects should be scaled to match available resources and skills. It may be prudent to ensure that proposed projects incorporate institutional capacity building.
- Projects need to be designed so that they prioritize local needs, rather than placing costs on communities and favoring export or extractive industries.
- Realistic project costs and the cost of generated electricity should be independently assessed based on robust energy sector planning, in order to ensure that the project is competitive and will be able to provide affordable services to people when it becomes operational. Lengthy projects rob the public of immediate social benefits and may become obsolete by the time they come online. Planning and construction time therefore need to be considered when planning of energy and water service provision.
- With the projected high impacts of climate change on the continent, especially in the basins of the Nile, the Zambezi and the Senegal, Rivers climate risks must be factored into the plans and designs. Countries must ensure that the right type of project is selected in the first place, and plan mitigation measures for the worst-case scenarios.
- To ensure that projects improve the lives of affected communities, it is crucial that communities are informed and participate in project development from the beginning, and are centrally involved in the development of resettlement action plans if a displacement project is agreed on. Further, compensation processes and resettlement should be completed before the project construction commences.
- Projects that displace large numbers of people should be avoided, as it is very difficult to restore lost livelihoods completely and governments around the world are still battling with how this can be effectively achieved.
- Given the prevalence of corruption in many countries, external developers working on projects should work with external governments and civil society to ensure that there are mechanisms in place for limiting incidences of corruption by standardizing contracts and publicly declaring the costs of project components to enable monitoring. African countries and investors will all benefit from a corruption free environment.
- The African Union should assist the African countries to develop legislation that safeguards their citizens to ensure that development projects follow the best labour, human rights and compensation standards.
- International legal safeguards for protection of the environment should be respected, and SEIAs should be undertaken, before any decision to construct is made. Time should be given for the SEIA reports and recommendations to be discussed before any design plans are made.

Through PIDA the African Union has an opportunity to shape development by ensuring that appropriate and sustainable infrastructure is developed that leads to eradication of poverty and achieves the climate goals.

The Zambezi River ecosystem below Kariba Dam has been seriously affected by reduced water flow
Photo: Diana Martin

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Right: Lesotho community member. Photo: Gus Greenstein

Annexes Adopted from the World Commission Dams Report (2000).

STRATEGIC PRIORITY		KEY MESSAGE
1	**Gaining Public Acceptance**	Public acceptance of key decisions is essential for equitable and sustainable water and energy resources development. To be socially legitimate and produce positive and lasting outcomes, greater public participation is required. A fair, informed and transparent decision-making process is required to give all stakeholders the opportunity to participate fully and actively. This process should be based on the acknowledgement and protection of existing rights and entitlements.
2	**Comprehensive Options Assessment**	Alternatives to dams do often exist. To explore these alternatives, needs for water, food and energy are assessed and objectives clearly defined. The appropriate development response is identified from a range of possible options. The selection is based on a comprehensive and participatory assessment of the full range of policy, institutional and technical options. In the assessment process social and environmental aspects should have the same significance as economic and financial factors. The options assessment process continues through all stages of planning, project development and operations.
3	**Addressing Existing Dams**	Opportunities exist to optimize benefits from many existing dams, address outstanding issues and strengthen environmental mitigation and restoration measures. Dams and the context in which they exist should not be seen as static over time. Changes in water use priorities, and physical and land use changes in the river basin can transform benefits and impacts. Technological developments and changes in public policy expressed in environment, safety, economic and technical regulations can similarly alter benefits and impacts. Therefore management and operation practices need to adapt continuously to changing circumstances over the project's life and must address outstanding social issues.
4	**Sustaining Rivers and Livelihoods**	Rivers, watersheds and aquatic ecosystems are the biological engines of the planet, and the basis for life and the livelihoods of local communities. Dams transform landscapes and create risks of irreversible impacts. Understanding, protecting and restoring ecosystems at river basin level is essential to foster equitable human development and the welfare of all species. Options assessment and decision-making around river development consequently must prioritize the avoidance of impacts, followed by the minimization and mitigation of harm to the integrity of the river system.
5	**Recognizing Entitlements and Sharing Benefits**	Joint negotiations with adversely affected people result in mutually agreed and legally enforceable mitigation and development provisions. These provisions recognize entitlements that improve livelihoods and quality of life, and affected people are beneficiaries of the project. Successful mitigation, resettlement and development that result in improved livelihoods for all affected people are fundamental commitments and responsibilities of the State and the developer. Accountability for these responsibilities needs to be ensured through legal means, such as contracts. There needs to be accessible legal recourse at national and international level in the event of reneging on contracts.
6	**Ensuring Compliance**	Ensuring public trust and confidence requires that governments, developers, regulators and operators meet all commitments made for the planning, implementation and operation of dams. Compliance with applicable regulations, with criteria and guidelines, and with project-specific negotiated agreements is secured at all critical stages in project planning and implementation. A set of mutually reinforcing incentives and mechanisms, both regulatory and non-regulatory, is required for social, environmental and technical measures.
7	**Sharing Rivers for Peace, Development and Security**	Specific interventions for diverting water, dams require constructive co-operation between countries. Storage and diversion of water on trans-boundary rivers has been a source of considerable tension between countries and within countries. Thus the use and management of resources needs to increasingly become the subject of agreement between States to promote mutual self-interest for regional co-operation and peaceful collaboration. This will lead to a shift in focus from the narrow approach of allocating a finite resource to the sharing of rivers and their associated benefits. States need to be innovative in defining the scope of issues for discussion.

Photo: Diana Martin

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