Riverscope

Case Study: Koukoutamba, Guinea Summary

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1. OVERVIEW

The electricity produced by large-scale hydropower is expensive in commercial, social, and environmental terms. Dams have significant and irreversible impacts on societies and ecosystems while being exposed to huge operational and financial risks. Yet, the way that these projects are assessed systematically underestimates these impacts and risks, meaning that investors, developers, and regulators often make the wrong decisions based on incomplete information.

This document summarizes an assessment of the proposed Koukoutamba hydropower project in Guinea, using the "Riverscope" assessment tool. Riverscope offers a new way to assess large dams by combining geospatial analysis, expert investigation, and financial modeling. Riverscope is unique in that it presents a commercial comparison between hydropower, solar, and wind, alongside a rapid but wide-reaching environmental and social risk analysis. As such, it provides relevant information and analysis for governments, investors, and the third sector. The full assessment report and methodology is available at www.riverscope.org.

This Riverscope assessment of Koukoutamba shows that:

1. **The project could be delayed by 10 years,** mainly because of a combination of social and environmental challenges. This delay significantly reduces the dam's financial value.
2. Under the most likely scenario, **Koukoutamba will be 46% more expensive than solar by 2027** (the most probable starting date of operation), and 90% more by 2035.
3. **Alternative energy technologies could deal with energy poverty and security more cheaply and rapidly** than Koukoutamba without incurring substantial negative impacts.

KOUKOUTAMBA

Koukoutamba is a multi-purpose dam planned for flood control, navigation, and hydropower, with a planned capacity of 294MW and projected capital expenditure of $812 million.[1] Three-quarters of the energy is intended for export to the West Africa Power Pool (WAPP), while a quarter will be used domestically.

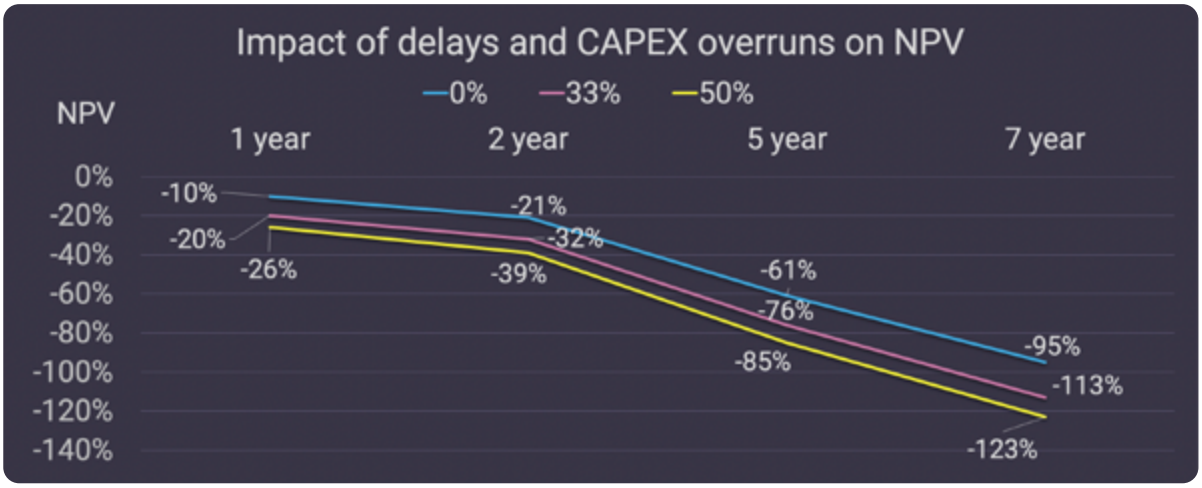
Financing for Koukoutamba is still unclear at this stage, and the project has not started construction. Sinohydro was commissioned by the Organization for the Development of the Senegal River (OMVS[2]) to develop Koukoutamba in 2019,[3] and is still looking to secure funding. Koukoutamba is the fourth large dam project commissioned by the OMVS. Hydropower potential in Guinea is widespread, and Koukoutamba is one of numerous recent dams planned or built in the country for which the Guinean government continues to show support.[4]

2. COMMERCIAL ASSESSMENT

Our commercial assessment of Koukoutamba evaluates three key areas of commercial risk: delays and slippage, the Levelized Cost of Electricity (LCOE), and offtake arrangements. In this case, even perfect implementation would produce an uncompetitive project. Riverscope shows that cost and time overruns are likely to make Koukoutamba even less attractive financially.

DELAYS AND SLIPPAGE

Koukoutamba was originally slated to start operation in 2021[5], then 2023[6]. But there is no evidence to suggest construction has officially started. If construction started immediately, Koukoutamba might be able to start operation in 2025. Our analysis based on similar cases suggests further delays are likely and the earliest plausible date of operation will be 2027. These delays and deferred cash flows would lead to a considerable decline in the Net Present Value (NPV).



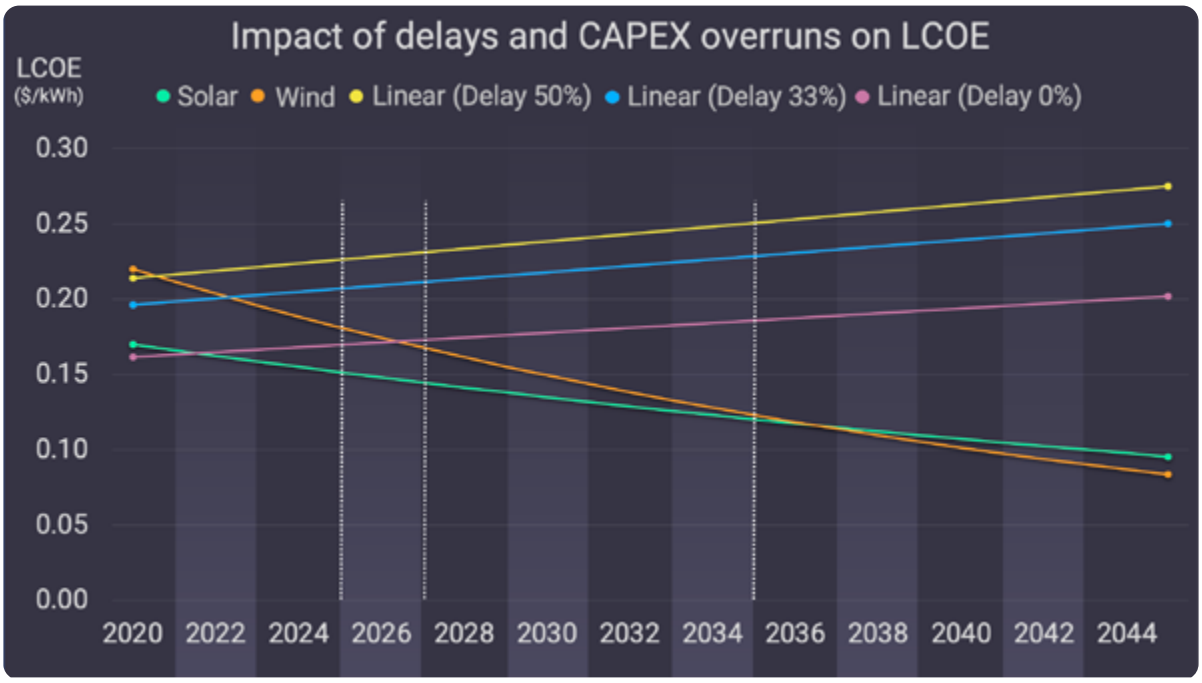
Graph 1. Created by TMP Public

A delay of 1-2 years without overspend translates into a 10%-21% decline in NPV, or a loss of $66-$126 million, respectively. A similar delay with typical overspend (33%) translates into losses of $122-$177 million.

LEVELIZED COST OF ELECTRICITY (LCOE)

The investment case for Koukoutamba appears to be weak, particularly when compared to alternative energy technologies. Our assessment demonstrates the commercial superiority of local solar and wind by comparing the LCOE of Koukoutamba with representative local values.

The graph below shows how the competitiveness of Koukoutamba deteriorates in proportion to delay. If Koukoutamba begins operations in 2025 without any budget overruns, it would still be 12% more expensive than solar, and wind would be competitive. But by 2027 both solar and wind are cheaper (19% and 3%, respectively). If we assume Koukoutamba also experiences budget overruns that are typical for hydropower (33%[7]), then the dam will be 46% more expensive than solar in 2027. If the project is delayed to 2035, which is entirely feasible according to our modeling, the electricity will be 90% more expensive than domestic alternatives.



Graph 2. Created by TMP Public

OFFTAKE ASSESSMENT

Roughly three quarters of the energy produced by Koukoutamba is slated for export through the WAPP, while much of the domestic portion will be used in other parts of Guinea. The pandemic and regional political tensions threaten the cohesion and economic health of the WAPP. There are also questions about the health of the bauxite market that supports the Guinean economy at a time of general economic decline. Domestic offtake could pose challenges. The transmission line is likely to be delayed and to run over budget, meaning that Koukoutamba could join several examples of energy projects in emerging markets that have been so hamstrung.[8]

3. ENVIRONMENTAL RISK ASSESSMENT

This section summarizes environmental risks for Koukoutamba, which undermine the investment case. The large environmental risks associated with dams are difficult to manage or avoid. Resulting controversies and measures taken by developers to deal with them hamper implementation and increase costs.

The scores below do not fully capture the importance of the Western Chimpanzee and other critically endangered species. This is a problem with the data, rather than with our method. This becomes clear in our qualitative investigation, which shows very high levels of biodiversity in the area that is threatened by the dam. Overall the region is quite remote which raises the level of risk for the project.

INDICATOR	SCORE			COMMENT
	DAM	RIVER	DISTRICT	
Water Scarcity	48	57	57	Guinea is water-rich, but water scarcity could still be an issue. This is reflected in low capacity factors
Sediment Flux	43	35	48	This score is worse than average: the dam could impact downstream food security and biodiversity.
Species Richness	29	29	36	Despite this relatively low score, the area is known to be biodiverse. Data is relatively scarce in Guinea.
Upstream Drainage	46	27	54	This score is worse than average: the dam will create some upstream water management issues.
Inter-Annual Variability	16	17		This is a low score which reflects the consistent nature of water supply in this part of Guinea.
Protected Areas			63	This high score suggests highly sensitive ecosystems pose a risk to the project (e.g. Moyen-Bafing National Park).
% Irrigated Cropland			75	The high number represents low levels of cropland: dams have greater problems in remote areas relatively untouched by development.
Drought Severity			26	This low score suggests that droughts are not a major risk in the region. This may change with climate impacts.

BIODIVERSITY

Koukoutamba will impact critically endangered species in their last stronghold: the Moyen-Bafing National Park. The dam will lead to the deaths of around 1,500 western chimpanzees (and other endangered animals)[9], which would exacerbate risks of extinction. Local and international NGOs have already targeted Koukoutamba in advocacy campaigns,[10] creating reputational problems that are likely to get worse. These risks are currently mostly at an international level, which may help explain the World Bank's decision to withdraw its support.[11]

Biodiversity impacts could also drive local opposition, creating enduring operational risks for the project and lengthy delays. Local people are apparently supportive of local biodiversity and the Chimpanzee populations[12] in particular, so an inevitable influx of poachers, loggers and similar could spark conflict.

WATER MANAGEMENT

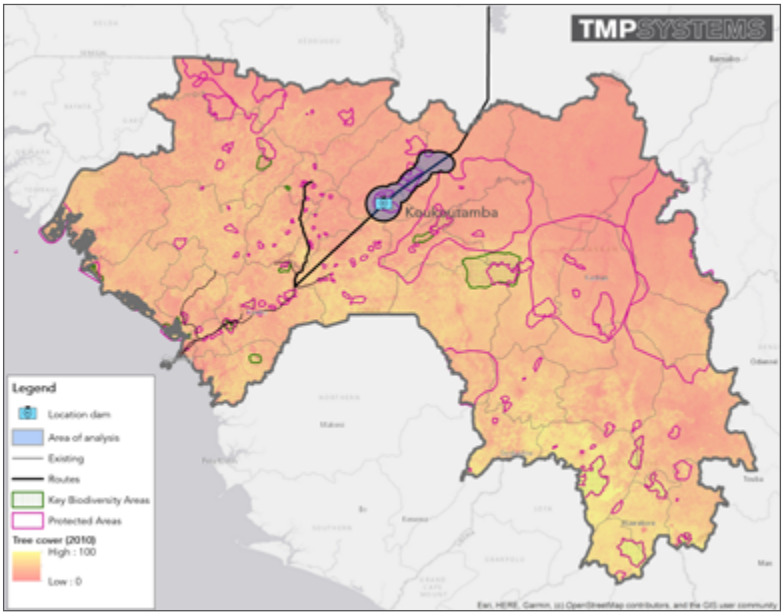
Koukoutamba promises flood control, increased water availability in the dry season, and improved navigability,[13] which are considerable attractions given that climate change will likely increase flood and drought issues in the area. Locals are excited by the prospect of better market access and improved economic opportunities.[14]

However, the impact of Koukoutamba on water management poses risks to local people and to the project's finances. Local people will experience reduced water availability and increased water contamination during construction and initial operation (which could be protracted). Downstream areas may see an increase in flooding too.[15] Koukoutamba may be operated at a lower annualized capacity to retain a degree of seasonality and so mitigate these social impacts, but this will reduce its commercial value.

CLIMATE

Guinea is highly exposed to climate risk, which may negatively affect the operation and output of the dam. Hydropower has already proven unreliable for Guinea during droughts,[16] and such climate extremes are expected to get worse. The extent of mitigation for a large reservoir in the tropics, which can lead to significant methane emissions,[17] is also uncertain.

Koukoutamba will be accompanied by a 600km transmission line[18] (see below), substations, and access roads. These will indirectly contribute to climate change via deforestation (which has been limited in the area to date), with attendant problems for biodiversity. Illegal logging is likely to increase, enabled by improved access to the area. This, together with a loss of agricultural and indigenous lands and resettlement, could increase opposition, leading to delays and added costs.



Map created by TMP Public

Moyen Bafing National Park.

4. SOCIAL RISK ASSESSMENT

This social assessment of Koukoutamba is split into three important drivers of social risk: impacts relative to expectations, social tension or conflict, and political risk.

The results below suggest that local disputes and delays are likely. The design of the dam will lead to displacement and compensation challenges, areas in which the Government of Guinea has a record of poor performance.[19] Local education levels are low, which makes it harder to obtain informed consent, and expectations of the project are sky-high.

INDICATOR	SCORE			COMMENT
	DAM	RIVER	DISTRICT	
% Deprived: Sanitation	47	46	58	Local people lack access to basic services and similar government support.
% Deprived: Drinking Water	91	94		Locals depend on the river for drinking water. Damaging this resource will create opposition.
% Deprived: Schooling	94	91		Low levels of schooling in this area increase the risk of dispute or conflict.
Multidimensional Poverty Index	89			Extreme socio-economic vulnerability increases the risk of dispute.
Vulnerability to Poverty	35			A low score here likely reflects the high level of absolute poverty in the area.
Population Density		77		These high scores suggest low population densities. This remote area has little experience with development and is higher risk as a result.
Night Lights		100		
Conflict			43	There are pre-existing disputes in the area that could be exacerbated by the project.

IMPACTS RELATIVE TO EXPECTATIONS

Locals expect Koukoutamba to bring economic development as well as better access to markets.[20] Based on some positive local attitudes towards migration into the area, it seems local people have not been informed of the threats that migration poses, including health issues and competition for resources, which could lead to clashes with newcomers.

Local people also appear to underappreciate the extent of displacement caused by the dam. The official impact assessment suggests 8,700 people would be displaced and 3,500-4,000 will be affected downstream, though both figures are likely significant underestimates.[21] Our assessment suggests the population of the dam area is 23,181 people, many of whom would be economically if not physically displaced. We estimate 31,495 people who live downstream may be impacted and in need of compensation.

The COVID-19 pandemic increases the likelihood that migration and displacement will jeopardise the project's social benefits and commercial success. Project employees increase the risk that the virus will be transmitted to the area and COVID-related delays could limit and defer local economic opportunity.

SOCIAL TENSION OR CONFLICT

Koukoutamba may lose local support if it cannot deliver economic opportunities in time and to the scale expected by local people. Loss of social license—or local approval—is particularly risky because much of the local population and regional leaders are Fula (or Fulani people).[22] A local conflict could therefore escalate into a regional issue. Tension between project developers and the Fulani has led to significant delays and problems elsewhere.[23]

Land is an important feature of social status and interaction around Koukoutamba. This customary tenure system will be disrupted by the dam and proposed migration, creating potential conflict. The region has already experienced riots and civil unrest over natural resources.[24]

POLITICAL RISK

The Government of Guinea appears committed to Koukoutamba and has been essentially unmoved by local and international advocacy to date. But the Government may not be a reliable counterparty. It will be expected to play an important role in managing social and environmental risks managing social and environmental risks but may fall short, judging from previous experience. In other instances, highly sensitive issues like displacement are being handled poorly. Moreover, a stable offtake relies on stable regional relationships because power is being fed to the WAPP. This exposes Koukoutamba's backers to political upheaval in Mali.

5. ALTERNATIVES

Alternatives have considerable benefits from a commercial, environmental, and social perspective relative to hydropower, despite potential storage, grid, and tariff challenges.

COMMERCIAL PERSPECTIVE

Solar can provide peak or base power to the grid or within a grid-tied, mini- or off-grid system and so provides a financially viable way to decentralize electricity production and rapidly meet both domestic and export energy demand. Guinea has extensive areas with good solar potential, as well as lower social and environmental risk than Koukoutamba. There are already good examples of solar projects in Guinea demonstrating its commercial potential.[25]

ENVIRONMENTAL PERSPECTIVE

Alternatives can be located nearer to demand, reducing the need for long transmission lines and their associated environmental impacts. Solar and wind technologies are more spatially efficient than hydropower[26] and can be sited more flexibly, minimizing the disruption to surrounding ecosystems and biodiversity (e.g. Moyen-Bafing National Park). These technologies can still have quite large footprints, which could bring them

into competition for land with agriculture and conservation. But these impacts are easy to manage relatively to those of large hydropower.

SOCIAL PERSPECTIVE

The decentralized renewable energy sector can be developed rapidly within or close to communities. Solar projects are also inherently less complex than large hydropower, making them easier to explain and to understand. Their smaller footprint and widespread potential reduce the need for the relocation of vulnerable groups. The sector can also be an increasingly important employer. In some countries, such as India, this alternative sector provides a comparable number of jobs to the national utility, and is expected to grow.[27]

6. SUMMARY AND RECOMMENDATIONS

Koukoutamba does not make sense on commercial, economic, or social grounds. Current plans are expensive and have an unacceptable environmental cost. Koukoutamba is unlikely to operate until 2027, at which point it will be 46% more expensive than alternatives.

Our assessment shows that hydropower is not the right technology to deliver energy access to Guinea. Zero-carbon options could be cheaper and quicker to roll out. These technologies can be located with greater flexibility, which makes social and environmental damage easier to avoid and allows a modular approach. Alternatives are much more attractive and suitable for private finance than hydropower. Private involvement increases efficiency and reduces the burden on public finances, which can be dedicated to competing priorities in pandemic recovery.

Overall, the case for Koukoutamba is weak. This suggests endemic problems in hydropower assessments, particularly in the way that they account for ESG risks. Governments and international financial institutions can create an enabling environment for alternatives by offering them the same sort of concessional finance awarded to hydropower. Clear and well-planned government support for large scale roll out of alternatives can help stimulate the sector.

RECOMMENDATIONS FOR GOVERNMENT:

- **Consider alternative sites with lower environmental risks.** Ensure that all energy projects deliver benefits (including electrification) locally and equitably, which is likely to be easier through alternatives.
- **Review the energy policy framework for new renewable energy** to provide an enabling environment for private investment. Support well-regulated independent power producers (IPPs). Consult developers of alternatives to understand how to de-risk investments in them.
- **Demand high social and environmental standards from developers.** Ensure these are independently assessed and monitored according to robust frameworks. Ensure that unique natural heritage is protected from unnecessary development.

RECOMMENDATIONS FOR PROSPECTIVE FINANCIERS:

- Work with OMVS and the contracted company Sinohydro on the above recommendations. **Evaluate how alternative technologies might perform in terms of LCOE and delay** in different locations if they had access to the same advantages as hydropower (e.g. concessionary finance).
- **Adjust the approach to financial modeling for projects like Koukoutamba using the Riverscope Assessment Process.** Request updates to risk and impact assessments. Consider a new cost-benefit analysis for this project. Use the data we have produced to develop a more reliable assessment of the risks of delay and impacts on NPV.
- **Demand higher social and environmental standards from developers.** Ensure that hydropower projects do not drive significant biodiversity loss or large-scale displacement.

ENDNOTES

1. https://www.afrik21.africa/en/guinea-sinohydro-to-build-the-294-mw-koukoutamba-hydroelectric-dam/.
2. The OMVS is a regional cooperative management body of the Senegal River which currently includes Guinea, Mali, Mauritania and Senegal.
3. https://www.ifc.org/wps/wcm/connect/497008dc-f1e0-4c62-adec-db5bc6b0528e/CPSD-Guinea.pdf?MOD=AJPERES&CVID=nlHaz9K.
4. https://guineematin.com/nouvel-an-voici-ladresse-a-la-nation-du-president-alpha-conde/.
5. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Nov/IRENA_Planning_West_Africa_2018.pdf.
6. https://www.hydropower-dams.com/news/sinohydro-to-build-the-294-mw-koukoutamba-dam-in-guinea/.
7. https://www.tandfonline.com/doi/full/10.1080/07900627.2019.1568232.
8. https://www.adb.org/sites/default/files/institutional-document/33872/files/assessment-gms-subregion-energy-sector-development.pdf (Laos); https://www.thenewsminute.com/article/why-farmers-13-tn-districts-are-opposing-power-transmission-towers-their-lands-93669 (India).
9. https://www.theguardian.com/world/2019/feb/28/chinese-dam-project-in-guinea-could-kill-up-to-1500-chimpanzees.
10. https://www.thepetitionsite.com/146/723/259/stop-the-construction-of-a-chinese-dam-that-will-flood-a-primate-sanctuary/.
11. http://documents1.worldbank.org/curated/en/168471577801992640/pdf/Official-Documents-First-Amendment-to-the-Financing-Agreement-for-Credit-5366-GN.pdf.
12. https://news.mongabay.com/2020/05/for-the-western-chimpanzee-sanctuaries-are-more-than-just-a-last-resort/.
13. https://www.hydropower-dams.com/news/sinohydro-to-build-the-294-mw-koukoutamba-dam-in-guinea/.
14. https://www.alnap.org/system/files/content/resource/files/main/guinea-acf.pdf.
15. http://www.water-alternatives.org/index.php/volume3/v3issue2/80-a3-2-3/file.
16. https://www.africa-energy.com/article/guinea-drought-puts-pressure-thermal-plants; https://reliefweb.int/report/guinea/guinea-water-and-power-shortages-blamed-drought
17. https://cordis.europa.eu/article/id/418240-tropical-dams-an-underestimated-source-of-greenhouse-gas-emissions.
18. There is some uncertainty around Koukoutamba's transmission line, as our research suggests a direct line to Labe, however the raw data we have used from the World Bank does not show this line. (https://www.africa-energy.com/article/guinea-koukoutamba-dam-tender).
19. https://communitiesfirst.net/wp-content/uploads/2019/03/Analysis-of-Guinea-Resettlement-Reference-Document_201903.pdf.
20. https://www.theguardian.com/world/2019/feb/28/chinese-dam-project-in-guinea-could-kill-up-to-1500-chimpanzees.

ENDNOTES

21. These figures likely ignore the large "floating population" – people who have left the area, often in search of economic opportunity, but still have claims to land that they may return to (especially if compensation is offered).
22. The Fula (or Fulani people) are an ethnic minority group spread across West African countries and associated with pastoralism and Islam. Also see: https://tariganter.wordpress.com/2011/09/17/who-are-the-fulani-people-their-origins/.
23. https://www.dw.com/en/west-africa-fulani-conflict-getting-worse/a-43679371
24. http://www.worldwater.org/conflict/map/.
25. https://www.pv-magazine.com/2020/10/07/financial-closing-for-82-mw-of-pv-in-guinea/.
26. Solar and wind have been shown to use far less land per megawatt produced than hydropower, with approximately 17.6ha/MW and 28.6ha/MW, respectively, versus 127.5ha/MW for hydropower (https://www.strata.org/pdf/2017/footprints-full.pdf).
27. https://www.powerforall.org/resources/research-summaries/research-summary-jobs-decentralized-renewables-and-energy-transition.