INGA 3: TOO HIGH A COST
A Study of the Socio-Economic Costs of the Inga 3 dam for South Africa

TMP SYSTEMS
This report assesses the socio-economic impact of the Inga 3 dam with a particular focus on South African citizens and on women. It looks at the commercial case for the dam, comparing it with alternatives on price, before weighing positive and negative social and environmental impacts against each other. Our report suggests that Inga 3 will deliver poor outcomes for South Africans at a very high price. At a time of high debt and unemployment, alternatives appear to offer a more prudent energy strategy with more substantial social benefits.
# Table of Contents

1. Glossary 2

2. Executive Summary 3
   - Background 4
   - Methodology 6
   - Results 7

3. Financial Assessment 8
   - Inga 3: Delays, NPV and LCOE 9
   - Inga 3 vs alternatives: Price Competitiveness 11
   - Financial Cost for South Africa 13
   - Financial Assessment Summary 15

4. Social Impact Evaluation 16
   - Negative Impacts: Conflict and Displacement 17
   - Positive Impacts: Inga 3 vs alternatives 23
   - Social Impact Evaluation Summary 27

5. Environmental Evaluation 28
   - Impacts on DRC 28
   - Impacts on South Africa 30
   - Environmental Evaluation Summary 33

6. Conclusion and Recommendations 34
   - Appendix I: Riverscope Risk Model 36
   - Appendix II: Transmission Line Risk Model 36
   - Appendix III: Methodology 36
1. Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffer</td>
<td>In the Riverscope analysis, we use an area around the specific location of analysis to ensure we capture all the impacts that are experienced.</td>
</tr>
<tr>
<td>Capacity Factor</td>
<td>Capacity factor is the ratio of actual generation and the rated capacity of a power plant.</td>
</tr>
<tr>
<td>Dam</td>
<td>Refers to the construction of the dam wall, immediate connecting infrastructure and the impacts of the resulting inundated area.</td>
</tr>
<tr>
<td>DCM</td>
<td>Discounted Cashflow Model is a cashflow model of the investment over the expected lifetime of the project and where the net cash flow is discounted in order to calculate the Net Present Value. (See below for the definition of Net Present Value.)</td>
</tr>
<tr>
<td>Discount Rate</td>
<td>Discount Rate can be considered as the cost of capital for the project shown as a percentage. This is similar to an interest rate, so a discount rate of 10% means that the borrower will need to pay the lender 10% more than the principal (the amount of the original loan).</td>
</tr>
<tr>
<td>ESG</td>
<td>Environmental, Social and Governance are three commonly used factors in measuring impact in terms of investments and are used to determine future financial viability.</td>
</tr>
<tr>
<td>IRP</td>
<td>South Africa’s Integrated Resource Plan (IRP) is an electricity infrastructure development plan until 2030, based on the least-cost electricity supply and demand balance, taking into account security of supply and the environment by minimising negative emissions and water use.</td>
</tr>
<tr>
<td>KBA</td>
<td>Key Biodiversity Areas are the most important places in the world for species and their habitats.</td>
</tr>
<tr>
<td>LCOE</td>
<td>Levelised Cost of Energy is the average cost per unit of electricity produced and connected to the grid, presented in current terms. This is useful to compare different energy generation technologies on a consistent basis.</td>
</tr>
<tr>
<td>NPV</td>
<td>Net Present Value is the net value of a project’s cash outflows and inflows presented in current terms. This value is used to determine whether the investment will be profitable or not. The metric is commonly used by investors assessing projects.</td>
</tr>
<tr>
<td>PA</td>
<td>Protected areas - national parks, wilderness areas, community conserved areas, nature reserves and so on - are a mainstay of biodiversity conservation, while also contributing to people’s livelihoods, particularly at the local level.</td>
</tr>
<tr>
<td>Sediment Flow</td>
<td>Sediment flow refers to the conglomerate of materials, organic and inorganic, that can be carried away by water to provide key nutrients and minerals for downstream ecosystems.</td>
</tr>
</tbody>
</table>

Inga 3 offers the promise of an enormous injection of energy capacity for South Africa. But when will South Africans get this energy and at what cost? This report investigates these questions using geospatial assessment (via the Riverscope process developed with International Rivers) and through expert analysis. This assessment, which is detailed throughout this paper, suggests that the socio-economic case for Inga 3 is weak and that there are strong arguments for investment in alternatives, such as solar and wind.

The South African energy sector is currently in transition, with numerous coal-fired power plants planned for decommissioning in the coming years. This will inevitably create supply gaps for South Africa to fill through new energy generation although the precise amount needed is disputed. However, South Africa’s national utility, Eskom, is heavily indebted to the tune of R488bn, which is a chronic problem and the result of long-standing structural challenges. These conditions already threaten any hopes for improving electricity access and availability, so how South Africa chooses to procure new energy generation will have a direct impact on the country’s future energy security and economy, particularly on the estimated 5 million people without access to electricity.

Our investigation assesses the plans for Inga 3 on a series of bases:

1. Financial assessment: We want to know whether the energy that Inga produces will be competitive for South Africa. To establish this, we develop realistic projections of the timelines and challenges involved. We have also considered which of these expenses will be borne by the South African government and/or public.

2. Social impact evaluation: We want to know what kind of social impact the Inga 3 project will have in South Africa. Here we pay particular attention to impacts on poor and vulnerable women.


3. Environmental impact evaluation: We want to establish what negative impacts the project will have on the local environment for South Africans. Since climate change is such a significant threat for South Africa, we also consider the extent to which Inga 3 might contribute to climate change.

Much of the analysis of Inga 3 to date has focused on the DRC and on impacts around the dam site (see Background section below). While we recognise these issues, the primary focus of this study is South Africa, which is currently the principal offtaker of the planned energy.

This report uses a range of analytical techniques (see Methodology section below) to produce important estimates, such as the ultimate cost of electricity produced by Inga 3 and how many people will be negatively impacted. We find that hundreds of thousands of people within and outside South Africa will be left worse off if Inga 3 goes ahead. They will be exposed to forced displacement, curtailed livelihoods, conflict and human rights abuses.

We find that hundreds of thousands of people within and outside South Africa will be left worse off if Inga 3 goes ahead.
Energy sources such as solar and wind are not necessarily without challenges - including their high reliance on fossil fuels, with considerable climate change impacts and alarmingly poor air quality, is further accompanied by extremely high levels of unemployment, borne disproportionately by women, and one of the worst rates of income inequality in the world.

In 2013, South Africa agreed to purchase 2,500 MW from Inga being phase 3 dam and to finance the costs of transmission from the DRC. However, the exact design and capacity of Inga 3 is highly uncertain, in part due to an overall lack of transparency around the project.11

Alternative plans can deliver energy more rapidly, at a lower cost and with significant social benefits.

Clearly, energy is urgently needed in South Africa so this paper also looks at the question of how it could be delivered. We consider the expense, social and environmental impact of alternatives like solar and wind, so that these impacts can be compared with Inga 3 while providing interesting opportunities for sustainable development.

Inga 3 has little to no chance of attracting investments. In several studies, Inga 3 is often criticised as a ‘pipe dream’. Alternative plans can deliver energy more rapidly, at a lower cost and with significant social benefits.

Should construction delays continue into 2023, which seems very likely at this point, South Africa and the DRC will need to review their agreement.7 This would create a window of opportunity for South Africa to adjust its energy plans. We want to ensure that decision-makers and the wider public have the full set of facts in front of them as they move towards this important juncture. We hope this paper will be helpful in this informative process.

**Background**

South Africa is facing an energy crisis. Rolling blackouts are coupled with an increasing debt burden held by the national utility, Eskom, that has only been worsened by new, albeit delayed and costly, large coal-fired power stations. Such reliance on fossil fuels, with considerable climate change impacts and alarmingly poor air quality, is further accompanied by extremely high levels of unemployment, borne disproportionately by women, and one of the worst rates of income inequality in the world.

In 2013, South Africa agreed to purchase 2,500 MW from Inga being phase 3 dam and to finance the costs of transmission from the DRC. However, the exact design and capacity of Inga 3 is highly uncertain, in part due to an overall lack of transparency around the project.11

Alternative plans can deliver energy more rapidly, at a lower cost and with significant social benefits.

Energy sources such as solar and wind are not necessarily without challenges - including their high spatial needs - but they can avoid major negative impacts associated with importing power from Inga 3 while providing interesting opportunities for sustainable development.

Inga 3 has little to no chance of attracting private finance and will therefore likely be funded exclusively through public finance. This means that the public sector will also carry the burden of debt (or a significant portion of it) and should Eskom default, the National Treasury, which guarantees some R330bn of Eskom’s R488bn debt, will be held liable. This is concerning given South Africa’s existing sovereign debt, which has been held liable. This is concerning given South Africa’s existing sovereign debt, which has been held liable.5

This paper evaluates the case for using public funds on Inga 3, recognising that this capital might be put to better use elsewhere, e.g. in the development of national renewable energy.

Inga 3 has also already faced multiple development challenges, including the withdrawal of support from the World Bank and key developers, as well as an overall eight-year delay. Indeed, large hydropower projects repeatedly face such delays that are frequently associated with significant environmental and social impacts, together with large cost overruns. It is therefore unsurprising that Inga 3 is often criticised as a ‘pipe dream’.

To date, previous research and analysis of Inga 3 has addressed its potential impacts on the DRC, the environment12, and on local communities.12 Other analyses have looked at the economic costs,14 alternatives15 and political dynamics16 of Inga 3; however, these have been primarily focused on the DRC.

There are currently no comprehensive analyses into the socio-economic impacts of Inga 3 for South Africa, nor has a feasibility study of importing power from Inga been carried out. This report therefore aims to address this gap by providing a combined quantitative and qualitative analysis into the socio-economic costs of Inga 3, and the associated transmission line from the DRC, for South Africa.

---

kom/southafricas-488-billion-debt-and-who-they-owe-20201212
nance/90475/what-the-latest-rating-downgrades-mean-for-the-average-south-african/
inga-3/8
8. Business Insider South Africa “Electricity is now 177% more expensive than 10 years ago - but water is up far more than that” (19th October 2020): 
https://www.businessinsider.co.za/electricity-is-now-177-more-expensive-than-10-years-ago-but-water-is-up-far-more-than-that-
9th-October-2020
9. World Bank: “We are the victims of pollution and victims of energy poverty. Coal affected women in Folsa, Quesp speak out” (October 2020): https://wommn. 
change/Documents/energy-efficiency_in_the_global_and_South_African context.pdf
11. Designs for Inga 3 range from 4,800MW to 11,000MW. President Tshisekedi intends to start with an initial 4,800MW phase and increase capacity to 
10,000MW over time. However, these time frames and details are unclear. Nevertheless, South Africa’s 2,500MW offtake is expected from the 4,800MW design. See Engineering News: “DRC revives a 4,800 MW plan for Inga” (16th December 2019): https://www.engineeringnewscou.co 
dice/10.1007/s12685-009-0001-8
c.org/article/10.1088/1748-9326/aabf60
files/attached-files/in_dent_and_in_the_dark.pdf
kom/southafricas-488-billion-debt-and-who-they-owe-20201212
18. Alternative plans can deliver energy more rapidly, at a lower cost and with significant social benefits.
19. Clearly, energy is urgently needed in South Africa so this paper also looks at the question of how it could be delivered. We consider the expense, social and environmental impact of alternatives like solar and wind, so that these impacts can be compared with Inga 3 while providing interesting opportunities for sustainable development.
20. Inga 3 has already faced multiple development challenges, including the withdrawal of support from the World Bank and key developers, as well as an overall eight-year delay. Indeed, large hydropower projects repeatedly face such delays that are frequently associated with significant environmental and social impacts, together with large cost overruns. It is therefore unsurprising that Inga 3 is often criticised as a ‘pipe dream’.

To date, previous research and analysis of Inga 3 has addressed its potential impacts on the DRC, the environment and on local communities. Other analyses have looked at the economic costs, alternatives and political dynamics of Inga 3; however, these have been primarily focused on the DRC.

There are currently no comprehensive analyses into the socio-economic impacts of Inga 3 for South Africa, nor has a feasibility study of importing power from Inga been carried out. This report therefore aims to address this gap by providing a combined quantitative and qualitative analysis into the socio-economic costs of Inga 3, and the associated transmission line from the DRC, for South Africa.

---

Photo courtesy of Wolfin

INGA 3: Too High a Cost - A Study of the Socio-Economic Costs of the Inga 3 Dam for South Africa

International Rivers and WoMin African Alliance
Methodology

Our analysis of Inga 3 was based in part on the Riverscope Analysis Process which combines a rapid geospatial quantitative assessment (Rapid Assessment (RA)) with a qualitative, desk-based review into critical project issues (see Riverscope Risk Model in Appendix I).

For the RA, we compared the geospatial profiles of 92 dams that are known to have significant Environmental, Social and Governance (ESG) problems with 190 dams that have not experienced reported problems.17 By comparing these two groups, we identified 17 social and environmental indicators that showed statistically significant correlations with the dams that have experienced problems associated with dispute and conflict (see Appendix III for full Methodology). These indicators relate to a diverse range of ESG conditions and were applied at three levels of analysis, namely the Dam, River and District.18 This analysis was used to identify potential social and environmental risks associated with Inga 3.

To quantify this risk financially, the scores were input into a Discounted Cashflow Model (DCM) to provide an assessment of Inga 3’s Net Present Value (NPV) and the likely Levelised Cost of Electricity (LCOE) that it will deliver. This allowed us to compare the LCOE of Inga 3 to South Africa with the LCOE of solar and wind, based on the best available local data.

Our analysis of the Transmission line routes (see Transmission Line Risk Model in Appendix II) was based on the Landscape19 analysis tool that we developed. Landscape was funded by the UK government and developed over four years with an 18-month intensive testing process involving nine development finance institutions as well as hundreds of private investors and companies. Landscape data is also available as a layer on the Bloomberg Terminal.

Results

Our assessment of Inga 3 suggests that it will be an expensive project with very limited benefits and quite considerable negative impacts. Many of these costs and negative impacts will affect South African citizens, particularly women, while the meagre employment benefits are largely concentrated in the DRC, around the dam site. Our analysis found that:

- Inga 3 is likely to be heavily delayed, which undermines the value of the project and pushes up the cost of the electricity it produces. We estimate that the dam’s ESG factors will lead to a three-year delay, with the most likely start for operation in 2032. Further delays around transmission infrastructure due to both ESG risks and general technical transmission delays are also possible.

- By the time Inga would deliver electricity, we estimate it would cost $0.121/kWh,20 which is more than three times the current cost of international energy purchases in South Africa ($0.036/kWh) and the current cost of energy production ($0.034/kWh).21

- Similarly, by 2032 Inga will cost significantly more than domestic solar and wind energy. South Africa would pay at least $690/m (R10,32bn) more per year for Inga’s electricity than if they bought the same from domestic solar and wind. And this cost, which grows over time, will ultimately lead to either increased tariffs or government subsidies paid by the taxpayer. Even once grid and storage complications are considered, solar and wind are likely to be much cheaper options that also deliver greater energy security.

- The project will have significant negative social impacts, particularly via the way that it will drive displacement and possible conflict. The transmission lines in South Africa would run through areas with high social risks where people are particularly vulnerable to the sort of disruption caused by major infrastructure construction work. Our estimates suggest that between 211,920 and 333,423 people within South Africa could be disturbed or in some cases displaced by this work. This potential conflict could cause additional delays and so further increase costs.

- Inga 3 will create very few jobs in South Africa. In comparison, investments in wind and solar could create approximately 8,096 full time jobs for South Africans. Based on the gender impact numbers we have from the Independent Power Producer Procurement Programme (REIPPPP), this would mean 739 jobs for women. But these technologies can do a lot better on gender impact: on average, The International Renewable Energy Agency (IRENA) finds that 32% of the global workforce for renewable energy is female. In general, renewable energy projects that are developed at site for communities will provide jobs and other benefits for local women. While still not enough, if alternatives in South Africa follow this path, we would be looking at over 2,500 jobs for women. Improvements on South Africa’s renewable energy programmes are needed to deliver real social impact for women.

- Transmission lines also run through some environmentally sensitive parts of South Africa. Our research shows that areas with low environmental risk and high renewable energy potential are abundant, offering a route to better environmental impact in energy planning.

Our report indicates that the Government of South Africa should reconsider its support for Inga 3 and must, at the least, conduct a full and transparent feasibility assessment. We are quite confident that this assessment would be unfavorable, based on currently available information.

17. Some of the dams in our control group may have experienced problems that have not been reported

18. Dam area of analysis considers 20km radius from the dam wall; River area of analysis considers 100km downstream from the dam wall and 10k on either side of the river; District area of analysis considers the GADM L2 district that the dam is situated in

19. For more details see: https://landscope.info/

20. All US Dollar to Rand conversions in this report use an exchange rate of $1/R14.95 from 11 March 2021. Based on X-Rates at https://www.x-rates.com/table/?from=ZAR&amount=1

3. Financial Assessment

This section looks at the financial costs for Inga 3, investigating these important questions:

1. How much will the electricity produced by Inga 3 cost once likely delays are factored in?
2. How do these costs compare with domestic renewable energy options such as solar and wind?
3. Which costs will be borne by the South African government or public?

The majority of dams are delayed and start operations late, often by years and with severe budget overruns (typically 33% in emerging markets). We have calculated the impact on electricity prices if Inga 3 follows this pattern. This calculation shows that the overall cost of Inga 3 is likely to be high. We show that the Net Present Value (NPV) of the project is severely impacted by delays.

We also show that the Levelised Cost of Electricity (LCOE) produced by Inga 3 is likely to be uncompetitive with solar and wind at the time that Inga 3 eventually starts to operate. This is a result of higher costs for Inga 3 as well as rapidly falling costs for alternatives. This assessment of overall cost and competitiveness is particularly important for two reasons: first, South Africa has not conducted its own feasibility assessment of the project, which means that it cannot be compared with solar and wind under the Integrated Resource Plan (IRP). We provide these data-driven estimates in the absence of official figures, which we would argue are still urgently needed.

Second, there is also a lack of clarity over what the South African government will pay for. The treaty signed between South Africa and the DRC indicates that South Africa is responsible for the construction of transmission lines from the DRC-Zambia border. This would mean that they would pay for thousands of kilometers of the longest transmission line in the world, but not for the dam itself. As such we have focused on the cost of transmission lines, as well as the cost of purchasing the electricity produced. But there is also considerable uncertainty over the cost of transmission lines, with estimates ranging from $3 - 4.3 billion. Recently, an Eskom official suggested "we simply do not have that kind of money." This fits with statements indicating the utility is about $30.3 billion (R463.7 billion in debt), in a context where electricity prices have increased by 177% in the past decade (with further increases expected), where electricity prices can already increase cost up to $0.25/kWh (R3.74/kWh) depending on the time of use, and where “load-shedding”, which is expected to continue for at least the next 5 years, just reached its worst year yet in 2020. In such circumstances, and where the government has yet to produce figures, the financial assessment of Inga 3 is particularly important.

Inga 3: Delays, NPV and LCOE

Hydropower projects are particularly exposed to delays, in part because they have large and irreversible social and environmental impacts that invite opposition, create controversy and stall progress. Inga 3 has been delayed by about eight years and has been in the pipeline for decades. Although the project was meant to start operation in 2020/2021, this was then delayed to 2024/2025. While recent reports suggest construction could start at the end of 2021, the project’s status, including financing, is all highly uncertain which means in actuality it could be on hold indefinitely.

According to our assessment, the most likely start date of operation, if it is not cancelled, would be 2032. Typically, these long delays go hand-in-hand with budget overruns. The average large dam experiences budget overruns of 33%. But, in some cases, delays can reach into decades and budget overruns into the hundreds of percent. The graph below shows how delays and CAPEX increases could impact Inga 3’s NPV.

---

23. The Integrated Resource Plan (IRP) is South Africa’s electricity infrastructure development plan until 2030. It is based on the least-cost electricity supply and demand balance, taking into account security of supply and the environment. The IRP plans for 28,730MW of renewable energy (~37% of total installed energy capacity) by 2030, from a 2018 baseline of 3,754MW. This ~37% includes solar, wind and Concentrated Solar Power (CSP) but excludes storage.
28. Business Insider South Africa “Electricity is now 177% more expensive than 10 years ago - but water is up far more than that” (19th October 2020): https://www.businessinsider.co.za/water-prices-have-increased-massively-in-south-africa-over-the-last-decade-the-reserve-bank-says-2020-10
30. Hydropower projects can be delayed by numerous factors, including technical issues related to engineering and commercial problems, as well as non-technical issues related to environmental, social and governance factors. This latter category can include resettlement issues, cultural and environmental concerns, corruption, and a general lack of social license to operate due to the aforementioned issues and others.
31. Engineering News “Construction on Inga 3 hydropower project could start by year end, ambassador says” (17th February 2021): https://www.engineeringnewses.co.za/article/construction-on-inga-3-hydro-power-project-could-start-by-year-end-ambassador-says-2021-02-17
33. Engineering News “Construction on Inga 3 hydropower project could start by year end, ambassador says” (17th February 2021): https://www.engineeringnewses.co.za/article/construction-on-inga-3-hydro-power-project-202425/
35. Engineering News “Construction on Inga 3 hydropower project could start by year end, ambassador says” (17th February 2021): https://www.engineeringnewses.co.za/article/construction-on-inga-3-hydro-power-project-202425/
36. This looked at the 4,800MW Inga 3 scenario with all transmission lines at a total CAPEX of $14bn
37. Typical large dam experiences budget overruns of 33%. But, in some cases, delays can reach into decades and budget overruns into the hundreds of percent. The graph below shows how delays and CAPEX increases could impact Inga 3’s NPV.
According to our model, the most likely outcome would see Inga 3 with an NPV of negative 54% (picked out in the graph above). Backers normally walk away from projects before projections reach this stage, but the figures show that delays could have a catastrophic impact on the financial case for Inga 3. In this context, it is worth noting that hydropower is also highly exposed to COVID-related delays, which may inject further uncertainty.

Delays to the dam or transmission line will, effectively, increase the price of electricity being delivered by Inga 3. This is evident on the graph below, which shows delays with different cost increases (0%, 33% and 50%). If Inga 3 were to start operating, as planned, in 2023 with a CAPEX overrun of 33%, its electricity might cost $0.11/kWh. But if operation is delayed until 2032, it could cost more than $0.121/kWh.

South Africa urgently needs energy, so it is important to locate Inga 3’s LCOE in a comparative context. This sub-section indicates that Inga 3 is more expensive than solar and wind, which can likely be rolled out more cheaply, as well as more quickly. Given Eskom’s indebtedness, the competitiveness of solar and wind provides strong rationale to reconsider commitment to Inga 3.

For this comparison with solar or wind to be meaningful, we need to compare actual values for Inga 3 dam with representative local values for alternatives. We have employed the IPP LCOE figures reported by the Department of Energy that use actual prices based on local conditions. Due to many uncertainties, particularly for Inga 3, we have had to rely on the best available information, as outlined in the table below.

### Table: Inga 3 vs alternatives: Price competitiveness

<table>
<thead>
<tr>
<th>Assumption Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Capital Expenditure</td>
<td>$14bn</td>
</tr>
<tr>
<td>Discount Rate</td>
<td>6.4%</td>
</tr>
<tr>
<td>Loan Duration</td>
<td>18 years</td>
</tr>
<tr>
<td>PPA cost per kWh</td>
<td>$0.07/kWh</td>
</tr>
<tr>
<td>Inflation</td>
<td>4.3%</td>
</tr>
<tr>
<td>Solar LCOE 2020</td>
<td>$0.085/kWh</td>
</tr>
<tr>
<td>Solar LCOE price decrease per year</td>
<td>2.28%</td>
</tr>
<tr>
<td>Wind LCOE 2020</td>
<td>$0.071/kWh</td>
</tr>
<tr>
<td>Wind LCOE price decrease per year</td>
<td>3.8%</td>
</tr>
</tbody>
</table>

46. INGA 3 has not secured a PPA, so this is indicative, as in: The World Bank “International Development Association project appraisal document on a proposed grant in the amount of SDR 47.7 million (US$ 73.1 million equivalent) to the Democratic Republic of Congo for an Inga 3 basse chute and mid-size hydropower development technical assistance project” (2014): http://documents1.worldbank.org/curated/en/817971468438637631/pdf/774200REPLACEM0140Box382121B00OUO90.pdf


Financial cost for South Africa

South Africa is supposed to be the primary off-taker of the Inga 3 dam, agreeing to 2,500 MW of the 4,800 MW currently planned. But with no Power Purchase Agreement (PPA) signed, the agreement between SA and the DRC may lapse in 2023 should the project continue to experience construction delays. Since these delays seem likely, we want to consider what deal would be on the table for the South African government.

So far, this section has used total figures for Inga 3 because liabilities are very unclear. But it is not plausible to expect South Africa to foot the entire bill. Instead, we deduce that South Africa will pay for the transmission line from the DRC-Zambia border to South Africa, as indicated in the treaty between South Africa and the Democratic Republic of the Congo, but not for the dam or other transmission infrastructure within DRC. As noted, these transmission lines could be the longest in the world with cost estimates ranging from $3 - 4.3 billion. Our calculations suggest a figure between at least $1.4bn - $2.7bn, while the World Bank estimated $2bn alone from the DRC-Zambia border to South Africa. However, these figures are shrouded in uncertainty, and our estimates are highly conservative.

Important, based on these estimates, South Africa could alternatively invest this same $2bn to build approximately 920 MW of solar or wind entirely, which could then be operated and distributed very cheaply.

But, like the dam itself, transmission lines may be exposed to significant delays and cost increases. Moreover, South Africa’s existing transmission infrastructure may be shrouded in uncertainty, and our estimates are highly conservative. The International Energy Agency has shown that the DRC loses 20% of its electricity through transmission. In South Africa total losses are 12%.

56 Our calculations were based on the World Bank’s estimated $2bn cost of transmission from the DRC border to South Africa, as indicated in the treaty between South Africa and the Democratic Republic of the Congo, but not for the dam or other transmission infrastructure within DRC. As noted, these transmission lines could be the longest in the world with cost estimates ranging from $3 - 4.3 billion.
57 However, these figures are shrouded in uncertainty, and our estimates are highly conservative. The International Energy Agency has shown that the DRC loses 20% of its electricity through transmission. In South Africa total losses are 12%.
Together such transmission losses would be between 10%64-20%66 of Inga 3’s generation. That’s as much as 500 MW. Given these uncertainties around transmission costs and losses, we carried out an analysis to understand how these uncertainties affect the cost of electricity delivered to South African consumers. Here we analysed the cost of Inga 3 and transmission lines separately, accounting for varied transmission costs and potential transmission losses.

Based on our assessment, we found that the actual LCOE for the dam and potential transmission line costs could be between $0.11/kWh65 – $0.122/kWh66. This LCOE for the dam and transmission line is significantly higher than for solar and wind, which at the likely point of operation in 2032 will be $0.064 for solar and $0.045 for wind. Importantly, the cost is also higher than the average cost of electricity in South Africa for generating coal, at $0.084/kWh.67

To put this opportunity cost into perspective, we compared a conservative LCOE for Inga68, with the average LCOE of solar and wind from 2032 onwards. The results below show that South Africa would pay at least $690m (R10,32bn) more per year for Inga’s electricity than if they bought the same from domestic solar and wind. And this cost, which grows over time, will ultimately lead to either increased tariffs or government subsidies paid by the taxpayer.

A further key consideration in this picture are the uncertainties around the costs of capital used for Inga 3, which have a significant impact on a comparison with solar and wind and also on the level of debt accrued to Eskom. Using the total cost of Inga 3 ($14bn) and a varied cost of capital, Inga 3 could produce electricity costing between $0.092 - $0.153/kWh69 by 2032, which is 54% - 155% more expensive than solar and 134% - 286% more expensive than wind per kWh.

This opportunity cost will be borne by Eskom and so contribute to its already significant debt burden.

<table>
<thead>
<tr>
<th>Year</th>
<th>LCOE difference between Inga &amp; solar + wind ($/kWh)</th>
<th>Additional cost per year (million $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2032</td>
<td>0.045</td>
<td>690</td>
</tr>
<tr>
<td>2033</td>
<td>0.047</td>
<td>727</td>
</tr>
<tr>
<td>2034</td>
<td>0.050</td>
<td>763</td>
</tr>
<tr>
<td>2035</td>
<td>0.052</td>
<td>798</td>
</tr>
<tr>
<td>2036</td>
<td>0.054</td>
<td>833</td>
</tr>
<tr>
<td>2037</td>
<td>0.057</td>
<td>867</td>
</tr>
<tr>
<td>2038</td>
<td>0.059</td>
<td>901</td>
</tr>
<tr>
<td>2039</td>
<td>0.061</td>
<td>933</td>
</tr>
<tr>
<td>2040</td>
<td>0.063</td>
<td>965</td>
</tr>
<tr>
<td>2041</td>
<td>0.065</td>
<td>997</td>
</tr>
<tr>
<td>2042</td>
<td>0.067</td>
<td>1,028</td>
</tr>
<tr>
<td>2043</td>
<td>0.069</td>
<td>1,058</td>
</tr>
<tr>
<td>2044</td>
<td>0.071</td>
<td>1,088</td>
</tr>
<tr>
<td>2045</td>
<td>0.073</td>
<td>1,117</td>
</tr>
</tbody>
</table>

Finally, IRPs over the past 10-20 years have consistently overestimated future energy demand.70 COVID-19 has also worsened this situation and arguably set South Africa’s demand back by several years. This creates a situation in which the electricity from a long-delayed Inga 3 may not be needed by the market at all. South Africa could instead consider a more incremental approach to energy development with shorter lead times and higher involvement from private sources of capital. This would significantly reduce liability for South Africa relative to known plans for Inga 3.

**Financial Assessment Summary**

A financial assessment of Inga 3 shows that the project makes little commercial sense and is likely to expose backers to significant losses. Our analysis shows that Inga 3 will likely be delayed by three years, if it is not cancelled altogether. In all plausible scenarios the dam has significant negative NPV, which should deter private investors. Offtakers and regulators should be aware that the electricity produced by Inga 3 is very likely to be more expensive than alternatives.

For South Africa, our assessment shows that Inga 3’s cost per kilowatt will be detrimental to Eskom, the economy, and ultimately South African consumers. Footing the bill of the transmission line from the DRC-Zambian border to South Africa will cost the country billions of rands, even excluding delays, which according to our environmental and social evaluation, are very likely. This at a time when South Africa already faces a debt crisis coupled with economic downturn from the COVID-19 pandemic.

Our assessment finds that the cost of electricity from Inga 3, including the potential cost of the transmission lines, is likely to be between $0.11/kWh - $0.122/kWh. This is more than three times higher than the current average weighted cost of energy production in South Africa and would therefore lead to likely increases in the cost of electricity sold to South Africans. Average South African households already spend between R450 - R600 (C$30 - $40) per month and often women-led, households particularly struggle to keep up with annual electricity increases.71

By contrast, alternatives like solar and wind are more commercially competitive. Our assessment shows that these technologies can respectively provide electricity priced 89% and 175% lower than Inga 3, by our expected operation date of 2032, which could ultimately affect the cost of electricity for South Africans. Even a conservative assessment of Inga shows that it will cost South Africa at least R690m (R10,32bn) more on an annual basis than the equivalent for solar and wind. Moreover, these alternatives are modular, allowing for smaller and lower risk investments that can yield higher returns over shorter periods. These are crucial comparisons for South Africa given that the exorbitant cost of electricity already limits energy access, which is key to addressing some of the country’s most pressing socio-economic challenges.

64. Werink, A. “Congo pushes for a mega-dam project, with no environmental impact studies” (3rd July 2016): https://www.pri.org/stories/2016-07-03/congo-pushes-mega-dam-project
65. Assuming a transmission cost of $2bn and a 3 year delay, with a discount rate of 10% and a transmission loss of 10%
66. Assuming a transmission cost of $4.3bn and a 3 year delay, with a discount rate of 10% and a transmission loss of 10%
68. Using the $14 total cost of Inga with a 0% CAPEX increase and excluding transmission line losses
69. These are based on a total CAPEX of $1.4bn, with a 3 year delay and 33% CAPEX increase (average), with costs of capital at 3% and 9%, respectively, using real rates from: RSA Retail Savings Bond (2021): https://secure.vanellusbond.co.za/ViewInterest.aspx & World Government Bond & South Africa Government Bonds - "Yields Curve" (2021): http://www.worldgovernmentbonds.com/country/south-africa
4. Social Impact Evaluation

Cheap and sustainable energy can deliver huge social benefits. In fact, it is often a precondition for rapid and equitable socio-economic development. But energy assets can also do serious social harm, particularly at a local level during their construction. Hydropower projects are associated with problems like forced displacement; deprivation of food and water; and conflict, to name a few. Many of these negative impacts are carried disproportionately by vulnerable groups and women.

This section looks at the social costs and benefits that might be associated with the Inga 3 dam to help determine whether the project is in the interests of the South African public. We first look at the negative impacts of the dam and compare them to those associated with solar and wind technologies. Our quantitative assessment analyses the risk that Inga 3 may drive displacement, social conflict and human rights issues, in the DRC and especially in South Africa. This is supported by qualitative evaluations of negative social impacts and their distribution by gender.

We then pivot to compare the positive social impacts that may be associated with Inga 3 or with alternatives. Any such investment will create jobs and economic opportunities at some considerable scale. However, we want to investigate whether Inga 3 provides a good return on public investment, considering factors like the number and quality of jobs directly and indirectly created. Again, we pay particular attention to how these benefits are distributed, paying close attention to gendered impacts.

In summary, we have found that Inga 3 will have large negative impacts and has the potential to drive conflict at scale. Entrenched opposition to the plan will likely contribute to further delays for a project that has been on the slate for decades. In terms of positive impacts, plans for Inga 3 are inefficient in terms of job creation and income improvement. This is especially so for South Africa, which will see very limited employment benefits. The project may erode public trust in energy planning in the process. The socio-economic case for Inga 3 therefore appears to have significant problems.

Negative impacts: conflict and displacement

Our investigation of negative impacts is split into an evaluation of the area around the dam, an assessment of the transmission lines and a relatively brief consideration of end use (a topic picked up again in the positive impact section). We pay particular attention to the impacts of the transmission lines since these will be the most directly relevant to South Africa.

Impacts around the dam

The table below presents the results of a quantitative assessment process of the area around the planned Inga 3 dam, based on previous analysis of 282 dams to identify social indicators that correlate with risk of dispute and conflict. This process is further described in the Methodology in Appendix III. Any score over 45 indicates that risk of dispute and conflict is above average, while any score above 60 indicates a very high risk of such (as reflected in our basic color coding).

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Score Description of Indicator Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>% poor and deprived: Improved Sanitation</td>
<td>Dam 61, River 56, District 59</td>
</tr>
<tr>
<td>% poor and deprived: Drinking Water</td>
<td>93</td>
</tr>
<tr>
<td>% poor and deprived: Schooling</td>
<td>78</td>
</tr>
<tr>
<td>Multidimensional Poverty Index</td>
<td>91</td>
</tr>
<tr>
<td>Population vulnerable to poverty</td>
<td>76</td>
</tr>
<tr>
<td>Population density</td>
<td>75</td>
</tr>
<tr>
<td>Night Lights</td>
<td>63</td>
</tr>
<tr>
<td>Conflict</td>
<td>10</td>
</tr>
</tbody>
</table>

These high scores suggest that Inga 3 will have large negative impacts on surrounding vulnerable populations and they also indicate that these impacts could be connected to dispute and conflict. Inga 3 is planned in a remote area inhabited by people with little experience of large-scale economic development. What experience there is has been largely negative, with displaced communities from the Inga 1 and 2 dams still without compensation and basic services decades after construction was completed.72

---

The most serious social problems for the area around the dam are connected to the likely relocation of at least 10,000 people living in and around the Bundi Valley. Our investigation suggests 75,786 people could be economically affected in the area of analysis around the dam and up to 144,945 people downstream. This is likely to include local populations like the Basangela people, who inhabit the Bundi Valley that would be flooded, as well as communities displaced decades ago by Inga 1 and Inga 2. Similarly, women and young people are likely to be disproportionately affected.

Free, prior and informed consent should at least be obtained from relocated communities and planning should be done jointly with affected parties. However, internationally there are numerous case studies that show scant or no regard for information dissemination and consultation prior to the implementation of mega projects like Inga 3, let alone the acknowledgement of women and their right to dissent over the loss of land. Partly as a result, these transmission corridors will be exposed to sabotage, public opposition and related land acquisition issues, amongst other challenges. These risks may delay transmission line development and so energy delivery, while also increasing the financial cost for South Africa.

**External transmission assessment**

Much of the route between the DRC and South Africa has not been officially identified - some reports suggest they will not be seriously considered until construction starts - so we developed five potential routes using the existing and planned transmission lines as guidance. Later, we consider three routes within South Africa. These routes are plotted out in the map below, along with an assessment of the risk of conflict or dispute in the areas the lines may pass through.

The graphic below shows the overall risk scores as calculated by our Rapid Assessment which was based on Landscape’s social risk analysis processes (see Transmission Line Risk Model in Appendix II for details) and the table overleaf provides average scores.

These routes vary in terms of social and overall impact and risk but the map shows that all five routes have sections with very high risk scores, which means that they are likely to drive and/or become exposed to social conflict and dispute. While we reviewed a direct route (Route 5) as reflected above, we recognise that this would be a highly unlikely case given that transmission lines often need to navigate through tough terrain.

**Impacts around transmission lines**

The transmission lines for Inga 3 have their own set of social and political challenges, both within South Africa and in the countries that they pass through. A key driver of these negative impacts is displacement and curtailed access to resources for local people. Partly as a result, these transmission corridors will be exposed to sabotage, public opposition and related land acquisition issues, amongst other impacts. Many of the transmission areas in question are quite remote and those along its route will be disproportionately impacted by displacement and construction work. Those that are highly reliant on traditional livelihoods struggle the most when those livelihoods are disrupted by reduced access to customary land and natural resources. These impacts will fall disproportionately on women, young people and vulnerable groups, who are less able to protect their rights and have less opportunity to get back on their feet. Most African women are still denied education and employment, and have limited opportunities in trade, industry and government positions. Furthermore, primary development policies focusing on poverty reduction in many Southern African countries still do not account for income and power disparities between men and women and therefore hamper the efforts of programs to reduce such inequalities.

<table>
<thead>
<tr>
<th>Route</th>
<th>Social Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 1</td>
<td>76</td>
</tr>
<tr>
<td>Route 2</td>
<td>78</td>
</tr>
<tr>
<td>Route 3</td>
<td>62</td>
</tr>
<tr>
<td>Route 4</td>
<td>56</td>
</tr>
<tr>
<td>Route 5</td>
<td>59</td>
</tr>
</tbody>
</table>

Many of the transmission areas in question are quite remote and those along its route will be disproportionately impacted by displacement and construction work. Those that are highly reliant on traditional livelihoods struggle the most when those livelihoods are disrupted by reduced access.
Internal transmission assessment

Our main concern in this sub-section is the impact of Inga 3’s planned transmission lines within South Africa. The map below presents three likely routes based on the most likely point of entry for transmission lines to South Africa. Again, we used planned and existing transmission lines to guide our analysis here, assuming that new transmission lines would likely follow these same routes. The highest demand routes are those that transport electricity to Gauteng, Kwa-Zulu Natal (KZN), and Mpumalanga, according to StatsSA.\(^85\)

These scores are above average, suggesting the construction of transmission lines in these areas will have negative social impacts that will lead to opposition, delay and possible conflict. Our analysis suggests that between 211,920 - 333,423 people could face disturbances from the construction of new lines, depending on the route selected.\(^88\)

South Africa’s recent history of land disputes and engrained unemployment will likely make local people resentful of and vulnerable to any displacement or curtailed opportunities associated with transmission line construction.

The negative social impacts of internal transmission development will likely fall disproportionately on South African women. The land used for the construction of transmission lines is more likely to be worked by women both in and outside of South Africa. In addition, South African women are often subsistence farmers who support families and local markets and who are vulnerable to any disruptions to their already challenging conditions (e.g. through biodiversity loss and climate change). Because the land that women live on is usually owned by their male spouses or male traditional leaders, when these men sell the land women are left displaced and penniless. This places women in an even more vulnerable position.

Similarly, areas of acute poverty, like the Limpopo region, will bear the brunt of negative impacts within South Africa (see map below). These areas have experienced major changes in recent decades, including through mining and large private agriculture, which have led to the displacement of many local communities\(^89\) and disrupted already vulnerable livelihoods.

---


\(^{86}\) See Transmission Line Risk Model in Appendix II for full Indicator List and scores for SA transmission lines

\(^{87}\) These scores indicate the social risk exposure of the routes to social conflict and dispute. Scores over 45 indicate that risk of dispute and conflict is above average, while any score above 60 indicates a very high risk.

\(^{88}\) These figures are based on the GPWv4 with a 3km buffer on either side the three internal transmission lines

More specifically, mining has left a legacy of forced removals where an estimated 1.6 million South Africans live on or near mine dumps, with severely polluted water, air and soils, as a loss of agricultural livelihoods and limited access to ancestral lands. The pollution also tends to impact women and children disproportionately. Moreover, many people were neither compensated nor provided jobs, as promised. Women and their households rarely escape poverty after such forced removals. This legacy both heightens the vulnerability of these areas to such development practices, while also raising the risk of local opposition.

**Impacts around end use**

Energy from Inga 3 would be sent to the mining sector in Katanga or exported to South Africa, with just over 20% allocated to residents in Kinshasa and surrounds. This sub-section briefly considers the negative impacts of this allocation in the DRC and in South Africa before considering positive impacts relative to alternatives in the next sub-section.

Within the DRC, energy from Inga 3 is going to the places that already enjoy relatively high levels of electrification. Overall, 19% of people in the DRC have access to electricity, but in Kinshasa the rate is as high as 80%. So although the 20% allocation from Inga 3 may have positive social impacts for Kinshasa residents and some surrounding areas, it will likely have limited to no impact on the majority of the DRC population in need. This is especially concerning given that low energy access has been linked to using wood and charcoal for energy, which is driving deforestation and local biodiversity loss. Because of patriarchal norms, women are also the ones who have to go out in search of, collect and bring back fuel sources and water, which can then be used by them for cooking. When resources are captured by dams and other projects, women have to travel further distances putting themselves at risk of sexualised violence and other kinds of abuse.

Within South Africa, Inga 3 may improve the country’s overall energy capacity but is unlikely to improve energy access for average South Africans, of which an estimated five million people are without electricity. It is unclear where the bulk of the energy from Inga 3 will go. However, it is in a model based on large scale generation assets and on distribution via Eskom, Inga 3 could serve to further embed structural problems in the South African economy, that deliver significant negative impacts to large parts of the population, particularly the poor and vulnerable.

As we go on to see in the next section, alternatives could offer considerably more support for local entrepreneurship and bottom up development. Solutions such as solar geysers and rooftop solar systems offer alternative options that could directly improve energy access and end use options for South Africans in both rural and urban areas.

**Solutions such as solar geysers and rooftop solar systems offer alternative options that could directly improve energy access and end use options for South Africans in both rural and urban areas.**

**Positive impacts: Inga vs. Alternatives**

Our assessment into the positive social impacts of Inga 3 compares possible benefits of Inga 3 with those offered by alternative energy sources. This comparative assessment focuses on the employment and economic opportunities created for South Africans. Given the high rates of unemployment and inequality in South Africa, we look closely at both the number and quality of jobs created for South Africans.

As noted, Inga 3 is likely to support Eskom’s existing distribution pathways as large chunks of capacity are dropped into the grid and largely allocated to energy-intensive industries. This supports the national economy but does not create jobs or spur economic activity. It also risks leaving underserved regions and locations behind. Solar and wind are much more flexible and can be sited in locations with low social risk (see map below) and high levels of energy poverty. This means the assets can be installed more rapidly at lower risk and with substantially more potential to address social challenges in those locations. As we can see below, these areas are extensive.

---


South Africa's REIPPPP supports community development and job creation through development requirements for bidding. The REIPPPP is far from perfect and has been criticised for lacking community development guidance for developers, as well as an overfocus on socially negative ownership models. However, the REIPPPP's potential for creating jobs and attracting private finance into poor rural communities has been quite well demonstrated to date, with R19 billion already secured for socio-economic development across South Africa.

**Impact on jobs**

Inga 3 will create jobs, but these jobs will mostly be in the DRC and associated positive social impacts will therefore be limited within South Africa. The construction phase of Inga 3 has been estimated to provide an average 3,000 jobs, peaking at 7,000, almost all of which will be within the DRC. Following construction, however, this figure is expected to drop to a few hundred. 104 We have not found any official estimates on potential job creation in South Africa, again reflecting the lack of a feasibility assessment on the South African side. We can assume that any jobs created by the line from Inga 3 to the South African border would be largely unavailable to South Africans, as these lines would be located outside of the country.

Although there will be jobs created by the construction of any new transmission lines within South Africa, or by the upgrading of existing lines, these are unlikely to compensate for the livelihoods lost and disrupted, and especially for women. Transmission construction is often contracted, technical work, suggesting local and affected communities are unlikely to reap these employment benefits.

Potential construction and maintenance jobs will be largely unavailable to women, who are also unlikely to command many of the skilled or senior positions on site. This is partly because not many women have the skills required and because women are endangered by camps of male workers required for construction, particularly in remote areas, and especially given the levels of gender-based violence South Africa experiences. 105 Women may often find themselves limited to activities such as providing accommodation, food and services to construction and maintenance workers, which would be short-term income streams. 106 Solar and wind energy projects, by comparison, may each be capable of creating large numbers of high-quality jobs for South Africans. These jobs do not have high barriers to entry but can transfer skills to the sector that is likely to continue to grow over the coming decades. In fact, a COBENEFITS study found that South Africa could create just 1.2 million job years across the renewable energy supply chain by adopting the CSIR’s proposed least-cost energy mix, which significantly increases the share of renewables. 107

In terms of direct job creation, the REIPPPP has led to the creation of at least 5,217 full time jobs by Q2 2020/21. 108 That is 8.8 construction jobs per MW installed, relative to 0.6 - 1.4 construction jobs per MW estimated for Inga 3 109 This means that South Africa could create 8,096 full time jobs 110 for South Africans should it rather invest in alternatives. However, the REIPPPP is by no means a perfect solution.

By 2017 there had been 3,892 job opportunities created for women 111 under the REIPPPP which equated to just 9% of total employment opportunities in the renewables sector, with 33% of top management positions filled by women during the construction phase of renewable projects and 31% of operational phase positions filled by women. 112 Based on this premise, the REIPPPP could create just 729 full time job opportunities for women, 12 which reflects significant room for improvement.

The value of supplies procured from women owned companies by 2017 was R1.1 billion. 113 This reflects progress for women in a nascent sector and there are considerable opportunities for increasing the number and options for women in coming years. Already at least one of the renewable energy companies that manufactures wind turbines in the Western Cape is majority women owned. 114

---

104. Of these jobs 44 290 (80%) were created during construction and 10 927 (20%) in the operational phase of projects, as in: IPP Office “Independent Power Producer Procurement Programme (IPPP) An overview” (30th September 2020): https://www.ipp-projects.co.za/Publications/GetPublicationFile?did=24741&file=ippb01-s1-19-241-d0679acia&fileformat=20200917-192908%2020%20v3%20cobben Curve-201.pdf
107. We have only included a comparison of construction jobs because official estimates for Inga 3 operational jobs are unavailable.
108. That is 8,096 job years from an investment into 620MW of solar or wind, rather than an equivalent investment into Inga 3.
109. As of 2020, black South Africans have averaged 66% of top management positions, while during construction phases, black South Africans, youths and rural / local communities have made up 81%, 44% and 49% of total job opportunities, respectively: IPP Office “Independent Power Producer Procurement Programme (IPPP) An overview” (30th June 2020): https://www.ipp-projects.co.za/Publications/GetPublicationFile?did=49895&file=e05d61-19-241-2d679acic&fileformat=20200619-194548%2020%20v3%20cobben Curve-201.pdf
109. Employment figures differ slightly between sources which may be attributed to different metrics used, however women seem to make up between 5% - 10% of total employment opportunities in the renewable energy sector.
111. As of 2020, black South Africans have averaged 66% of top management positions, while during construction phases, black South Africans, youths and rural / local communities have made up 81%, 44% and 49% of total job opportunities, respectively: IPP Office “Independent Power Producer Procurement Programme (IPPP) An overview” (30th June 2020): https://www.ipp-projects.co.za/Publications/GetPublicationFile?did=49895&file=e05d61-19-241-2d679acic&fileformat=20200619-194548%2020%20v3%20cobben Curve-201.pdf
112. As of 2020, black South Africans have averaged 66% of top management positions, while during construction phases, black South Africans, youths and rural / local communities have made up 81%, 44% and 49% of total job opportunities, respectively: IPP Office “Independent Power Producer Procurement Programme (IPPP) An overview” (30th June 2020): https://www.ipp-projects.co.za/Publications/GetPublicationFile?did=49895&file=e05d61-19-241-2d679acic&fileformat=20200619-194548%2020%20v3%20cobben Curve-201.pdf
113. As of 2020, black South Africans have averaged 66% of top management positions, while during construction phases, black South Africans, youths and rural / local communities have made up 81%, 44% and 49% of total job opportunities, respectively: IPP Office “Independent Power Producer Procurement Programme (IPPP) An overview” (30th June 2020): https://www.ipp-projects.co.za/Publications/GetPublicationFile?did=49895&file=e05d61-19-241-2d679acic&fileformat=20200619-194548%2020%20v3%20cobben Curve-201.pdf
Women have shown themselves to be adept at running wind farms,115 biogas digestors116 (although these are more challenging because they need water) and a variety of solar home systems117 and solar PV118 installations.

The modulator nature of renewable technologies, meaning they can be deployed at small scale, improves the chances that South Africans will benefit from the renewable energy roll out, both in terms of direct access and indirect economic opportunities. This also opens the door for alternative avenues to the REIPPPP, through which South Africa could promote the roll-out of renewable energy at a local level. These alternatives are important because there are clear limitations with the REIPPPP, especially regarding gender diversity, impact for vulnerable groups and protection of ecosystem services.

Job creation is particularly important in South Africa at the moment due to the exceptionally high unemployment rate (>30%) and in that the second quarter of 2020 alone saw the number of unemployed persons increase by 2.2 million to 14.1 million.119 Women consistently bear the brunt of this unemployment120 in addition to low wages.121 This level of unemployment will fall during recovery but the issue is chronic.122 South Africa’s unemployment situation, with a majority unskilled and semi-skilled labour force,122 further underscores the need for both immediate and sustainable job creation for these groups.

Impact on energy access
In South Africa, the energy poverty challenge demands at least an increase in the number of people connected to the grid, and an assurance that those with access have sufficient energy at an affordable price to meet their energy needs. Both electricity access and affordability issues increase usage of cheaper, hazardous and dirty non-electricity energy sources.123 In terms of improving basic access, renewables are preferable because it is easier to connect small lands and to construct systems like mini-grids with solar and wind than it is to connect people to high voltage, large-scale power lines. The case is even stronger for accessing affordable energy. According to the CSIR, alternatives like solar and wind are now able to provide electricity that is at least 40% cheaper than coal,124 with the potential to address affordability issues faced by many South African women.125 As we have shown in our Financial Assessment of Inga 3, they are also likely to be much cheaper than hydropower. Per rand, investors and consumers get more alternative electricity access and affordability issues increase or from any other source. This is critical because it means that private money will be used in ever greater quantity to support the roll out of alternatives (see Financial Assessment).

This contribution from private capital, particularly where well regulated, could lighten the load on public and concessional finance. These resources could then be devoted to more targeted poverty and energy poverty alleviation processes, such as supporting the development of energy cooperatives, or for improving existing energy infrastructures to address inefficiencies, together creating a more enabling environment for faster and more equitable renewable energy growth.

One such example of targeted public finance includes the Renewable Energy Performance Platform’s (REPP’s) recent request for proposals that specifically targets women-led renewable energy project development.126 With additional support and the introduction of incentives from government, such opportunities will become more frequent and could help address gender inequality in South Africa.

Social Evaluation Summary
Inga 3 is exposed to significant social issues as a result of deferred benefits and increased negative impacts from the construction process. These deferrals and impacts generally produce resentment, leading to organised opposition and, potentially delays. This was found in our evaluation of the project and is reflected by the existing delays. The dam and transmission lines will likely displace up to tens of thousands of vulnerable people, disrupting rural livelihoods and driving these vulnerable groups further into poverty. Women will be particularly negatively affected by such displacement. Furthermore, the power from such large-scale energy generation is unlikely to address rural energy access and local socio-economic needs which are pressing in both South Africa and the DRC.

Inga 3 and its transmission lines will provide little to no jobs for South Africans. The project is expected to provide between 3,000 - 7,000 construction jobs for the DRC, with some jobs expected for South Africans during internal transmission line development or upgrades. This in comparison to a potential 8,089 full time jobs, with 729 created for women, should South Africa similarly invest in solar or wind. These alternatives could also create local economic opportunities for South Africans while addressing the energy gap of approximately five million South Africans without access to electricity.

Our social evaluation therefore shows that South Africa’s procurement of electricity from Inga 3 will not sufficiently address the socio-economic and energy needs of its citizens. From a social perspective, the South African government could reap higher social returns on investment from solar and wind.

---

115 Teyakwa, V “Perdekraal East Wind Farm allows women to flourish in key roles” (7th August 2019): https://social.ts.co.za/perdekraal-east-wind-farm-allows-women-to-flourish-in-key-roles/
122 Over the past 11 years, the average unemployment rate is 26%. The upper (30.8%) and lower (21.5%) unemployment figures are almost 10 percent different where the low occurred in 2009 and the high in 2020. Trading Economics “South Africa Unemployment Rate” (2021): https://tradingeconomics.com/south-africa/unemployment-rate
124 This includes paraffin, candles, wood and charcoal - commonly associated with fires and pollution. These resultant health and safety concerns fall disproportionately onto women, who are often responsible for household cooking.
126 WoMin “We are the victims of pollution and victims of energy poverty: Coal affected women in Prole-Ogies speak out!” (October 2020): https://womin. africa/community-activists-resources/women-activists-confront-energy-inequality/
5. Environmental Evaluation

Our environmental evaluation briefly considers the potential environmental impacts of Inga 3 and its transmission line on the DRC, with potential implications for South Africa. We then take a more in-depth look at the environmental impacts of transmission lines within South Africa, focusing on how these could affect the country. This latter section also ends with a short comparative evaluation of alternative energy technologies for South Africa.

This environmental evaluation shows that Inga 3 and associated transmission lines will have environmental impacts with local, national and even global implications. Large hydropower projects with long transmission infrastructure can directly threaten local biodiversity and natural ecosystems, and can also drive deforestation and induced climate change impacts. High environmental standards for Inga 3 and the transmission lines could help mitigate these risks but they would also increase project costs.

Our environmental evaluation shows that investments in solar and wind energy can deliver greater benefits, with lower environmental risks for South Africa, while avoiding most of the serious negative environmental impacts associated with Inga 3.

Our environmental evaluation shows that investments in solar and wind energy can deliver greater benefits, with lower environmental risks for South Africa, while avoiding most of the serious negative environmental impacts associated with Inga 3. Typically, the environmental damage done by large hydropower is justified by backers in terms of the economic and commercial benefits of these projects. However, in the case of Inga 3 this socio-economic case is very weak. Moreover, the environmental impacts of the dam and its extensive transmission infrastructure appear to be substantially negative and irreversible.

Impacts on the DRC

The construction of Inga 3 will have considerable impacts on biodiversity through the likely alteration of water and sediment flows124 and increased pollution, with such freshwater ecological changes threatening endemic freshwater species in the area and downstream.125 The 4,800 MW option of Inga 3126 would inundate particularly the lower reaches of the biodiverse Bundi Valley tributary, destroying natural vegetation and impacting aquatic species.

Inga 3 and its ancillary infrastructure could also contribute to deforestation in the Lower Congo Rapids ecoregion.127 However, given the relatively limited tree cover in the immediate impact area of the dam, these impacts on deforestation, with associated loss of biodiversity, would likely be primarily associated with transmission infrastructure to the DRC border.

Such extensive and severe environmental impacts give advocacy groups and locals the grounds to oppose and delay the project. This has direct implications for South Africa, as such delays will further increase project costs and ultimately increase the overall cost of electricity sold to South Africa.


129 River sediment will likely increase during construction activities and be trapped behind the dam wall during operation. Sediments play an important role in maintaining natural balances in river ecosystem structure and function.


131 President Tshisekedi has recently opted to start with the 4,800 MW option of Inga 3 and to add further capacity in phases, to a total capacity of 11,000 MW. This environmental evaluation shows that investments in solar and wind energy can deliver greater benefits, with lower environmental risks for South Africa, while avoiding most of the serious negative environmental impacts associated with Inga 3. Typically, the environmental damage done by large hydropower is justified by backers in terms of the economic and commercial benefits of these projects. However, in the case of Inga 3 this socio-economic case is very weak. Moreover, the environmental impacts of the dam and its extensive transmission infrastructure appear to be substantially negative and irreversible.

Impacts on South Africa

While the environmental impacts of Inga 3 will likely be severe for the DRC, the most relevant impacts for South Africa are those associated with transmission lines. One of the more significant environmental concerns of transmission line expansion is the necessary clearing of vegetation or forest cover, leading to habitat and forest fragmentation. At a local level, such deforestation directly threatens biodiversity that is reliant on these natural habitats, but when these impacts are brought to scale, they can also have regional and even global impacts on climate. Transmission corridors can also hinder the movement of certain species with potential long-term impacts on breeding and species diversity. These same changes can further enable the colonisation of new species, with uncertain impacts on ecosystem dynamics.

External transmission assessment

The table below looks at routes from the DRC border to South African and shows their environmental risk score, as calculated by our Rapid Assessment. This assessment was based on Landscape’s environmental risk analysis process (see Transmission Line Risk Model in Appendix II for details).

<table>
<thead>
<tr>
<th>Route</th>
<th>Environmental Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 1</td>
<td>73</td>
</tr>
<tr>
<td>Route 2</td>
<td>75</td>
</tr>
<tr>
<td>Route 3</td>
<td>58</td>
</tr>
<tr>
<td>Route 4</td>
<td>55</td>
</tr>
<tr>
<td>Route 5</td>
<td>63</td>
</tr>
</tbody>
</table>

These high (negative) Environmental scores are likely due to areas of high biodiversity, such as Key Biodiversity Areas (KBAs) and Protected Areas (PAs), and relatively high forest cover (especially within the DRC and Angola) that the routes directly pass through (see External Transmission route map in Social section). These areas may have also seen significant land use change in the last few years or experience water-related risks which can be very destructive environmentally.

**Internal transmission assessment**

South Africa would be directly affected by the environmental risks associated with new transmission lines within the country. We assume that no new lines would be needed, however all lines would need to be upgraded to accommodate the additional load. Nevertheless, the existing transmission lines already have ongoing environmental impacts.

The graphics below show the three likely internal transmission routes, based on the energy demand and load of each province within SA and guided by existing and planned transmission routes. The top left graphic includes all potential routes, while the remaining three show each potential route to either Gauteng, Mpumalanga or KZN. The table that follows then provides the risk scores for these routes.

<table>
<thead>
<tr>
<th>Route</th>
<th>Environmental Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauteng</td>
<td>45</td>
</tr>
<tr>
<td>KZN</td>
<td>45</td>
</tr>
<tr>
<td>Mpumalanga</td>
<td>41</td>
</tr>
</tbody>
</table>

All potential routes pass through areas of particularly high tree cover in the northeastern areas, while the KZN route also passes through areas of high tree cover towards the southeast. Another key factor to note includes the proximity of all the routes to PAs and KBAs, which further raises their environmental risks (see risk scores in table below).

The above scores are relatively low when compared to the route scores from the DRC to South Africa. While they suggest that some environmental risks are evident for South Africa, these risks appear to be lower than their social equivalents.

136. These scores indicate the environmental risk exposure of these routes that could trigger social conflict and dispute. Scores over 45 indicate that risk of dispute and conflict is above average, while any score above 60 indicates a very high risk.
137. Although these scores are relatively low when compared to the route scores from the DRC to South Africa, while they suggest that some environmental risks are evident for South Africa, these risks appear to be lower than their social equivalents.
Alternative comparative assessment
Alternatives like solar and wind provide South Africa with a way to limit environment risks by being both modular and decentralised. This is not to say that solar and wind roll out is “no regrets” from an environmental point of view. Large capacity will still require large amounts of land and some transmission lines will be needed too.

Solar and wind can be connected to problems like deforestation and biodiversity loss. The impacts of wind on bird migration provide one salient example here. But these risks are smaller than those posed by Inga 3’s transmission lines and they can be largely mitigated through appropriate site selection. As shown in the suitability maps below, areas for solar and wind development with both renewable energy resources and relatively low social and environmental risks are abundant.

Moreover, South Africa’s environmental regulations already help to ensure that solar and wind projects have minimal impacts on the environment through both the extensive Renewable Energy Development Zones (REDZ), as well as the strict EIA regulations.

Environmental Evaluation Summary
Our environmental evaluation found that Inga 3 will have negative environmental impacts with local, national and possibly even global implications, raising the risk of project opposition and potential delays. This has direct implications for South Africa as these delays would increase project costs and ultimately the cost of electricity sold to South Africa.

The 2000+ kilometers of transmission line from the DRC to South Africa will add to Inga 3’s environmental impacts and risks. These lines are likely to pass through environmentally sensitive areas which include areas of high forest cover, KBAs and PAs. Our evaluation found that environmental risks were greatest for external transmission routes, yet transmission development both in and outside of South Africa creates a risk of delay, which could increase overall costs to South Africa and delay the delivery of much needed energy to the country.

Alternatives offer a more modular and decentralised approach which would allow South Africa to target specific energy demands at the source, reducing the need for extensive transmission development. South Africa already has robust environmental regulations for these alternative technologies. Although alternatives like solar and wind can still have considerable environmental impacts, they demonstrate widespread potential in South Africa with areas of low overall environmental and social risks for both the South African government and its citizens.


142. The map above shows suitable wind potential areas (dark and light blue areas) where the average wind speed is greater than 6m/s at 50 and 100m. The map on the next page shows suitable solar potential areas (dark and light yellow areas) where the DNI is greater than 1200 kWh/m² per annum. Suitable areas for both maps have a Landscape social risk score that is less than 60 and they indicate where FA areas are less than 15% of the L2 district area. The respective dark areas (dark blue and dark yellow) for each map indicate where KBA areas are between 15% and 30% of the L2 area.


144. The REDZ minimise environmental impacts by ensuring close proximity to the grid and avoiding Key Biodiversity or Protected Areas, amongst other considerations, while each and every project must adhere to the EIA regulations, regardless of location.
6. Conclusion and Recommendations

Inga 3 has faced significant delays to date and will inevitably face further delay due to its considerable social and environmental impacts, in addition to a lack of funding. We estimate that the dam’s ESG factors will lead to a three-year delay, with the most likely start for operation in 2022. Such delays undermine the project’s viability and push up the cost of electricity it produces, which could fall onto the shoulders of ordinary South Africans, if it is not cancelled altogether.

So although the construction of Inga 3 will have fewer direct impacts on South Africa, its delays as a result of ESG factors could increase the costs of electricity sold to the country. The cost of electricity from Inga 3, when accounting for potential transmission line costs and losses could be between $0.11/kWh\(^{145}\) – $0.122/kWh\(^{146}\) by the time it starts operation. This is more than three times higher than the current average weighted cost of energy production in South Africa and would therefore lead to likely increases in the cost of electricity.

Inga 3 would require the development of the longest transmission line in the world from the DRC to South Africa. The footprint of these lines will cross farmlands, areas of high tree cover, KBAs and PAs, which will have considerable social and environmental impacts both within and outside of South Africa. Our estimates suggest that 211,920 - 333,423 people within South Africa could be disturbed or in some cases displaced by this work, which could spark conflict, additional delays and increases to overall project costs. Likely transmission delays would also prolong the delivery of energy to South Africa at a time of rolling blackouts and when an estimated five million South Africans live without access to electricity.

Inga 3 will create very few jobs in South Africa. In comparison, alternatives could create approximately 8,096 full time jobs for South Africans, including 729 for women, with similar investment into solar or wind.\(^{147}\) Alternatives are also better suited to increasing energy access for individuals, households and SMEs.

South Africa has abundant solar and wind potential in areas with low social and environmental risks. These technologies offer a clear alternative case for energy generation in South Africa. Their modular and decentralised nature means that South Africa could rapidly meet energy demand, while creating local employment opportunities, including for women, and with lower costs of electricity. By the time Inga 3 comes online, solar and wind could respectively produce electricity at just $0.064/kWh (R0.96/kWh) and $0.044/kWh (R0.66/kWh), which is 89% and 175% lower than the cost of electricity from Inga 3. Even a conservative assessment of Inga shows that it will cost South Africa at least $690m (R10,32bn) more on an annual basis than if it rather invested in domestic solar and wind. Overall, these alternatives minimize South Africa’s exposure to lengthy energy delays and costs associated with investment in Inga 3.

**Recommendations**

To the South African government, including the ministries of finance and energy, and parliamentary oversight committees:

- Take steps to withdraw from the Inga 3 treaty with the DRC, at latest in 2023, with a view toward a renewed national energy plan that can deliver energy security, increased certainty for energy and economic planners, and can bring electricity in at a much lower cost to South Africans.
- A feasibility study of Inga 3 must be urgently developed and made public, making transparent the assumptions under which South Africa continues to back the project. This study should inform a revision of the Integrated Resource Plan (IRP) for the energy sector.
- This feasibility study must factor in environmental, social and governance (ESG) risks and impacts. It must also include a robust assessment of energy alternatives that factors in their respective financial, environmental and social costs as well as the distribution of these costs, recognizing that vulnerable groups are likely to get a bad deal.

To NEDLAC, opposition parties, and labour unions:

- Advocate for an immediate and transparent feasibility assessment that fully considers who, if anyone, benefits from Inga 3 going ahead, and explores possible vested interests.
- Build on TMP’s analysis by further establishing the superiority of alternatives over Inga for the purposes of job creation, energy access for all, and wider development.
- Produce sub-national estimates on job losses if Inga proceeds at the expense of wind and solar and analysis of the economic and employment impacts of future energy deficits.
- Lead calls for more robust energy demand forecasting, including in light of the impacts of COVID-19 on energy demand projections.

To civil society:

- Use findings from the study to motivate government, financiers, companies and other actors to reconsider the implementation of the Inga project.
- Push for South Africa to conduct a robust and transparent feasibility study of Inga 3 and a subsequent review of the IRP electricity sector plan.
- Work with communities and developers to build a pipeline of high-quality energy projects that support the rights, interests, and welfare of South Africans via a just transition.
- Continue to examine and expose the harmful impacts of big dams such as Inga in a time of climate and ecological crisis, and contrast these with technologies like solar and wind which are more environmentally and socially responsible.

146. Assuming a transmission cost of $22n and a 3 year delay, with a discount rate of 10% and a transmission loss of 10%.
147. This is if South Africa were to rather invest $22n for the cost of transmission into 920MWh of either solar or wind.

---

34 INGA 3: Too High a Cost - A Study of the Socio-Economic Costs of the Inga 3 Dam for South Africa

International Rivers and WoMin African Alliance
Appendices

Appendix I: Riverscope Risk Model
Appendix II: Transmission Line Risk Model
Appendix III: Methodology

All appendices available at:
https://www.internationalrivers.org/resources/reports-and-publications/
inga-3-too-high-a-cost-for-south-africa/