# Uganda's Oil Refinery: Gauging the Government's Stake

PAUL BAGABO AND THOMAS SCURFIELD

JANUARY 2024

**Natural Resource Governance Institute**

# Contents

# Key messages

- Uganda's planned oil refinery will have several benefits for the country, including for its security of fuel supply and balance of payments.

- The refinery could be reasonably profitable, generating an internal rate of return of 13 percent in a baseline scenario.

- The government is planning to take a 40 percent stake but may ultimately pay a higher price for this equity than it expects. Even if it borrows to cover its upfront contribution to costs, it will need to divert around $330 million in present value terms from the national budget for loan repayments in the 2030s.

- This price will increase if downside risks, such as cost overruns or lower global oil prices, materialize.

- The government can take several steps to increase interest from other investors, including by reducing the risk of cost overruns, ensuring deregulated product prices continue, and providing less risky forms of state support such as tax incentives. These should reduce the need for the government to take a large stake.

# Summary

## The government's plan to take a large equity stake in the oil refinery is risky and may be unnecessary.

French supermajor Total and Chinese state oil company CNOOC decided to go ahead with Uganda's first oil project at the start of February 2022. As part of this, they are constructing the East Africa Crude Oil Pipeline (EACOP), which will have the capacity to export 216,000 barrels per day (bpd) of oil. The government is also pursuing construction of a refinery that will process 60,000 bpd when built. The key question for the government now is when and how the planned refinery will go ahead, including in relation to its planned equity stake.

The refinery will have several benefits. It should address Uganda's problem with fuel supply, with current import routes from Kenyan and Tanzanian ports having suffered several disruptions. Fewer petroleum product imports, which currently account for around 11 percent of total imports, will also reduce the country's foreign exchange needs. If the refinery sells petroleum products at the same price as imported products as planned, it will not significantly reduce prices for Ugandans. However, the government hopes that the refinery will stimulate the birth of a petrochemical industry, which could produce a cheaper source of other products such as fertilizers and plastics. While the refinery will not employ many people directly, Stanbic Bank estimates that the refinery could generate 32,000 jobs during its lifetime overall due to the various indirect effects on the economy.

The government canceled its agreement with the Albertine Graben Refinery Consortium (AGRC), the companies selected to construct and operate the refinery, in June 2023 after AGRC failed to secure sufficient financing within the agreed timeframe. The government has been planning to take an equity stake of up to 40 percent in the refinery through the Uganda National Oil Company (UNOC) (with the possibility of it selling some of this stake to other governments from the East African Community). But the challenges with AGRC could encourage the government to take an even larger stake to ensure the project proceeds.

There is limited clarity on the price that the government might ultimately pay for its equity stake. To provide further clarity and thereby inform government decision-making, we have analyzed the refinery's economics and the implications for the government stake.

Our modeling suggests that the refinery could be reasonably profitable. With our baseline assumptions, it generates an internal rate of return (IRR) of 13 percent, with an average price of USD 54 per barrel between 2025 and 2050.[1] This IRR is within the range of the typical investor requirement of 10-15 percent. The refinery is likely to have high construction costs relative to its size, possibly around $4.5 billion. But these costs will be at least partly offset by the refinery's access to cheap crude oil and a growing domestic market for petroleum products, along with the ability to sell at relatively high prices to that market.

With a construction cost of $4.5 billion and assuming debt financing of 70 percent, a government stake of 40 percent requires the government to contribute around $540 million to this cost. This is equivalent to about $440 million in present value terms (assuming a real discount rate of 8 percent). Given budgetary constraints, we expect that the government will borrow this money to avoid this upfront cost.

But borrowing is not a silver bullet. Our model suggests that the refinery will be repaying its loans and therefore generating a lower cash flow for UNOC at around the same time as UNOC's own loans also fall due. UNOC's annual returns are unlikely to cover its costs during this period. Therefore, while UNOC ultimately makes a profit over the lifetime of the refinery in our baseline, the government needs to divert around $330 million in present value terms from the budget to contribute to loan repayments in the 2030s.

The price that the government ultimately pays for a 40 percent stake will be impacted by a range of factors and uncertainties that affect the profitability of refineries. Refinery economics are notoriously difficult to get right and many operators of African refineries have struggled. We analyzed five factors that will affect the profitability of the Ugandan refinery. We looked at downside and upside scenarios for each.

**Construction cost.** As is often the case with large infrastructure projects, the refinery may suffer from cost overruns. The estimated cost has already increased about 12.5 percent, from $4 billion to $4.5 billion. An industry study of refinery projects across the world in 2014 found that they were, on average, 69 percent over budget. We modeled this development cost overrun (taking into account the cost increase to date) as a downside risk. It is possible, though unlikely, that the cost will instead be lower. We modeled this upside as a cost of $3.3 billion in line with the Stanbic study's estimates in 2021.

**Feedstock volume.** We assumed that the refinery will receive 490 million barrels of oil from the Lake Albert project, based on the reserves that Rystad Energy predicts will be available from 2028 onwards (when we think that the refinery will start operations). However, we also modeled a downside risk that the refinery will only have around 407 million barrels of feedstock based on the refinery starting operations later and the energy transition away from fossil fuels resulting in prices falling below the Lake Albert's projects operating costs, leading to Total and CNOOC ending production earlier than expected. In contrast, it is possible that other oil projects will be developed in Uganda. We assumed 232 million barrels of additional feedstock as an upside, based on Rystad estimates.

UNOC cash flow from 40 percent equity in refinery in baseline (USD millions 2023, 8 percent real discount rate)
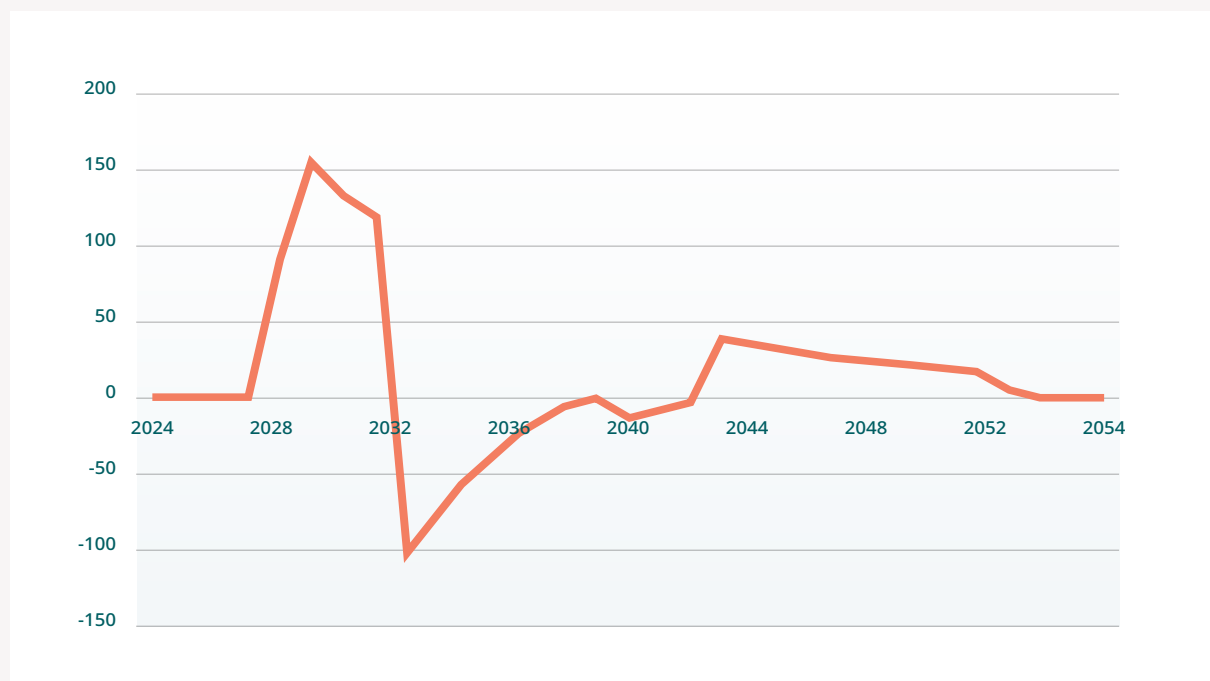
**Global oil price.** Depending on the pace of the energy transition, the global oil price could be less or more favorable than the average $54 per barrel that we assumed in our baseline. Many analysts and oil companies have been revising their long-term price assumptions downward. While a lower price will reduce the refinery's feedstock costs, it will likely reduce its sales revenues even more. As the downside risk, we modeled the world achieving net zero $CO_2$ emissions by 2050 to meet the Paris Agreement target of limiting the global temperature rise to 1.5C. The impact on demand expected by the International Energy Agency could lead to an average price of $16 per barrel between 2025 and 2050. An upside, albeit an unlikely one, could be an average price of $94 per barrel during this period, in line with OPEC's demand projections.

**Product prices.** Uganda's current arrangement of leaving petroleum product pricing to the market is an important factor in increasing the viability of the refinery, making it more likely that it can pass higher costs on to consumers. However, discussions with various Ugandan stakeholders suggest that oil production might result in citizen pressure on the government to make petroleum products cheaper. We modeled a downside risk of the government capping the price at which the refinery can sell its products at 10 percent less than we assumed in our baseline. We modeled an upside of the refinery selling at a price that is 10 percent higher.

**Regional exports.** We assumed that Ugandan demand follows that set out in the government's Energy Transition Plan. This means Uganda consumes almost all the refinery's production in our baseline. In our downside scenario, we assumed that petroleum product demand continues growing at the same rate as the past decade, a lower rate than in our baseline.

As a result, the refinery is not able to sell all its liquefied petroleum gas or heavy fuel oil production to the domestic market in its first decade of operation. The refinery may struggle to sell all this surplus to other countries in the region, particularly to Kenya and Tanzania given their ports already provide a relatively cheap source of imports and they have liquefied petroleum gas ambitions of their own. As a downside risk, we modeled the refinery being able to sell to only Burundi, Central African Republic, Democratic Republic of the Congo, Rwanda and South Sudan.[2]

Refinery post-tax internal rate of return if upside or downside risks are realized
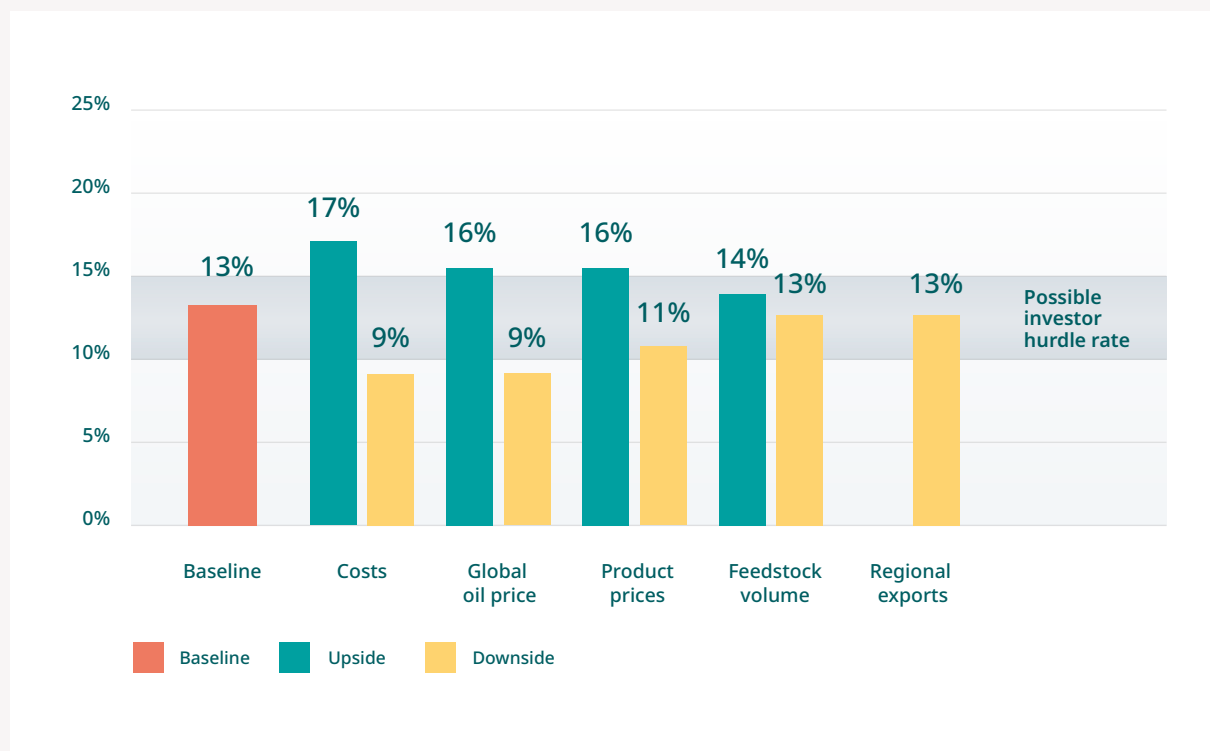


These factors may have a significant impact on the refinery's returns, both positive and negative. For example, our model suggests that if costs are lower, in line with Stanbic's estimate, returns are 17 percent rather than the 13 percent in our baseline. However, costs overrunning by the global average, even on its own, reduces returns to 9 percent. If OPEC is right and prices significantly increase over the next few decades, returns are 16 percent. Yet the impact of the world meeting the Paris Agreement on the global oil price reduces returns to 9 percent.

This impact on the refinery's returns will have a knock-on effect on the costs to UNOC. All these risks materializing, in one direction or the other, is unlikely. However, the government will pay a very different price to what it expected even if only some of these risks materialize. For example, if costs are in line with Stanbic's estimate, as the first figure on the next page shows, the government only needs to find $90 million in present value terms to support UNOC in repaying its loans rather than the $330 million that we estimated in our baseline, and UNOC

makes a significant profit over the lifetime of the refinery. However, as the second figure on the next page shows, if costs overrun by the global average, the government needs to find $920 million in present value terms, and UNOC makes a loss over the refinery's lifetime.

Taking a large equity stake could therefore generate substantial challenges for Uganda. If costs overrun by the global average, for example, the $920 million that the government would need to divert from the budget would significantly reduce the government's ability to use oil revenues to finance public programs.

To put that number in perspective, it is equivalent to about 8 percent of the revenue that the government expects to receive from the Lake Albert project during the 2030s,[3] and 13 percent of the total revenue that the government collected in 2022-23. It is also similar to the country's annual road construction and maintenance budget and double the Ministry of Health's budget in 2023-2024.[4,5]

Change in UNOC funding required in 2030s if upside factors materialize (USD millions 2023, 8 percent real discount rate)[6,7]
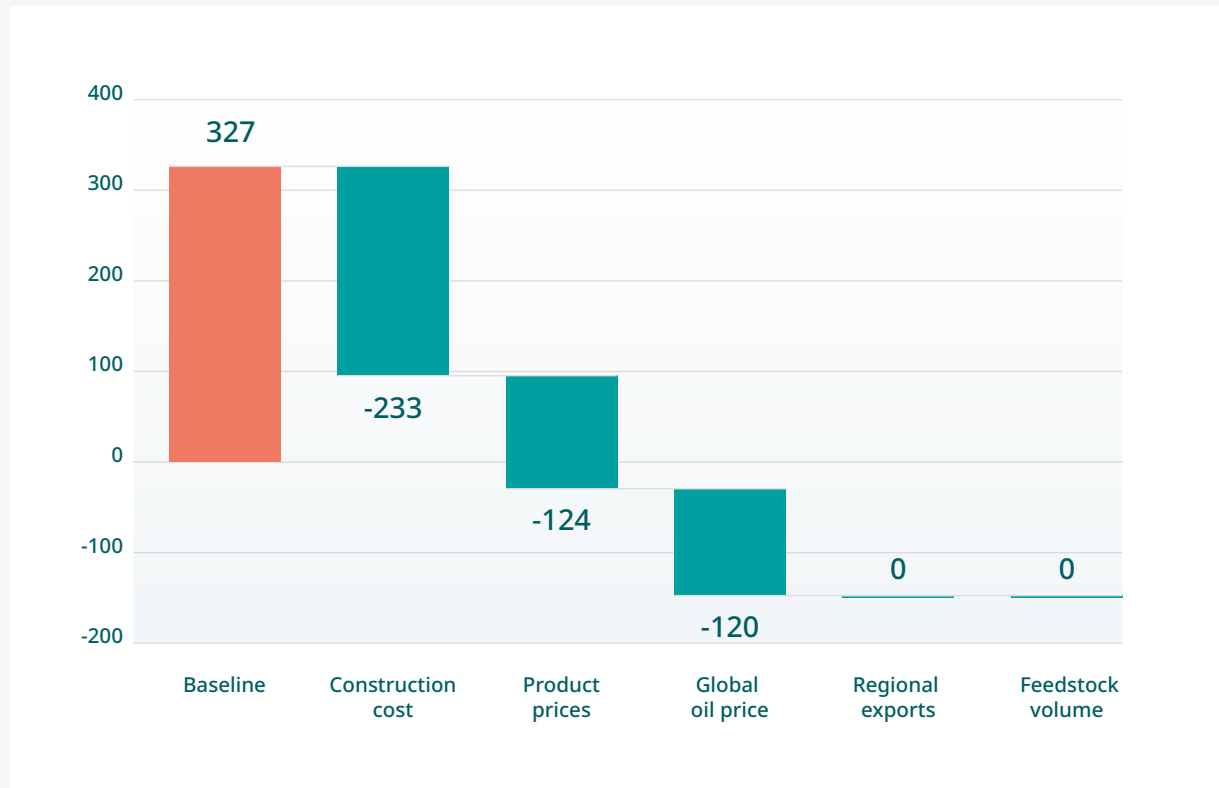


Change in UNOC funding required in 2030s if downside factors materialize (USD millions 2023, 8 percent real discount rate)[8]
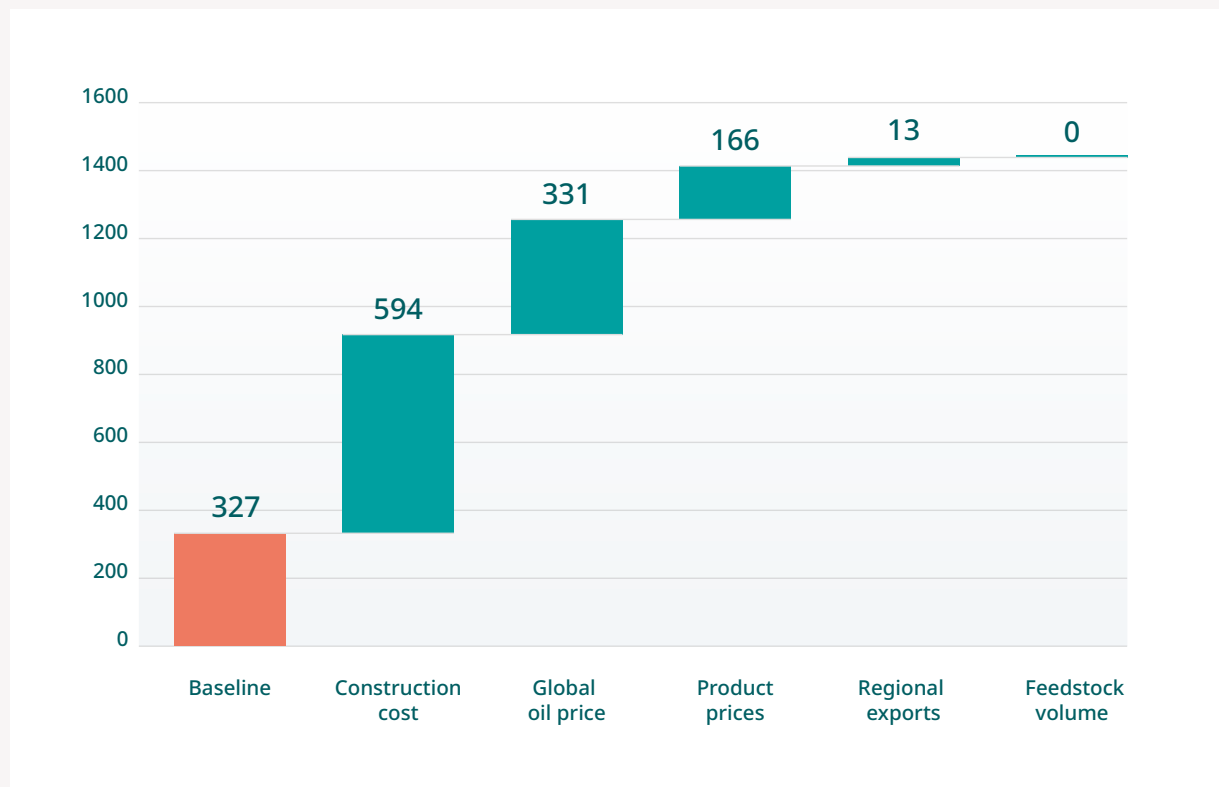
Of course, the refinery will generate considerable benefits for Ugandans. The government may therefore decide this is a risk worth taking, and a price worth paying.

The government may not need to expose the country to this amount of risk, however. It is unclear whether the failure of AGRC to raise sufficient financing relates to the refinery's profitability or other reasons. The refinery is profitable in our baseline scenario.

If the government can establish and address the reasons for AGRC's fundraising failure, other investors may still be willing and able to provide most, if not all, the investment.

Our analysis points to a sequence of steps that the government could take to reduce the risk that the refinery becomes a burden on the public finances and a drag on the country's development, while also increasing the likelihood of attracting new investors and securing financing.

1. Mitigate the risk of cost overruns and ensure efficient operation through regulation.
2. Ensure deregulated product prices continue.
3. Verify export opportunities before finalizing the mix of products that the refinery produces.
4. Provide less risky forms of state support than paid state equity if the refinery requires additional support to attract investment, such as sovereign guarantees for its financing, loans and targeted tax incentives.
5. Take a lower stake in the project if other investors are willing to step in, and at the very least, not consider increasing its planned stake until it has exhausted all other options.
6. Carefully assess whether the refinery's benefits justify the price that the government may need to pay after attempting to reduce its risk exposure through steps 1-5.



Photo credit: Oil and Gas Photographer for Shutterstock

# Introduction

After a long wait since oil was first discovered in 2006, Uganda's oil sector looks finally to be proceeding. Total and CNOOC decided to go ahead with the Lake Albert project in February 2022 and currently expect to start production in 2025. This project—made up of the Tilenga and Kingfisher blocks—could produce around 1.4 billion barrels of oil in total.[9] In addition to developing the oil fields, the companies are constructing the East Africa Crude Oil Pipeline (EACOP), which will have the capacity to export 216,000 barrels per day (bpd) of oil. The government is also planning construction of a 60,000 bpd refinery. Once built, this refinery will have first call on production, with the rest being exported through EACOP.

**Figure 1.** Expected configuration of Uganda's oil sector[9]



The Lake Albert project will produce 230,000 barrels per day (bpd) of oil at its peak

Tilenga Development

CONGO (DRC)

Processing Facility

Lake Albert

Butiaba

Oil field

UGANDA

Tonya

Kaiso

Kingfisher Development

Kabalega Industrial Park

The refinery's capacity is expected to be 60,000 bpd

Locations shown on this schematic are for illustrative purposes only.

Bugoma

Refinery

Processing Facility

The East Africa Crude Oil Pipeline (EACOP) will transport up to 216,000 bpd for export overseas

25km

Crude oil export pipeline to Tanga, Tanzania

The government signed a framework agreement for the refinery project with the Albertine Graben Refinery Consortium (AGRC) in 2018. This agreement entailed the government taking an equity stake of 40 percent.[11] Front-end engineering and design (FEED) work and environmental impact assessments were subsequently completed, most of the land was acquired and cleared and a final investment decision was targeted for the middle of June 2023. However, the government canceled its agreement with AGRC after the consortium failed to secure sufficient financing within that timeframe. The government has said that it would like to partner with another national oil company but is considering all alternatives.[12] AGRC's challenges could persuade the government to take an even larger stake than 40 percent.

# The refinery could generate significant benefits for Uganda

Various government policy documents and external studies have set out the impact that the refinery could have on Uganda's development.

Concerns about the security of Uganda's fuel supply have been at the heart of the government's long pursuit of a refinery, set out as early as 2008 in the National Oil and Gas Policy. All petroleum products consumed in Uganda are currently imported from overseas through the ports of Mombasa in Kenya and Dar es Salaam in Tanzania. The main route involves a pipeline from Mombasa to Eldoret in western Kenya, and then more than 400 kilometres of substandard road to Kampala. This route has suffered several significant disruptions due to logistical issues and political instability.[13] The government has for some time been considering an extension to the pipeline from Eldoret to Kampala to improve the reliability of this route. However, this project appears to have stalled, apparently reinforcing the government's belief that Uganda needs its own refinery.

The refinery could generate other benefits for Uganda, as set out in a macroeconomic study by Stanbic Bank that the government commissioned in 2021.[14] Petroleum products accounted for $1.1 billion or 11 percent of total imports in 2020-2021. Fewer petroleum product imports will improve the balance of payments. While the export of all of Uganda's crude would also improve it, a refinery will result in greater improvements given the difference in value between crude and petroleum products.

Given the government's intention for the refinery to sell its products at import parity, the refinery is unlikely to significantly reduce prices for consumers. However, the government is hoping that the refinery will stimulate the birth of a petrochemical industry, as part of the Kabalega Industrial Park. This could potentially produce a cheaper source of products such as fertilizers and plastics for Ugandans, and further improve the balance of payments through import substitution.

The government expects 4,000-6,000 jobs will be created through the four years of building the refinery. Once the refinery is operating, it will only employ a small fraction of this number: the government expects around 650 people.[15] Any significant job creation therefore depends on the refinery procuring substantial amounts of local goods and services, and on the success of related downstream industries. Stanbic estimates that overall, the refinery could generate around 32,000 jobs during its lifetime: about 21 percent of the jobs that the government expects the oil sector to generate at its peak.[16]

If profitable, the refinery will also generate government revenue from taxes and the government's equity stake. The government estimates that it will collect around $3.3 billion in total: an average $130 million a year assuming the refinery operates for about 25 years. This translates to about 5 percent of the revenue that the government expects to collect from the oil sector overall.[17] However, even then, an independent analysis in 2020 estimated that the government could collect less revenue from the sector overall by allocating some of Lake Albert's oil to a domestic refinery rather than exporting it all as crude.[18]

It is also important to consider the impact the refinery will have on the environment, both locally and globally. This impact will depend on government and company efforts to minimize it. Air pollution, water contamination and solid waste leakage are the greatest risks to the local environment. The refinery is also expected to generate up to 1 million tonnes of carbon dioxide per year—doubling Uganda's current emissions. However, to minimize the impact on the climate crisis, the government is planning to plant 40 million trees, which it expects will remove a similar amount of carbon dioxide from the atmosphere.

# The price that the government might ultimately need to pay for its equity stake needs further analysis

Given the government's longstanding commitment to constructing a refinery, we do not further assess its overall impact on Uganda's development. We focus on only one of the determinants of this impact: the government's planned equity stake. The Uganda Refinery Holding Company, a subsidiary of the Uganda National Oil Company (UNOC), is likely to hold most of the equity. Government officials have indicated that some equity could be taken by other government entities, such as the National Social Security Fund.

Part of the stake could also be taken by other governments in the East African Community, including a possible 2.5 percent by Kenya and 8.5 percent by Tanzania.[19] However, the involvement of other countries is uncertain at this stage.

There is limited clarity on the price that the government might ultimately need to pay for its equity stake. To provide further clarity and thereby inform government decision-making, we have analyzed the refinery's economics and the implications for the government stake.



Photo credit: Jonathan Ernst / The World Bank for Flickr

# The refinery is profitable in the baseline scenario

We developed an economic model of the refinery project (available on our website and described in the appendix) to assess its profitability. Our modeling suggests that the refinery could be reasonably profitable. It generates an internal rate of return (IRR) of 13 percent in our baseline scenario. This IRR is within the range of the typical investor hurdle rate of 10-15 percent.

The economics of Uganda's refinery reflect the balancing act that refineries must strike with their configuration. The refinery has high construction costs, but our modeling suggests that the impact on its profitability will be offset by its access to reasonably cheap crude and ability to sell its products at relatively high prices.

## The refinery has high construction costs

The configuration of the refinery currently envisaged in the FEED is a 60,000 bpd Residue Fluid Catalytic Cracker. This would make the refinery relatively small but one of the region's more complex. Only 24 percent of Africa's current refining capacity has fluid catalytic

cracker capability.[20] The government has said the refinery will produce petrol, Euro V; diesel, Euro V; liquefied petroleum gas (LPG); jet fuel, A-1; and heavy fuel oil (HFO). The yield in the FEED is set out in Figure 2.[21]

**Figure 2.** Expected yield of Uganda's oil refinery



Petrol 55%

Diesel 24%

LPG 13%

Jet fuel 4%

HFO 4%
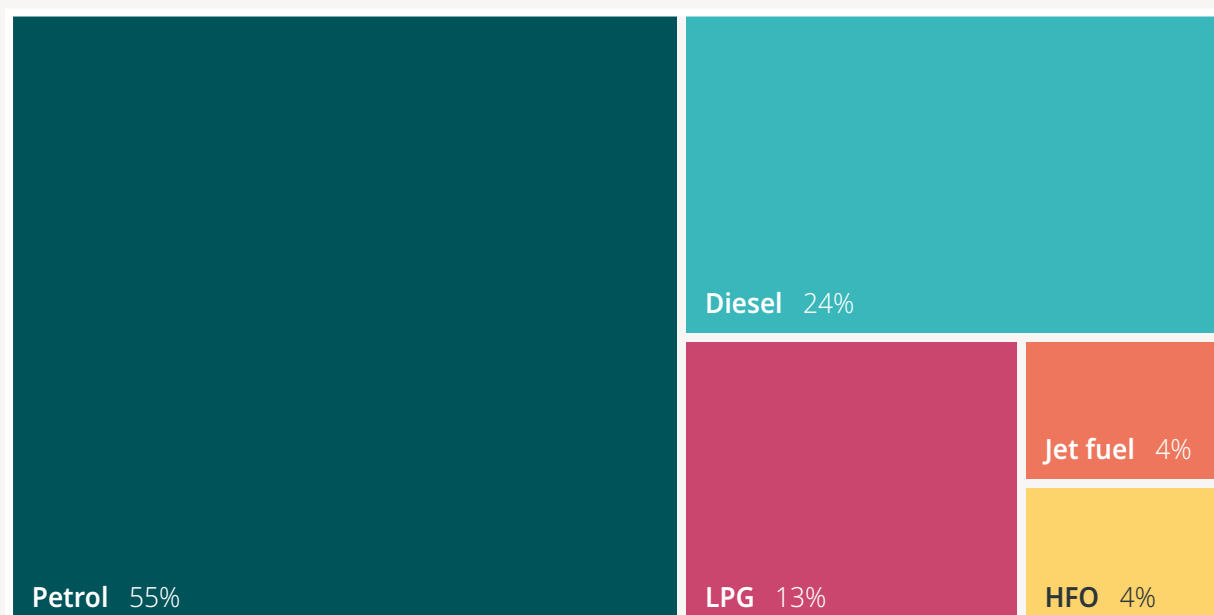
## Construction cost

The government currently expects the refinery and supporting infrastructure to cost $4.5 billion to construct. Around $3.7 billion is likely required for the refinery, and around $0.8 billion for a product pipeline from the refinery to Kampala and for storage terminals in Kampala. The refinery will be expensive even considering its complexity. The $3.7 billion cost for 60,000 bpd of capacity translates to around $62,000 per barrel of refining capacity.

This is higher than the typical range of $20,000-$50,000 per barrel, which spans varying complexity, locations, related projects and time periods. For example, the Dangote refinery in Nigeria, a 650,000 bpd complex refinery, will cost about US$29,000 per barrel.[22] A very complex 1,200,000 bpd refinery in India, planned by Saudi Aramco and Abu Dhabi National Oil Company, will cost around $42,000 per barrel.[23]

The main reason for the high cost of Uganda's refinery is its relatively small size, which prevents economies of scale. Projects tend to generate these scale economies only with a capacity of at least 100,000 bpd. However, building a larger refinery would probably not be to Uganda's advantage either. A larger refinery would be able to benefit from economies of scale but would face crude supply challenges that could offset any improvement in its economics.

## Access to crude

The government signed a memorandum of understanding with the companies involved in the Lake Albert project in 2014, in which they agreed to the project supplying 60,000 bpd to a domestic refinery. The government will therefore not be able to secure a larger volume of crude from the Lake Albert project. Doing so would harm the project's profitability, particularly given the capacity of EACOP was calibrated for the agreed export volumes and the pipeline is already under construction. Total and CNOOC would therefore strongly resist any such attempt.

Whether and when other projects will advance to oil production is uncertain. 60 percent of Uganda is unexplored and there has been a high success rate in areas that have been explored. Exploration plans are advancing in several other blocks, such as Ngassa, Kanywataba and Turaco. However, it remains to be seen which projects will advance to oil production, particularly given the uncertainty generated by the global energy transition. Even if some of these projects do proceed, they are unlikely to start production for a long time. They should get to first oil faster than the Lake Albert project because much of the infrastructure and regulatory framework that they will use will already be in place. Nevertheless, the average project globally takes 7.5 years to get from discovery to production.[24,25]

The refinery could instead import the additional feedstock required for a larger refinery. However, importing feedstock reduces the benefit of being located close to oil production, and the lower transport costs that this allows.

## Demand for petroleum products

The optimal size of a refinery is also determined by the characteristics of the markets in which it intends to sell its products, and the competition it faces in these markets.

Ugandan demand for petroleum products is growing quickly. Growth averaged about 5 percent a year in the decade up to 2021 (the most recent year for which data is available), in line with economic growth.[26] The country consumed the equivalent of 41,000 bpd in 2021, with petrol and diesel consumption by the transport sector accounting for about 85 percent.

Some projections of future Ugandan demand are included in the Energy Transition Plan that was released in December 2023.[27] We used these projections to build out projections of demand for each petroleum product, which are set out in Figure 4. We provide an explanation of our methodology in the appendix. If this projected consumption materializes, Uganda consumes almost all the refinery's production.

**Figure 3.** Uganda's petroleum product mix in 2021[28]
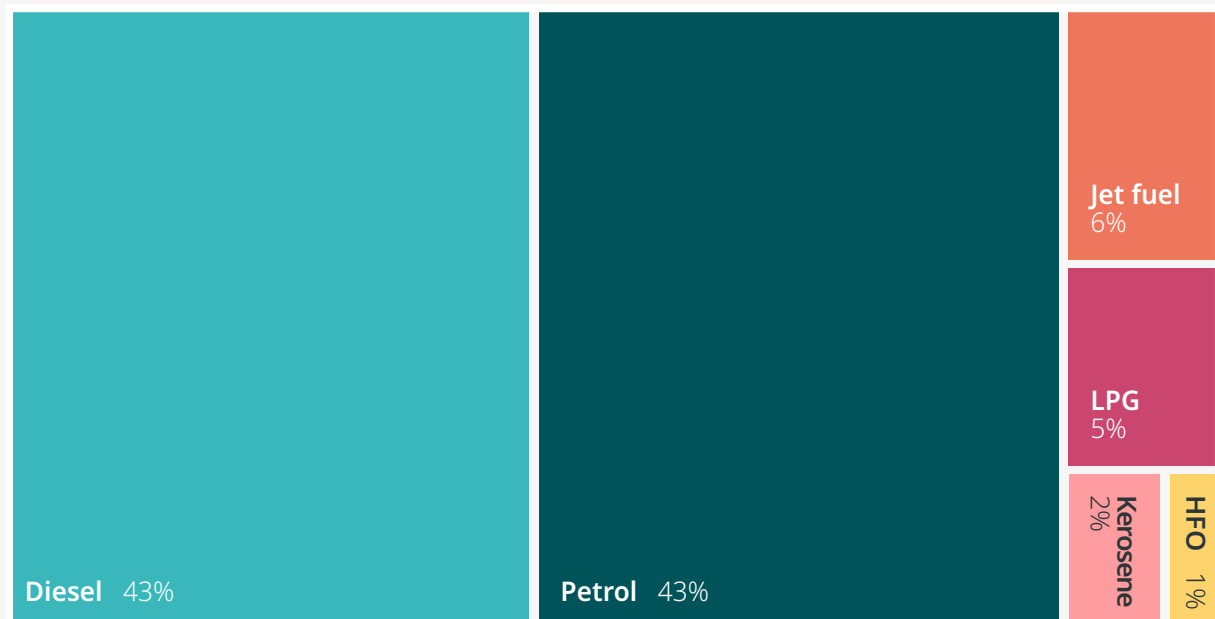


**Figure 4.** Projected Ugandan demand to 2050 (thousands of barrels per day)
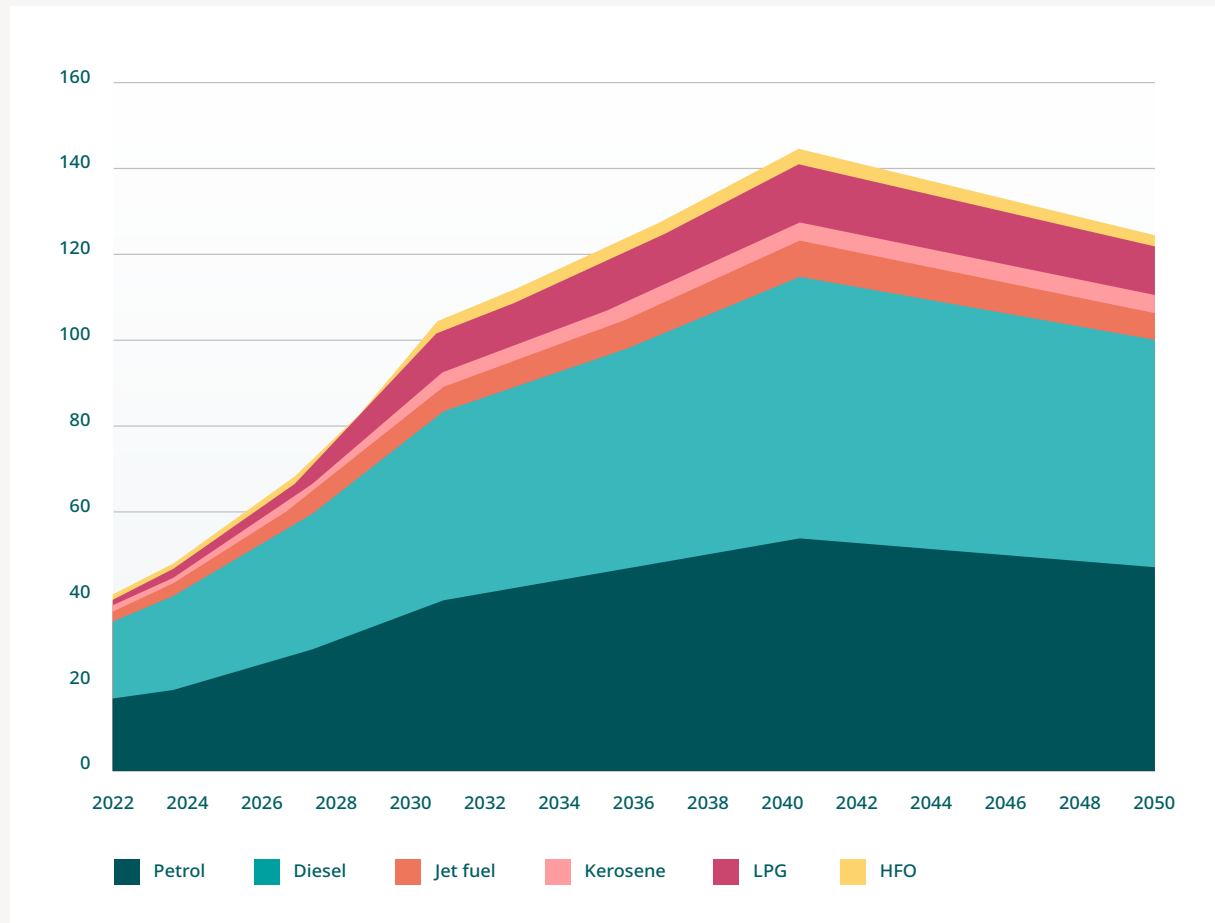
The refinery must export any production that the domestic market does not consume. Being located inland, it should be able to supply its landlocked neighbors without much competition unless other inland refineries are built in the vicinity.

Uganda's most likely customers are Burundi, eastern Democratic of the Congo (DRC) and Rwanda. Like Uganda, they import most of their petroleum products via Mombasa and Dar es Salaam. The routes are thousands of kilometres long which increases final sales prices (see Table 1). As the refinery will be closer than these ports, it should be able to undercut current import sources and offer cheaper products to these countries.[29]

South Sudan could be another market for Uganda's refinery, but this depends on how South Sudan's own refining ambitions develop. Until recently, it also imported most of its products via Mombasa. However, a 10,000-bpd refinery began operations in 2021.[30]

The government is planning other refineries, with the aim of supplying both the domestic and regional markets.[31] There is little information about these planned refineries in the public domain, so it is difficult to determine their prospects or what they may produce. However, they highlight the possibility that Ugandan exports may face competition even in inland markets. The Ugandan government has suggested that it is also exploring exporting to eastern Central African Republic (CAR).[32]

The refinery will face greater competition in its coastal neighbors of Kenya and Tanzania, given their accessibility to overseas refineries.

The refinery may be able to supply western Kenya and northern Tanzania. However, even there, it may need to offer lower prices than it offers to its landlocked neighbors. This highlights another downside of a larger refinery—the larger it is, the more likely it will need to sell to these markets.

**Table 1.** Diesel prices across the region in 2020 (USD per liter)[33]

| | |
|---|---|
| Tanzania | 0.73 |
| Kenya | 0.90 |
| Rwanda | 0.97 |
| Democratic Republic of the Congo | 1.00 |
| Uganda | 1.01 |
| Burundi | 1.21 |
| Central African Republic | 1.48 |
| South Sudan | 1.55 |

# The refinery has access to cheap crude and should be able to sell at high prices

Our modeling suggests that the refinery's high construction costs are offset by its access to reasonably cheap crude and ability to sell its products at relatively high prices.

We expect the Lake Albert project to sell its crude to the refinery at the export netback price, as set out in the MPSA 1999—on which the Lake Albert production-sharing agreements (PSAs) are based—and the publicly available PSA for Block 3A.[34] Given the high cost of transporting crude exports to the coast through EACOP (around $13 per barrel), the refinery will get its feedstock at a significant discount.

The government is planning for the refinery to sell its products at a price based on import parity. Uganda's petroleum products market is deregulated. As the Petroleum Supply Act 2003 stipulates, prices are set by the market rather than the government.[35] The refinery can therefore price its products at only slightly less than the import price and still undercut any import competition. Given that import prices include transport costs from Mombasa to Kampala of around $7 per barrel, the refinery can achieve a reasonable profit margin.[36]



Photo credit: David McNew via Getty Images

# Borrowing to pay for the government's equity is not a silver bullet

With a construction cost of $4.5 billion and assuming debt financing of 70 percent, we estimate that an equity stake of 40 percent would cost the government an initial $540 million.[37] This amount is similar to UNOC's expectations.[38] We convert the $540 million to present value terms to take into account the time value of money. Assuming a real discount rate of 8 percent, the initial cost is $440 million in present value terms. This would be a significant investment by UNOC, or any other state entity that takes a stake, such as the National Social Security Fund.[39]

Paying for UNOC's stake from the government budget would have significant opportunity costs. To put the required $440 million in perspective, the government expects to receive revenue and grants of $9 billion in 2023/24.[40,41] These budgetary constraints mean any money that goes towards paying for UNOC's stake would result in less money going towards other development priorities. We therefore expect the government would borrow the money to avoid these upfront opportunity costs.



Photo credit: Wenbin via Getty Images

Borrowing to pay UNOC's equity contribution is not a silver bullet, however. Our model suggests that borrowing results in UNOC facing a financing challenge in the 2030s. The refinery will be repaying its loans and therefore generating a lower cash flow for UNOC at around the same time as UNOC's own loans also fall due. Therefore, while UNOC ultimately makes a profit over the lifetime of the refinery in our baseline, UNOC's annual returns are unable to cover its costs during the 2030s.

The government will have to find money from alternative sources to make its loan repayments. Tax revenues from the refinery will be insufficient. Our model suggests that the refinery will not have recovered its initial construction costs and be profitable until the late 2030s. The government will also find it difficult to obtain another loan specifically for the refinery at this point, given the challenges facing the refinery that would make this additional financing necessary.

The government will therefore probably need to divert money from the national budget. Our modeling suggests that the government will need to divert around $330 million in present value terms from the budget to contribute to loan repayments in the 2030s.

**Figure 5.** UNOC cash flow from 40 percent equity in refinery in baseline (USD millions 2023, 8 percent real discount rate)
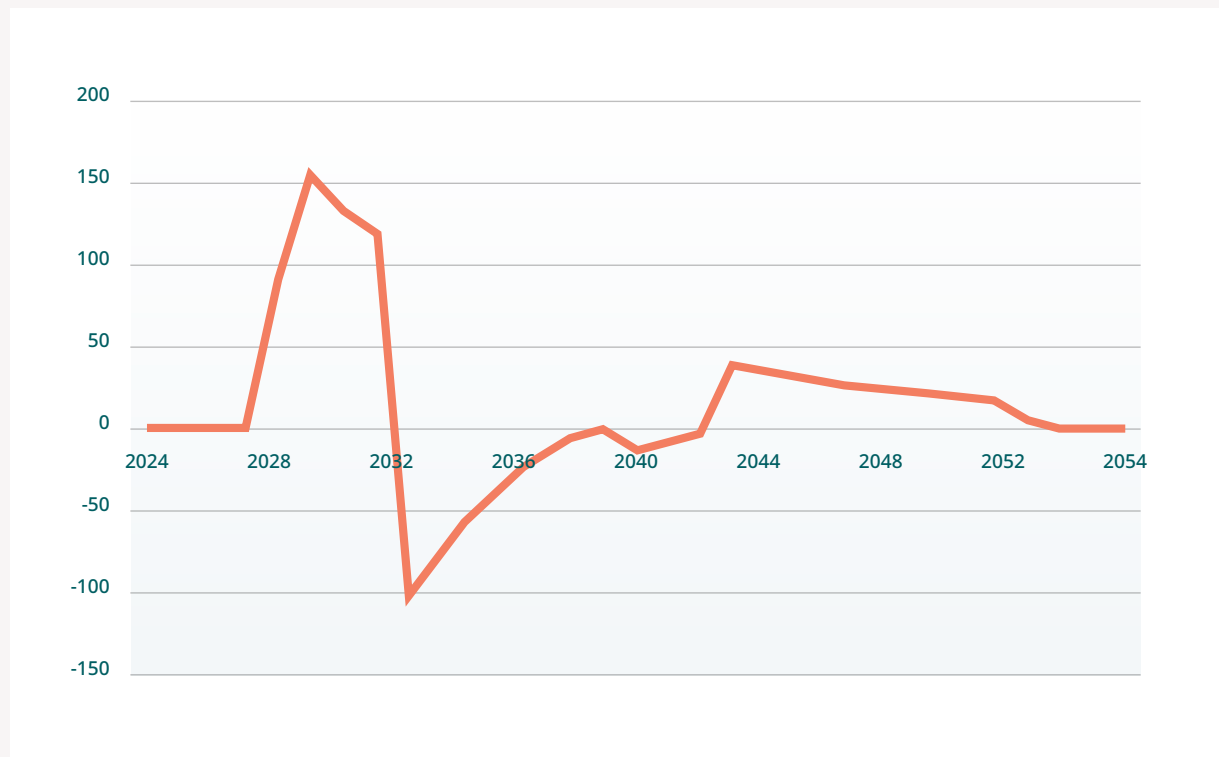
# The refinery faces large downside risks

The price that the government ultimately pays for a 40 percent stake will be impacted by a range of factors and uncertainties that affect the profitability of refineries.

Refinery economics are notoriously difficult to get right. Many refineries in sub-Saharan Africa have struggled: often operating intermittently and below capacity and generating a loss. For example, Nigeria's refineries operated at an average of 15 percent capacity between 2010 and 2018, and have been closed since for rehabilitation.[42] Ghana's 45,000 bpd refinery currently only operates at around 30,000 bpd, and is not only struggling to secure funds for maintenance and repairs, but also to procure crude.[43] Niger's refinery, constructed in 2011, has struggled to pay back its loans.[44]

Although Côte d'Ivoire's refinery is viewed as one of the better performing in sub-Saharan Africa, it has also been facing financial challenges over the last decade.[45] In addition to these historical challenges, refineries are now facing new or increasing downside risks as the global energy transition accelerates.

We analyzed five factors that will affect the profitability of the Ugandan refinery, and therefore the price that the government will pay for its equity stake. We looked at downside and upside scenarios for construction cost; feedstock volume available; global oil price; product prices; and regional exports. Several of these risks have a significant impact on the refinery's returns, as Figure 6 shows. We discuss each of them below in order of the size of their impact.

**Figure 6.** Refinery post-tax internal rate of return if upside or downside risks are realized
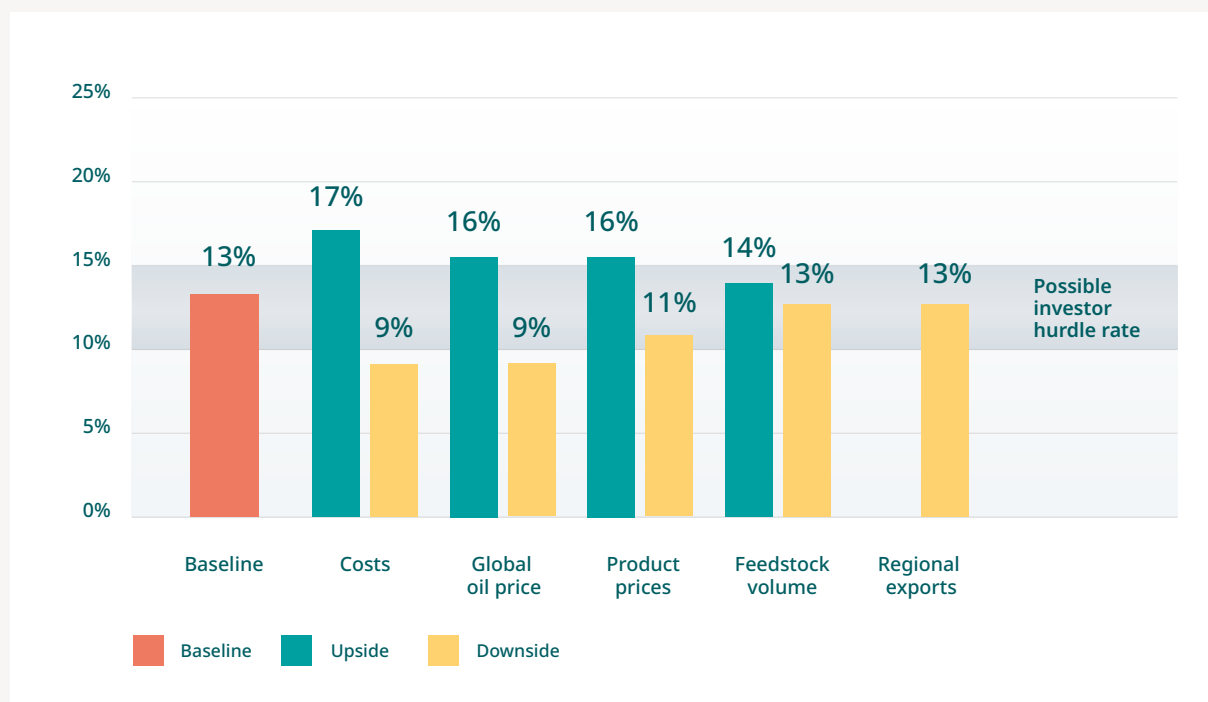
## Construction cost

As is often the case with large infrastructure projects, the refinery may suffer from cost overruns. The estimated cost has already increased about 12.5 percent, from $4 billion to $4.5 billion. This cost may rise further still. An industry study of refinery projects across the world in 2014 found that they were, on average, 69 percent over budget.[46] We modeled this development cost overrun (taking into account the cost increase to date) as our downside scenario.[47]

In this scenario, the refinery generates an IRR of only 9 percent. Therefore, even if no other downside risks materialize, the refinery still generates a low return merely by replicating the experience of most other refineries. Even this significant overrun may be underestimating the risk. The cost of Nigeria's Dangote refinery is now 111 percent more than initially expected, rising from $9 billion to $19 billion.[48]

It is possible, though unlikely, that the cost will instead be lower. We modeled this upside as a cost of $3.3 billion in line with the Stanbic study's estimates in 2021. This results in a refinery IRR of 17 percent.

## Global oil price

The global oil price affects both the refinery's costs and revenues, though not equally. A lower global price will likely reduce the refinery's profitability. It lowers only one cost driver—its feedstock—but is likely to reduce most, if not all, its revenue streams.

The global energy transition is expected to result in a structural decline in the oil market in the next few decades. The pace of this transition is uncertain. However, even before governments unanimously agreed at COP28 to transition away from fossil fuels,[49] the transition was accelerating.[50]

Clean energy technologies appear to be adhering to the S-curve growth model experienced in previous technological transitions, with slow initial growth followed by exponential expansion because of industries' rapid learning. This creates a positive feedback effect. More growth leads to more learning, lower costs, bigger markets and more growth.[51]

The average price in our baseline of $54 per barrel is around the 50-year historical average, and is similar to the long-term forecast of many international oil companies of $55-65 per barrel.[52]



Photo credit: Berkut_34 for Getty Images (via Canva)

However, if the world achieves net zero CO2 emissions by 2050 to meet the Paris Agreement target of limiting the global temperature rise to 1.5C, the impact on demand expected by the International Energy Agency (IEA) could lead to an average price of $16 per barrel between 2025 and 2050.[53] This is our downside scenario, in which the refinery IRR is only 9 percent.

Our upside scenario has an average price of $94 per barrel during this period, in line with OPEC's demand projections.[54] This price rise results from OPEC's expectation that oil demand will, in contrast to recent signs, continue gradually growing over the next three decades and that oil will become increasingly expensive to extract as cheap sources are exhausted. In this scenario, the refinery IRR is 16 percent. However, OPEC's price projections are significantly higher even than the IEA's Stated Policies Scenario, in which governments only implement policies already in place or currently being developed.

## Product price

Uganda's current arrangement of leaving petroleum product pricing to the market is important for the refinery's profitability. This arrangement makes it more likely that it can pass higher costs on to consumers. However, our discussions with various Ugandan stakeholders suggest that oil production might result in citizen pressure on the government to make petroleum products cheaper. This is unsurprising. All African countries with a refinery, except for Ghana, subsidize petroleum product prices.[55] We therefore modeled a downside scenario in which the government caps the price at which the refinery can sell its products at 10 percent less than the baseline.[56] In this scenario, the refinery IRR is 11 percent.

Our upside scenario has the refinery selling at a price that is 10 percent higher than the baseline. This results in a refinery IRR of 16 percent.

**Figure 7.** Historical and projected oil prices (2023 USD per barrel)
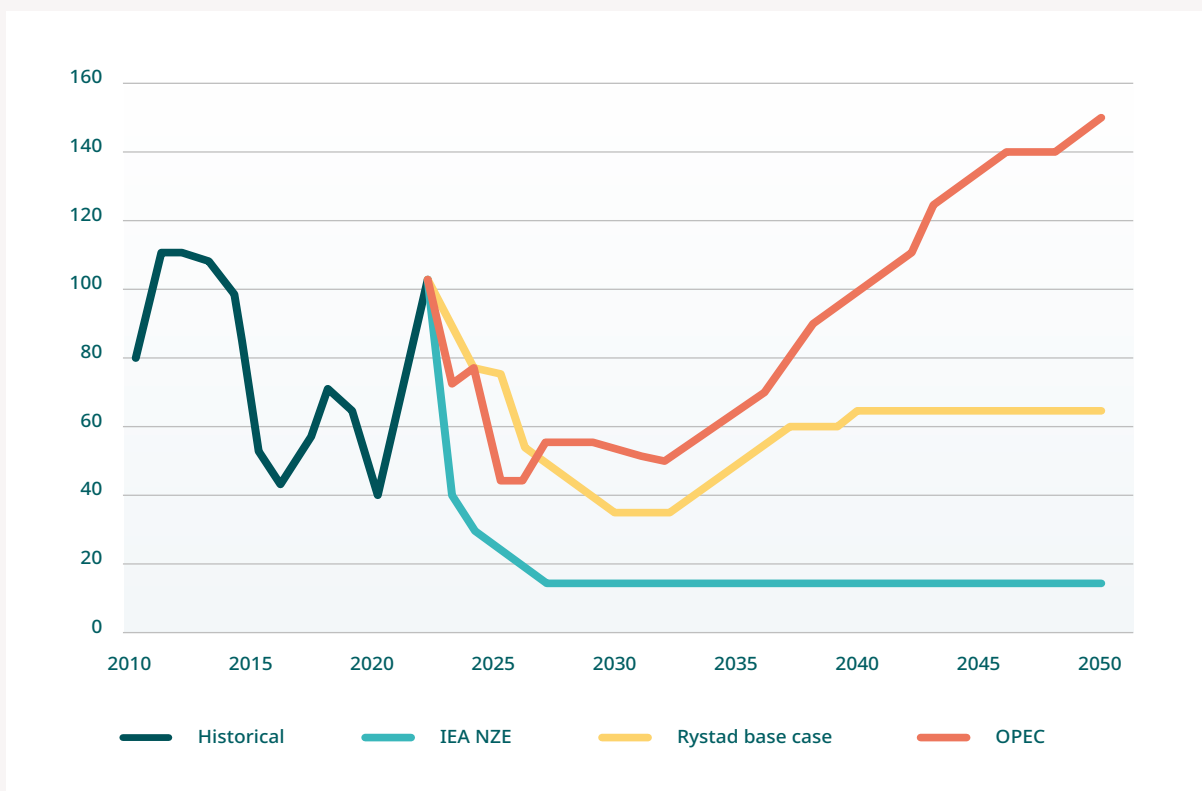
## Feedstock volume available

We assumed that the refinery will receive 490 million barrels of oil from the Lake Albert project. This is based on the reserves that Rystad expects will be available from 2028 onwards, which is when we think that the refinery will start operations.

The current uncertainty about financing means that the refinery may start operations later, which would reduce the feedstock volume available to it. Total and CNOOC may also end production from the Lake Albert project earlier than expected if the global energy transition results in prices falling below its operating costs. Rystad estimates that the Lake Albert project will produce only 91 percent of its reserves if the world achieves net zero $CO_2$ emissions by 2050. Combining these two impacts results in the available feedstock volume decreasing to 407 million barrels. We modeled this volume as our downside scenario. However, the impact of this risk materializing does not seem significant, as it only affects feedstock availability late in the refinery's operations. The refinery IRR is only slightly lower and remains around 13 percent.

In contrast, it is possible that other oil projects will be developed in Uganda. We assumed 232 million barrels of additional oil production in our upside scenario, based on Rystad estimates of possible projects, and assumed that it is all used to supply the refinery. In this scenario, the refinery IRR is 14 percent.

## Regional exports

As the government acknowledges, its Energy Transition Plan charts a feasible but ambitious future for Uganda. This includes, for example, expansion of clean cooking, including through LPG use, at a rate that is unprecedented in Africa. Domestic consumption in our baseline also relies on other government ambitions being realized, such as attracting investment for the conversion of the refinery's HFO production into fertilizers. We hope that these initiatives succeed. However, in our downside scenario, we modeled petroleum product demand growing at the same rate as the past decade until 2040.[57] This is a lower rate than in our baseline. We modeled growth declining after 2040 in line with the Energy Transition Plan projections. In this downside scenario, the refinery is unable to sell all its LPG or HFO production to the domestic market in its first decade of operation.

**Figure 8.** Share of refinery's first decade of production consumed domestically at current rate of demand growth[58]



Legend: ■ Domestic consumption   ■ Surplus
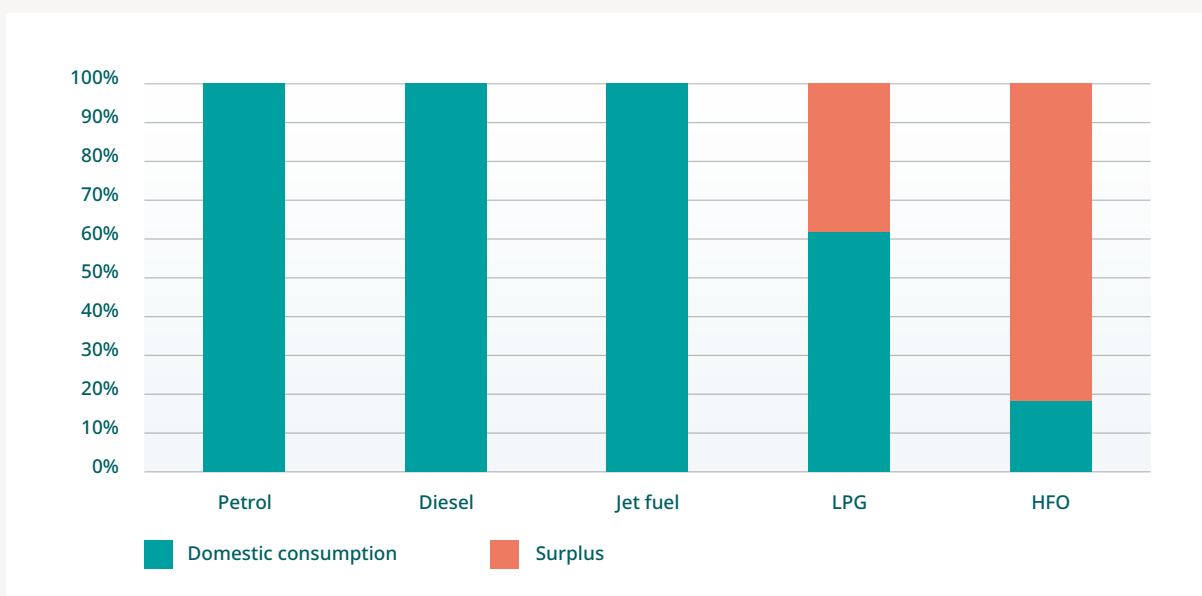
We assumed that the refinery can export the surplus to only Burundi, eastern CAR, eastern DRC, Rwanda and South Sudan. The refinery will find it difficult to compete in Tanzania and Kenya, as discussed above. It might be particularly challenging with LPG given Tanzania and Kenya have LPG ambitions of their own.

Tanzania is constructing its own LPG facilities. The country is also attempting to develop its large offshore gas reserves in the next decade, which would further boost domestic LPG production. Some analysts predict that Kenya will emerge as an LPG import hub for East Africa.[59] Many of the markets that the refinery exports to in this scenario are small.

As Table 2 shows, if demand continues growing in each of them at the same rate as the past decade, only Rwanda consumes a large amount of the refinery's LPG and only Rwanda and Burundi consume a large amount of HFO. Together, these markets only consume 75 percent of the refinery's LPG and HFO surplus.

The impact of this risk materializing does not appear to be significant, however. In this scenario, the refinery IRR is only slightly lower and remains around 13 percent. We did not model an upside because our baseline entails the refinery exporting any surplus to the region at the same price as it sells to the Ugandan market.

**Table 2.** Possible LPG and HFO surplus and regional consumption in refinery's first decade of operation (million barrels)[60]

|  | LPG | HFO |
|---|---|---|
| **Refinery surplus for export** | 13.67 | 6.45 |
| **Burundi** | 0.02 | 3.00 |
| **Eastern CAR** | 0.12 | 0.04 |
| **Eastern DRC** | 0.05 | 0.04 |
| **Northern Tanzania** | 20.96 | 0.04 |
| **Rwanda** | 9.69 | 1.77 |
| **South Sudan** | 0.35 | 0 |
| **Western Kenya** | 60.62 | 3.53 |

# Uganda could pay more than it expects for its equity

The impact of the factors discussed above on the refinery's returns will have a knock-on effect on the costs to UNOC of taking an equity stake. All these risks materializing, in one direction or the other, is unlikely. However, the government will pay a very different price to what it expected for a 40 percent stake even if only some of these risks materialize.

If costs are in line with Stanbic's estimate, for example, our model shows the government

needing to find only $90 million in present value terms to support UNOC in repaying its loans (as Figure 9 shows) rather than the $330 million that we estimated in our baseline, and UNOC making a significant profit over the refinery's lifetime. However, if costs overrun by the global average, the government needs to find $920 million in present value terms (as Figure 10 shows), and UNOC makes a loss over the refinery's lifetime.

**Figure 9.** Change in UNOC funding required in 2030s if upside factors materialize (USD millions 2023, 8 percent real discount rate)[61]
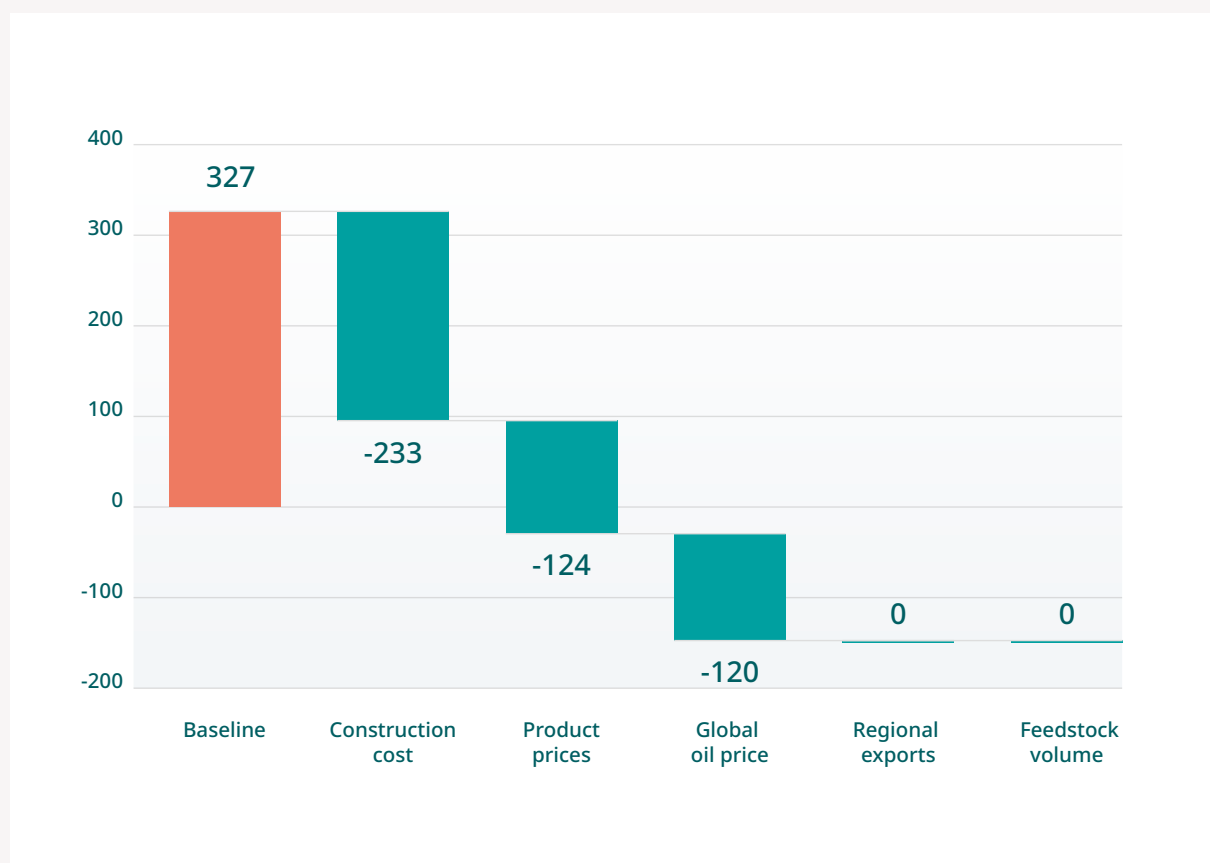
**Figure 10.** Change in UNOC funding required in 2030s if downside factors materialize (USD millions 2023, 8 percent real discount rate)[62]
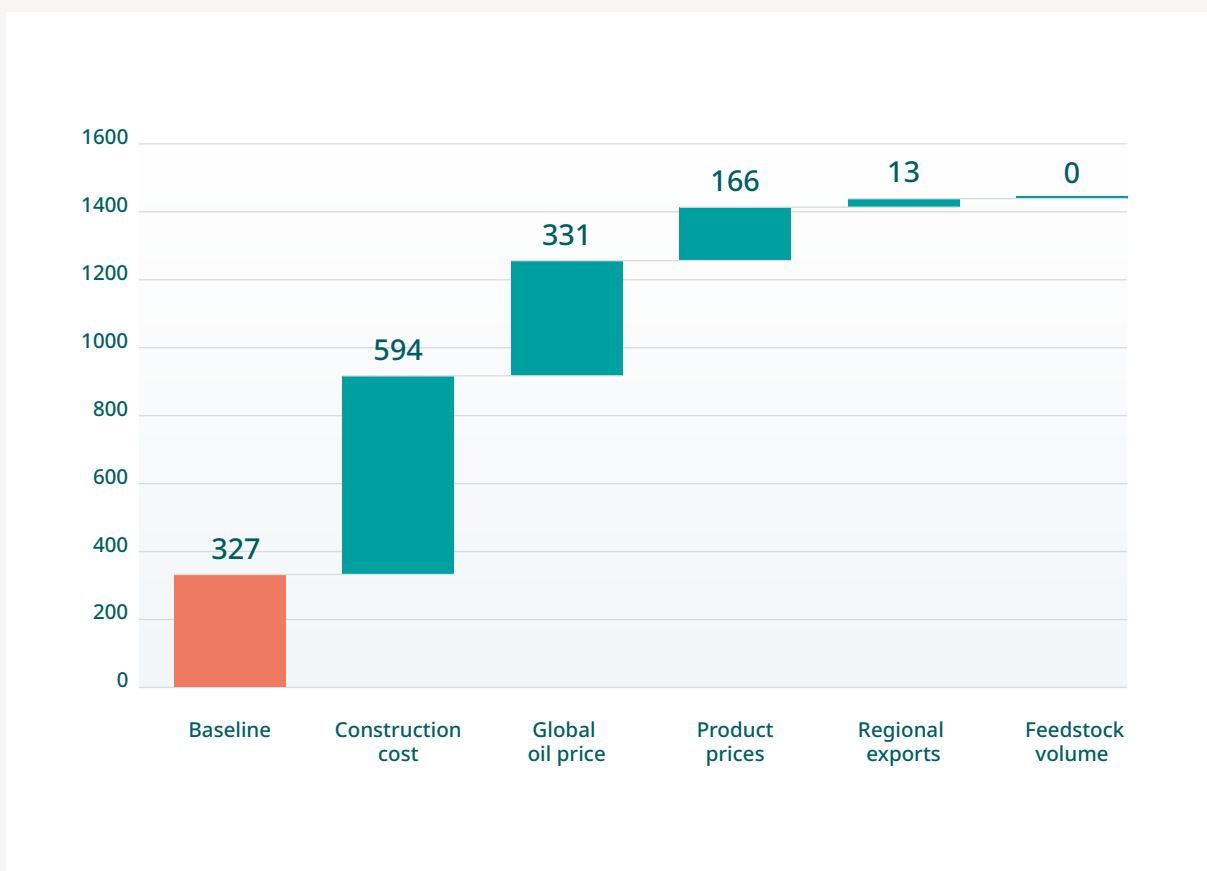


Therefore, even if oil markets hold up in the face of the global energy transition and no other downside risks materialize, the government will face a huge additional cost merely from the refinery replicating the experience of most other refineries. Prices falling because of the energy transition will also have a significant impact, however. If OPEC is right and prices significantly increase over the next few decades, the government needs to find $210 million. Yet if the world reaches net zero by 2050, the government needs to find $660 million.

Taking a large equity stake could therefore generate substantial challenges for Uganda. If costs overrun by the global average, for example, the $920 million that the government would need to divert from the budget would significantly reduce the government's ability to use oil revenues to finance public programs.

To put that number in perspective, it is equivalent to about 8 percent of the revenue that the government expects to receive from the Lake Albert project during the 2030s,[63] and 13 percent of the total revenue that the government collected in 2022-23. It is also similar to the country's annual road construction and maintenance budget and double the Ministry of Health's budget in 2023-2024.[64,65] Spending this amount of money on the refinery would therefore have severe opportunity costs.

# The government may not need to take such a large equity stake

The refinery will generate considerable benefits for Ugandans. The government may therefore decide such a large equity stake is a risk worth taking, and a price worth paying, if it is needed for the refinery to go ahead. An equity stake will also generate significant returns if the downside risks do not materialize.

The government may not need to expose the country to this amount of risk, however. It is unclear whether the failure of AGRC to raise sufficient financing relates to the refinery's profitability or other reasons. Investors are likely to see the refinery as a risky project. Yet, the refinery is profitable in our baseline scenario. If the government can establish and address the reasons for AGRC's fundraising failure, other investors with sufficient risk appetite may still be willing and able to provide most, if not all, the investment. If so, the government would be able to achieve its primary goal of having a domestic refinery without making such a large equity contribution. With a smaller equity stake, the government will lose out on some of the potential upside if the refinery is ultimately profitable. However, while private investors are likely willing to take the risk for this possible reward, the calculus should be different for the government given the significant opportunity costs attached to public money. If the decision to take a large stake does not pay off, the impact on Uganda's development could be severe.



Photo credit: Witthaya Prasongsin via Getty Images

# The government could take steps to reduce the public finance risks

Our analysis points to a sequence of steps that the government could take to reduce the risk that the refinery becomes a burden on the public finances and a drag on the country's development, while also increasing the likelihood of attracting new investors and securing financing for it.

## 1. Mitigate the risk of cost overruns and ensure efficient operations

1.1 **Require the project company to consult the government if costs are expected to exceed a certain threshold above the development plan estimates.** The government might ultimately decide that the cost increase is justifiable or unavoidable, but this requirement at least gives it the opportunity to assess that, rather than finding out later after the costs have already been incurred.

1.2 **Set a limit for management fees.** Management fees are often a source of cost increases. The operator has little incentive to keep them under control, and depending on the tax status of its headquarter jurisdiction, sometimes has an incentive to inflate them. The government could set a limit on such fees, based on what is reasonable for a refinery and the corporate structure. This limit could be a percentage of turnover or operating costs, or an absolute amount, and could be applied to both the project company and its contractors.

1.3 **Conduct frequent and rigorous cost audits.** Strict auditing by both government and independent auditors will improve the government's chances of identifying costs that may still be excessive despite the above control mechanisms.

These measures would boost lenders' confidence in the project having sufficient cash flows for debt service and new investors' confidence that they will achieve their required return on investment.

## 2. Ensure deregulated product prices continue

2.1 **Guarantee deregulated product prices in the state-investor contract.** A deregulated petroleum products market is set out in law, but laws can be changed. Including it in the state-investor contract provides more certainty.

2.2 **Consider increasing the mark-up between the market price and the actual sales price.** Another way that the government can ensure prices remain deregulated, at least from the perspective of the refinery, is to build in a cushion between the market price and the actual sales price through a sales levy—for example, by increasing the fuel levy already in place. If prices rise to a level that the government feels the country cannot bear, it could then cut the levy. This would allow prices to fall without impacting the refinery.

## 3. Verify export opportunities before finalizing the product slate

3.1 **Verify offtake agreements for exports to ensure any surplus supply in a downside scenario can be sold elsewhere.** The companies will need to justify to creditors that they have viable and likely offtake arrangements. However, these processes are not always robust. The government could require sight of the offtake agreements and the right to verify their credibility (for example, through third-party verification). This requirement could be set out in the state-investor contract.

## 4. If development of the refinery requires additional support, provide less risky forms than paid state equity

4.1 **Provide land for free and prepare it for the refinery without charge.** However, this arrangement should not negate the need for the government to compensate the current landowners or to ensure that adequate funding is available to mitigate any environmental harms caused by the refinery.

4.2 **Pay for supporting infrastructure that could be shared with other users.** For example, the roads connecting the refinery to other areas. With this approach, the government would contribute to the refinery's costs without the size of this contribution being dependent on the refinery's profitability, and generate other benefits for Uganda.

4.3 **Consider targeted tax incentives.** Incentives like corporate income tax holidays should be approached with caution. They can significantly reduce tax revenues, often by more than expected, given that companies may then adjust their operations to frontload profits and take greater advantage. However, the government could consider incentives that help the project to recover its investment more quickly—for example, accelerated capital depreciation or import duty exemptions on specific items. Any tax incentive is risky in that it may result in the government forgoing revenue unnecessarily. Tax incentives would also increase the possibility that the benefits the refinery generates will be insufficient to compensate for the environmental and social harms that it will entail. However, these risks are lower than the significant risks to public finances of the government taking a large equity stake.

4.4 **Consider more innovative approaches to financing:**

a. Offer a sovereign guarantee for the debt that the refinery takes on rather than contributing through a large equity stake. A sovereign guarantee also exposes the public finances to risk, but the likelihood that the refinery will not be able to repay its loans is much lower than it not delivering a return to its shareholders. The government could agree that if it needs to cover some of the refinery's loans, UNOC receives equity in exchange. By providing a sovereign guarantee, the government can also require access to all the refinery's operational and financial information in the same way as an equity stake.

b. **Explore taking carried equity.** This approach would allow the government to receive equity on preferential terms, with the other investors financing the state's share of costs up front and the government paying them back via foregone dividends. Carried equity is more common for upstream oil projects, but there is no reason why the government could not at least explore taking this approach for the refinery. Given the interest that the government will pay on the carry loan, carried equity will reduce the refinery's potential upside. However, it is less risky. The government would not have to pay anything up front, and could therefore avoid taking loans from other sources that would need to be repaid regardless of the refinery's profitability.

## 5. Consider a lower stake in the project

5.1 **Try to take less than 40 percent equity.** If the government can establish and address the reasons for AGRC's fundraising failure, other investors could still be willing to provide most, if not all, of the investment—particularly after the government has taken steps 1-4. If so, the government would be able to establish a refinery without making such a large equity contribution and exposing the public finances to significant risk. A smaller stake would also still provide access to all the refinery's operational and financial information. At the very least, the government should not consider increasing its planned stake in response to AGRC's challenges until it has exhausted all other options.

## 6. Assess whether the refinery's benefits justify the price that the government may need to pay after attempting to reduce its risk exposure

6.1 If the government takes steps 1-5 and the refinery still hasn't attracted sufficient financing for it to go ahead without the government taking a large paid equity stake, the government would need to conduct a cost-benefit analysis to determine whether the refinery's benefits justify the price that it may ultimately need to pay. This analysis should include the opportunity cost of having less money for Uganda's other development priorities.

# Appendix: Economic model of the refinery project

**We developed an economic model of Uganda's refinery project to inform our analysis. The refinery's economics in our baseline scenario are summarised in Figure 11.**

**Figure 11.** Economics of refinery (2023 USD)
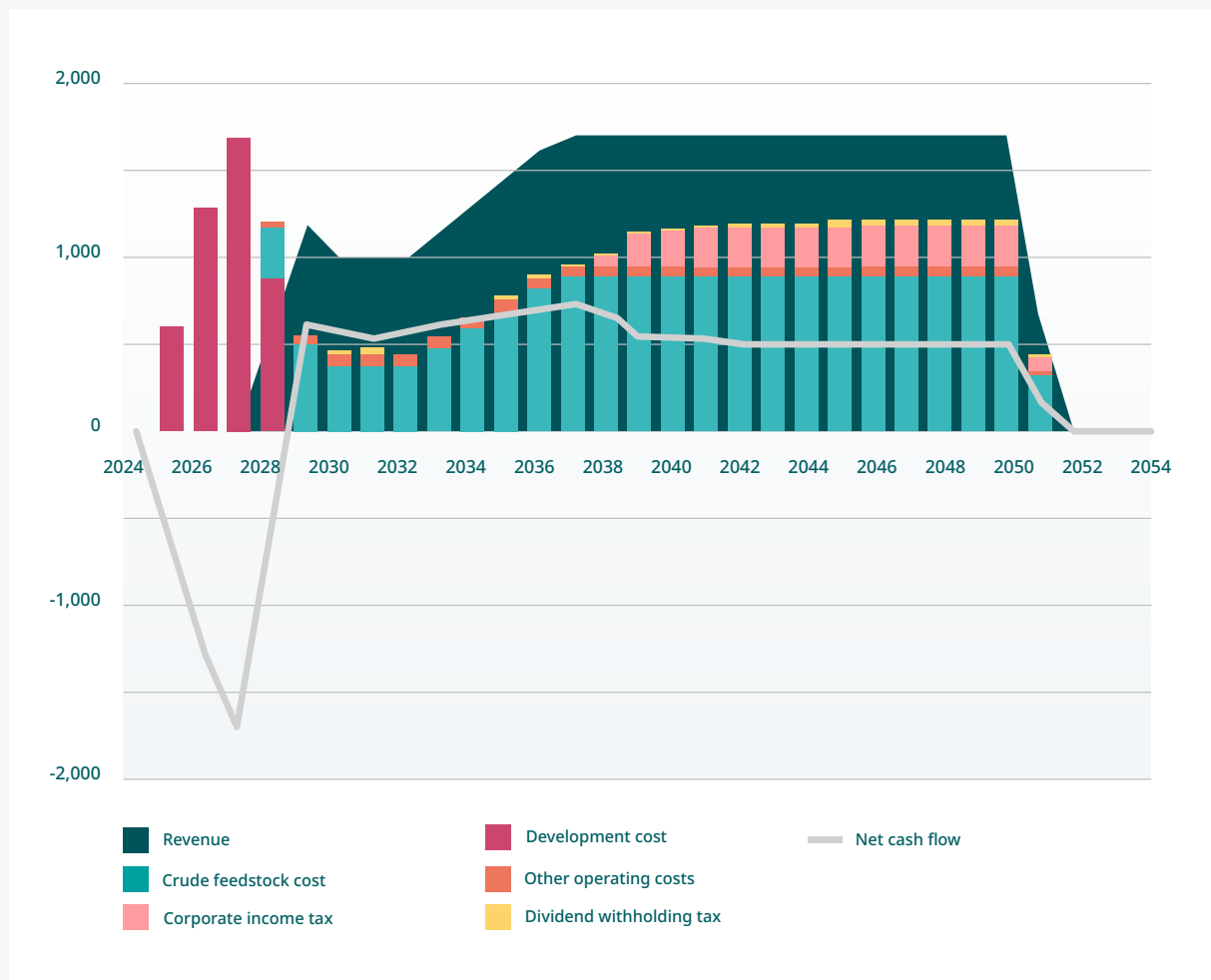


Like all models, the results depend crucially on the assumptions used. There are varying degrees of uncertainty around key inputs into the model, including the project's design, costs and regulatory framework, any of which may have a significant impact on our estimates.

Our main assumptions are presented in Table 3 and discussed further below. Other assumptions can be found in the model.

**Table 3.** Baseline assumptions for refinery (2023 USD)

| Element | Assumption |
| --- | --- |
| Timeline | Final investment decision (FID) in 2024, start of operations in 2028 |
| Capacity | 60,000 bpd |
| Capacity utilization | 95% |
| Yield | Petrol: 55%<br>Diesel: 24%<br>Jet fuel: 4%<br>LPG: 13%<br>HFO: 4% |
| Development cost | $4.5 billion |
| Operating costs | $3 per barrel |
| Global crude price | $54 per barrel on average in 2025-2050 |
| Crude feedstock price | $36 per barrel on average in 2025-2050 |
| Sales price | As % of global crude price:<br>Petrol: +35%<br>Diesel: +37%<br>Jet fuel: +64%<br>LPG: +60%<br>HFO: -13% |
| Feedstock volume | 490 million barrels |
| Domestic consumption in 2021 | 41,000 bpd, of which:<br>Petrol: 41%<br>Diesel: 44%<br>Jet fuel: 6%<br>Kerosene: 3%<br>LPG: 3%<br>HFO: 2% |
| Annual growth in domestic consumption | In line with Energy Transition Plan |
| Taxation | Corporate income tax of 30%;<br>Initial capital depreciation allowance of 50% followed by declining balance of 30% a year; Unlimited loss carry-forward;<br>Dividend withholding tax of 10% |
| Ownership | UNOC: 40%; other investors: 60% |
| Overall financing | Equity: 30%; Debt: 70% |
| Interest rate on loans to refinery | 8% in nominal terms |
| UNOC financing | Paid up front, with UNOC taking a loan to do so |
| Interest rate on loan to UNOC | 8% in nominal terms |
| Government discount rate | 8% in real terms |
| Inflation rate | 2% |

### Timeline

We based our assumption of an FID in 2024 on the urgency that the government is approaching its search for new investors and most pre-FID activities having already been completed. We based our assumption of operations starting in 2028 on construction taking four years as set out in the Stanbic macroeconomic study commissioned by the government in 2021.[66]

### Capacity and yield

We based our assumption that the refinery will have an initial capacity of 60,000 bpd on government statements, while the utilization rate of 95 percent is a typical industry assumption. The refinery's yield aligns with that considered in the FEED according to government statements.[67]

### Costs

We based our assumption that the refinery project will cost $4.5 billion to develop on government statements.[68] This amount includes around $3.7 billion for the refinery, and around $0.8 billion for a product pipeline from the refinery to Kampala and for storage terminals in Kampala. We based our assumption of the time profile of this spending, set out in Figure 12, on discussions with the government. For operating costs, we took the assumption of $3 per barrel from the Stanbic study.

**Figure 12.** Assumed development costs of refinery (2023 USD)



Legend: Refinery (teal), Product pipeline (yellow), Product storage terminals (orange)
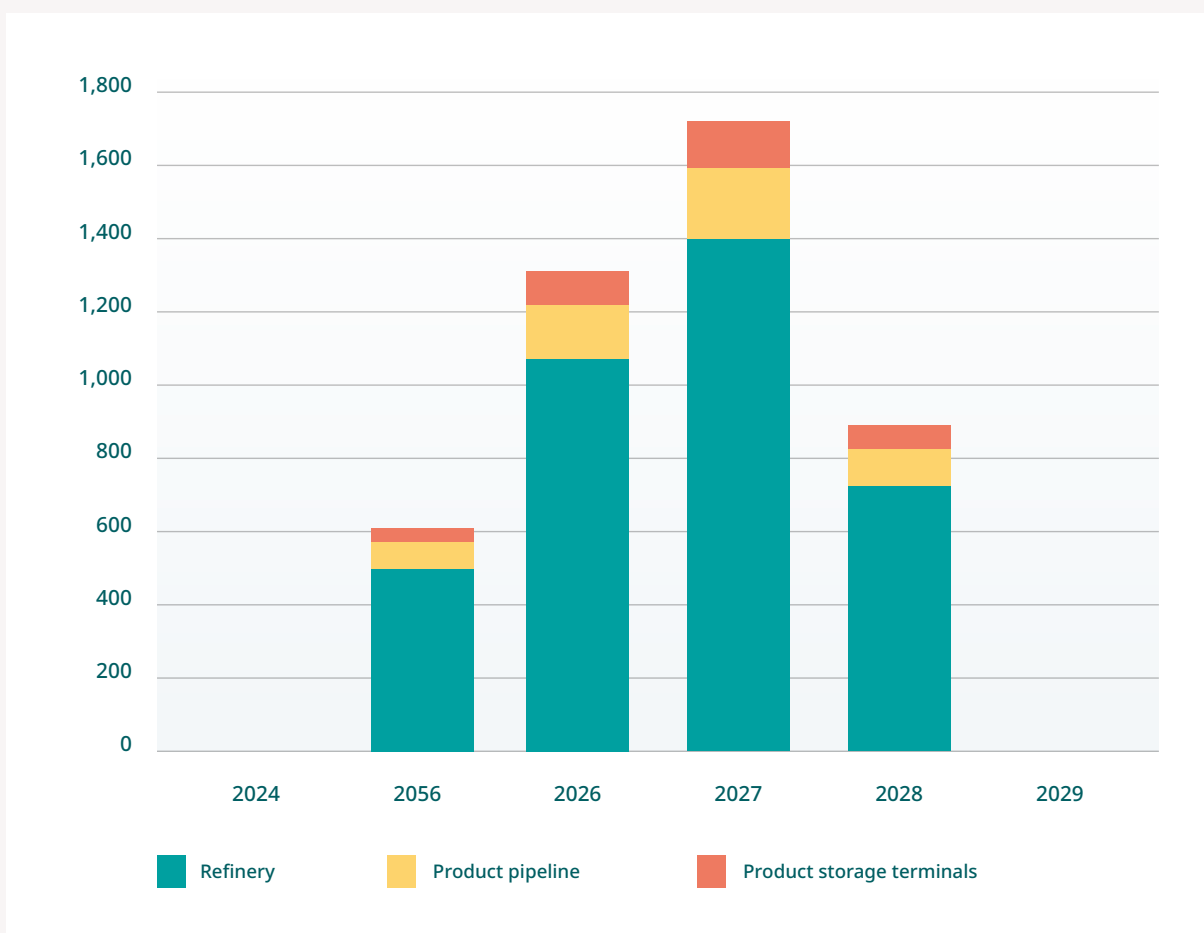
**Prices**

Our assumption of an average global crude price of $54 per barrel between 2025 and 2050 reflects Rystad Energy's base case. This is similar to the long-term forecast of many international oil companies of $55-65 per barrel.

We assumed this average global price of $54 per barrel translates into an average feedstock price for the refinery of $36 per barrel. This assumption is based on the feedstock price being the export netback price. We calculated the netback price by assuming that Uganda's crude is discounted by $1 per barrel compared to the Brent price, in line with the Stanbic study. We assumed transport costs of around $17 per barrel, which is also in line with the Stanbic study. This cost comprises a tariff of around $13 per barrel to transport the crude to the coast through EACOP and shipment costs of $4 per barrel.

The prices at which we assumed that the refinery can sell its petrol and diesel output are based on our calculation of the import parity price. We drew on Kenyan government data on the landing price of crude at the port of Mombasa, and the difference between the sales price in Mombasa and the sales price in Eldoret. This difference allowed us to estimate the transport cost per kilometre, which we used to estimate the transport cost from Mombasa to Kampala. Given that there is less data on the other products—jet fuel, LPG and HFO—we used the prices assumed by the Stanbic study.

**Feedstock volume**

We based our assumption of feedstock volume of 490 million barrels on the reserves that Rystad expect will be available from 2028 onwards.

**Consumption of petroleum products**

Our assumption of domestic consumption in 2021 of 41,000 bpd reflects the most recent data on Ugandan consumption. The Uganda Bureau of Statistics provides data on petrol, diesel, jet fuel and kerosene, but not LPG and HFO.[69] We therefore used EIA data.[70]

The reported volumes are similar for petrol, diesel, jet fuel and kerosene.

We based our projections of future domestic consumption on the data provided in the Energy Transition Plan.[71] The plan expects demand of around 105 kb/d in 2030, 145 kb/d in 2040 and 125 kb/d in 2050. We worked backwards using data provided on LPG and HFO demand to estimate the product mix in these years and then extrapolated to develop projections for the interim years.

The plan does not envisage HFO demand increasing significantly from existing sources. However, the government plans to convert all the HFO produced by the refinery into fertilizers. We assumed that the fertilizer plant starts operating in 2030, two years after the refinery starts operations. The plan expects LPG demand to increase to around 300 thousand tonnes (kt) in 2030, to 450 kt in 2040 and then fall to 350 kt in 2050.

We assumed the remaining demand is for petrol, diesel, jet fuel and kerosene and that the amounts demanded of each are in line with their share of the current mix.

We assumed that the refinery can export any surplus that the domestic market cannot consume in our baseline scenario.

**Taxation**

We took our assumption of corporate income tax of 30 percent and dividend withholding tax of 10 percent from the Stanbic study. Like this study, we are conservative and assumed that no other significant taxes are levied on the project.

The corporate income tax rate aligns with that in the Income Tax Act 1997, as amended. Our other assumptions about the administration of this tax also align with this act. For simplification purposes, we assumed that all capital spending is on plant and machinery.

The dividend withholding tax rate aligns with that in the Income Tax Rate for resident recipients but is lower than the rate of 15 percent for non-resident recipients.

### Ownership

We based our assumption that UNOC (or other government entities) will take an equity stake of 40 percent on government statements. This assumption aligns with the assumption in the Stanbic study. It is possible that other governments in the region will take part of this stake, but this is currently uncertain.

### Financing

We based our assumption that around 70 percent of the refinery's development costs will be financed by debt and around 30 percent will be financed by equity on government statements.[72] We assumed that the interest rate on this debt will be 8 percent, since this is the weighted average cost of capital for oil-related projects in emerging markets.[73]

We based our assumption that UNOC will pay up front for this equity and borrow to cover this cost on discussions with the government. We assumed that the government will not be able to secure a loan with significantly lower interest rate than the industry average.

### Government discount rate

Our assumption that the government has a discount rate of 8 percent in real terms, and therefore a discount rate of 10 percent in nominal terms after accounting for inflation of 2 percent, is typical for this type of analysis and is in line with the Stanbic study.

# Endnotes

1. This is Rystad Energy's base case scenario, as of 15 June 2023.

2. We did not model an upside for regional exports because our baseline entails the refinery exporting any surplus to the region.

3. UNOC's required funding turning negative indicates that UNOC does not require any additional funding during this period and has cash flow left over from the refinery even after repaying its loans.

4. More feedstock volume increases UNOC's profits over the refinery's lifetime but does not change the amount of funding required in the 2030s because its main effect is enabling the refinery to operate for longer. We did not model an upside for regional exports because our baseline entails the refinery exporting all its surplus supply to the region.

5. Less feedstock volume reduces UNOC's profits over the refinery's lifetime but does not change the amount of funding required in the 2030s because its main effect is shortening the duration of the refinery's operations.

6. The government expects to receive $66.4 billion in total from the Lake Albert project, averaging about $2.6 billion a year. The government's estimate is not in present value terms. We therefore compare it with the undiscounted amount of additional funding that we estimate that UNOC will need in the 2030s, which is $2.1 billion. See Peninah Aheebwa, "Uganda's Oil and Gas Projects: The Value at Stake," Petroleum Authority of Uganda, 13 September 2022, www.pau.go.ug/ugandas-oil-and-gas-projects-the-value-at-stake.

7. Ministry of Finance, Planning and Economic Development, *Budget Speech: Financial Year 2023/24*, 2023, www.finance.go.ug/sites/default/files/2023-06/Min%20of%20Finance%20Budget%20Speech%20FY2023-24.pdf.

8. US dollar amounts based on the exchange rate in June 2023 of UGX 3,708 per US dollar.

9. Rystad Energy UCube.

10. We recreated this map from a similar map on the website of Tullow Oil, which previously participated in the Lake Albert project: www.tullowoil.com/our-operations/africa/uganda

11. Members of the consortium include Nuovo Pignone International SRL (an Italian subsidiary of General Electric), Saipem Spa (also from Italy) and YAATRA Africa and Lionworks Group, both from Mauritius.

12. Offshore Technology, "Uganda in talks with potential partners for $4bn oil refinery," 14 August 2023, www.offshore-technology.com/news/uganda-talks-partners-refinery/.

13. Luke Patey, *Oil in Uganda: Hard bargaining and complex politics in East Africa* (Oxford Institute of Energy Studies, 2015), www.oxfordenergy.org/wpcms/wp-content/uploads/2015/10/WPM-601.pdf.

14. This study was shared with us by government officials.

15. Directorate of Petroleum, "Uganda Refinery Project," www.petroleum.go.ug/index.php/projects/1st-licensing-round/uganda-refinery-project.

16. Aheebwa, "Uganda's Oil and Gas Projects: The Value at Stake."

17. These estimates are not in present value terms and are therefore not directly comparable with the funding requirements for the government's equity stake that we report in this brief. See Aheebwa, "Uganda's Oil and Gas Projects: The Value at Stake."

18. Matthew Huxham, Muhammed Anwar, Eoin Strutt and David Nelson, *Understanding the impact of a low carbon transition on Uganda's planned oil industry* (Climate Policy Initiative, 2020), www.climatepolicyinitiative.org/publication/understanding-the-impact-of-a-low-carbon-transition-on-ugandas-plannedoil-industry.

19. Ed Reed, "Uganda refinery FEED to complete in August," Energy Voice, 22 June 2021, www.energyvoice.com/oilandgas/africa/refining-africa/331699/feed-uganda-refinery-august

20. Eni, *World Energy Review 2023*, 2023, www.eni.com/en-IT/global-energy-scenarios/world-energy-review.html.

21. UNOC, "Uganda Refinery Project," pbs.twimg.com/media/E4eK1pjXIAM_aW0?format=jpg&name=900x900.

22. William Clowes, "Dangote Refinery Complex in Nigeria Set to Cost $19 Billion," Bloomberg, 1 September 2021, www.bloomberg.com/news/articles/2021-09-01/dangote-refinery-complex-in-nigeria-set-to-cost-19-billion.

23. Saudi Aramco, "Saudi Aramco Signs Framework Agreement with ADNOC and MoU with Indian Consortium RRPCL to Jointly Pursue Ratnagiri Mega Refinery and Petrochemicals Complex on India's West Coast," 25 June 2018, www.aramco.com/en/news-media/news/2018/ratnagiri-mega-refinery.

24. David Mihalyi and Thomas Scurfield, *How Did Africa's Prospective Petroleum producers Fall Victim to the Presource Curse?* (The World Bank, 2020), openknowledge.worldbank.org/handle/10986/34470.

25. If any new projects do advance, the government should be able to secure their oil for the refinery if the economics work. Article 17.3 of the prevailing model production sharing agreement 2018, which will likely be used as a template for the arrangement with any new projects, states that Ugandan refineries would have right of first refusal on any oil production, as long as they pay the market price.

26. The Uganda Bureau of Statistics (UBOS) and U.S. Energy Information Administration (EIA) provide consumption data, though UBOS data is not available for all products. See UBOS, "Annual sales of selected petroleum products 2014-2021," accessed 15 October 2023, www.ubos.org/wp-content/uploads/statistics/Annual_sales_of_selected_petroleum_products_in_litres_E5_(2014_2021).xls, and EIA, "Petroleum and other liquids: Uganda," accessed 15 October 2023, www.eia.gov/international/data/world/petroleum-and-other-liquids/annual-refined-petroleum-products-consumption?pd=5&p=0000001001vg0000000000000000000000000000000000g&u=0&f=A&v=mapbubble&a=-&i=none&vo=value&t=C&g=none&l=249--234&s=94694400000&e=1640995200000&.

27. Ministry of Energy and Mineral Development and International Energy Agency (IEA), *Uganda Energy Transition Plan*, 2023, www.iea.org/reports/uganda-energy-transition-plan.

28. Based on the government's energy transition plan.

29. For example, the distance from Dar es Salaam to Bujumbura in Burundi is 1,500km but it would be only 900km from the Uganda refinery to Bujumbura. Similarly, the distance from Mombasa to Kisangani in the DRC is 2,300km but it would be only 1,100km from the Uganda refinery to Kisangani.

30. Sudans Post, "Juna receives first locally refinery oil from Bentiu refinery," 6 March 2021, www.sudanspost.com/juba-receives-first-locally-refined-oil-from-bentiu-refinery.

31. Charlie Mitchell, "Interview: South Sudan eyeing crude production, refinery-building blitz," S&P Global, 6 July 2023, www.spglobal.com/commodityinsights/en/market-insights/latest-news/oil/070623-interview-south-sudan-eyeing-crude-production-refinery-building-blitz.

32. CAR currently sources around 80 percent of its petroleum products from Brazzaville in the Republic of Congo, and the remaining 20 percent from Douala in Cameroon. While the Ugandan refinery will not be any closer to eastern CAR than Douala, it would be closer than Brazzaville. It could therefore offer cheaper products than the largest existing source of imports, depending on how much the Brazzaville route can take advantage of cheaper river transport and how much the likely ferry crossings on the Ugandan route impact costs. However, imports through the Brazzaville route appear to receive some protection from competition: Douala's imports are limited to a maximum 20 percent of petroleum product imports by law. Ugandan imports may also face legal constraints.

33. Prices for all countries but South Sudan are from globalpetrolprices.com. Due to a lack of data, the South Sudanese price is for petrol and was initially given in South Sudanese pounds (SSP). We used an exchange rate of 1 USD to 161 SSP—the exchange rate used by the IMF for 2019-2020. See FEWS NET, "South Sudan Price Bulletin," 2021, reliefweb.int/sites/reliefweb.int/files/resources/PB_SS_202111.pdf.

34. Articles 12.1 and 15.1 in the MPSA 1999, and Articles 15.1 and 18.1 in the PSA for Block 3A. The export netback price is the price that the upstream companies will receive for its crude exports. This price will be the global oil price minus any quality adjustments and the costs incurred transporting the crude to its buyer.

35. Sections 29-30.

36. We estimated this transport cost by comparing prices in Mombasa and prices in Eldoret. See Kenya Energy and Petroleum Regulatory Authority, "Public Notices," accessed 15 October 2023, www.epra.go.ke/category/public-notices.

37. This is based on 70 percent of the refinery's $4.5 billion cost being financed by debt, and 30 percent by equity.

38. Proportionate to the estimated construction cost. See Caroline Muriuki, "UNOC to invest $840m in oil and gas sector," The Exchange, 20 February 2020, theexchange.africa/industry-and-trade/unoc-to-invest-840m-in-oil-and-gas-sector.

39. We refer to the government's stake as UNOC's stake in this section, but the implications are the same if other state entities ultimately take a stake.

40. Ministry of Finance, *Budget Speech: Financial Year 2023/24*.

41. US dollar amounts based on the exchange rate in June 2023 of UGX 3,708 per US dollar.

42. NNPC, "Annual Statistics Bulletin 2019," 2020, nnpcgroup.com/NNPCDocuments/Annual%20Statistics%20Bulletin%E2%80%8B/2019%20ASB.pdf.

43. Oxford Business Group, "Ghana aims to meet domestic demand for refinery petrochemicals," oxfordbusinessgroup.com/analysis/moving-forward-refining-industry-attempts-overcome-challenges-meet-domestic-demand-and-establish.

44. Patey, *Oil in Uganda: Hard bargaining and complex politics in East Africa*.

45. Reuters, "Ivory Coast SIR refinery asks government to help with debts," 15 July 2016, www.reuters.com/article/ivorycoast-refinery-idUSL8N1A12R8.

46. EY, *Spotlight on Oil and Gas Megaprojects*, 2014, www.yumpu.com/en/document/read/45994813/ey-spotlight-on-oil-and-gas-megaprojects.

47. Given the estimated cost of the refinery has already increased from $4 billion to $4.5 billion, we model a further increase of 50.2 percent.

48. William Clowes, "Dangote Refinery Complex in Nigeria Set to Cost $19 Billion."

49. UNFCC, "COP28 Agreement Signals "Beginning of the End" of the Fossil Fuel Era," 13 December 2023, unfccc.int/news/cop28-agreement-signals-beginning-of-the-end-of-the-fossil-fuel-era

50. IEA, *Net Zero Roadmap: A Global Pathway to Keep the 1.5C Goal in Reach*, 2023

51. For more discussion on the future of oil demand, see David Manley, Andrea Furnaro and Patrick Heller, *Riskier Bets, Smaller Pockets: How National Oil Companies Are Spending Public Money Amid the Energy Transition* (NRGI, 2023), resourcegovernance.org/publications/riskier-bets-smaller-pockets-national-oil-companies-public-money-energy-transition.

52. See for Equinor, page 89 of Barbara Davidson and Rob Schuwerk, *Still Flying Blind: The Absence of Climate Risk in Financial Report* (Carbon Tracker, 2022), carbontracker.org/reports/still-flying-blind-the-absence-of-climate-risk-in-financial-reporting/; Ecopetrol, *Form 20-F for 2022*, 2023, www.ecopetrol.com.co/wps/portal/Home/en/investors/financial-results/sec-filings; Petrobras, *Sustainability Report 2022*, 2023, sustentabilidade.petrobras.com.br/documents/1449993/82e65618-3b63-674e-6355-451c4a635edb.

53. Rystad estimated this price scenario, using the IEA's demand projections. IEA, *World Energy Outlook 2022*, 2022, www.iea.org/reports/world-energy-outlook-2022.

54. Rystad estimated this price scenario, using the OPEC's demand projections. OPEC, *World Oil Outlook 2022*, 2022, www.opec.org/opec_web/static_files_project/media/downloads/WOO_2022.pdf.

55. International Monetary Fund, "Fossil Fuel Subsidies by Country and Fuel Database," accessed 15 November 2023, www.imf.org/-/media/Files/Topics/energy-subsidies/external-fuel-subsidies-template-2023-10-02.ashx.

56. If Uganda is still importing some petroleum products, it would likely need to subsidize the price of these imports in this scenario, either by capping the import price and compensating the importers or subsidizing the price more directly.

57. We calculated historical demand growth for each petroleum product. UBOS data is not available for all products. We therefore used EIA data for these calculations: www.eia.gov/international/data/world/petroleum-and-other-liquids/annual-refined-petroleum-products-consumption?pd=5&p=0000001001vg00000000000000000000000000000000g&u=0&f=A&v=mapbubble&a=-&i=none&vo=value&t=C&-g=none&l=249--234&s=94694400000&e=1640995200000&.

58. In our calculation of the LPG surplus, we considered the 3 kb/d of LPG that the Lake Albert project is expected to produce at its peak. The government expects oil production to peak in 2030 and then decline by an average 6 percent a year. We modeled LPG production following the same trajectory. See IEA, *Uganda 2023 Energy Policy Review*, 2023, www.iea.org/reports/uganda-2023, and Ministry of Energy and Mineral Development and IEA, *Uganda Energy Transition Plan*.

59. Keefer Douglas, "Kenya is emerging as the center of LPG demand growth in East Africa," S&P Global, 8 April 2021, www.spglobal.com/commodityinsights/en/ci/research-analysis/kenya-lpg-market-outlook.html.

60.  We calculated historical demand growth using EIA data, except for the DRC, which is from NORAD. (See Multiconsult, *Study on the Potential of Increased Use of LPG for Cooking in Developing Countries*, 2020, www.multiconsultgroup.com/assets/LPG-for-Cooking-in-Developing-Countries_Report-by-Multiconsult.pdf). Given DRC's consumption data is not disaggregated at the subnational level, we assumed that eastern DRC consumes half the country's total. We assumed that Uganda could only target northern Tanzania and western Kenya, given the rest of each country is likely to have access to cheaper alternative supplies. Given that Tanzania and Kenya's consumption data is not disaggregated at the subnational level, we assumed that northern Tanzania and western Kenya consume a third of their country's total. We assumed that South Sudan will not import any HFO given its own refinery currently produces sufficient HFO to meet demand and growth in consumption was minimal in the past decade.

61.  UNOC's required funding turning negative indicates that UNOC does not require any additional funding during this period and has cash flow left over from the refinery even after repaying its loans. More feedstock volume increases UNOC's profits over the refinery's lifetime but does not change the amount of funding required in the 2030s because its main effect is enabling the refinery to operate for longer. We did not model an upside for regional exports because our baseline entails the refinery exporting all its surplus supply to the region.

62.  Less feedstock volume reduces UNOC's profits over the refinery's lifetime but does not change the amount of funding required in the 2030s because its main effect is shortening the duration of the refinery's operations.

63.  The government expects to receive $66.4 billion in total from the Lake Albert project, averaging about $2.6 billion a year. See Aheebwa, "Uganda's Oil and Gas Projects: The Value at Stake." The government's estimate is not in present value terms. We therefore compare it with the undiscounted amount of additional funding that we estimate that UNOC will need in the 2030s, which is $2.3 billion.

64.  Ministry of Finance, *Budget Speech: Financial Year 2023/24*.

65.  US dollar amounts based on the exchange rate in June 2023 of UGX 3,708 per US dollar.

66.  This study was shared with us by government officials.

67.  Reed, "Uganda refinery FEED to complete in August."

68.  Directorate of Petroleum, "Uganda Refinery Project."

69.  UBOS, "Annual sales of selected petroleum products 2014-2021."

70.  EIA, "Petroleum and other liquids: Uganda."

71.  Ministry of Energy and Mineral Development and IEA, *Uganda Energy Transition Plan*.

72.  Directorate of Petroleum, "Uganda Refinery Project."

73.  Damodaram Online, "Cost of equity and capital," accessed 15 October 2023, view.officeapps.live.com/op/view.aspx?src=http%3A%2F%2Fpeople.stern.nyu.edu%2Fadamodar%2Fpc%2Fdatasets%2Fwaccemerg.xls&wdOrigin=BROWSELINK.

## About the authors

Paul Bagabo is a senior officer at the Natural Resource Governance Institute (NRGI) and leads its Uganda program. Thomas Scurfield is an Africa senior economic analyst at NRGI.

## About NRGI

The Natural Resource Governance Institute is an independent, non-profit organization that supports informed, inclusive decision-making about natural resources and the energy transition. We partner with reformers in government and civil society to design and implement just policies based on evidence and the priorities of citizens in resource-rich developing countries. Learn more at **www.resourcegovernance.org**

Natural Resource
Governance Institute