BITUMEN IN NIGERIA

Weighing the True Costs of Extraction

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NIGERIA

Bitumen in Nigeria - Weighing the True Costs of Extraction

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Printed by: Abeysteph, Abuja

Open pit surface mining of bitumen in Canada. This aerial image shows a massive open pit surface mine in Alberta, Canada. The foreground of the image shows the remnants of the boreal forest that was removed across the site. This middle ground of the image shows an active mining pit, while the background shows a tailing pond where the toxic wastes of the industry are processed. *(Image: Christina Milos 2015)*

The Future of Bitumen in Nigeria

Nigeria's bitumen, also known as oil sands, has not yet been exploited, but is a potential source of future revenue for Nigeria. Though **the social and environmental impacts of bitumen exploitation are anticipated to be serious and widespread**, there is limited public understanding of what exactly Nigerians can expect during and after development.

The development of Nigeria's bitumen poses **two important questions for resource governance** – (1) Is it truly in the best future interests of Nigeria to exploit bitumen? (2) If so, can Nigeria avoid repeating the mistakes made during oil development in the Niger Delta?

Fig. 1: Top 10 Countries with Bitumen and Extra-Heavy Oil Reserves. Nigeria ranks #6 globally in heavy oil and bitumen reserves, with an estimated 38 billion barrels of oil in place. While this remains a significant quantity of oil, it is substantially less than Canada and Venezuela, who hold the number one and two spots, respectively.

Bitumen and extra-heavy oils are unconventional oils that generally require additional processing to extract, transport, and refine into petroleum products than lighter, conventional oils. These additional steps typically incur additional costs - including investment costs as well as environmental and social costs. As conventional oil reserves decline, international companies are increasingly turning their attention towards unconventional oils to meet rising global demand for petroleum products.

Nigeria has an estimated 38 billion barrels of extra-heavy oil and bitumen reserves. While this amount is significant, and roughly equivalent to its present conventional oil reserves, this amount is much, much smaller than Canada's 2.4 trillion barrels and Venezuela's 2.1 trillion barrels[1], as shown in Figure 1, left. Geologists and engineers predict that Nigeria would use similar methods to extract bitumen as Canada, as the reserves are geologically similar. Throughout this publication, Canada is used as a reference point for understanding what the impacts of bitumen development in Nigeria could be.

1 USGS 2010

This publication seeks to raise awareness of the potential impacts of Nigerian bitumen development, and asks two questions : (1) Is it truly in the best future interests of Nigeria to exploit bitumen? (2) If so, can Nigeria avoid repeating the mistakes made during oil development in the Niger Delta? The intent of the publication is not to directly answer either question. Instead, the publication aims to inform stakeholders of the potential impacts of bitumen development. As Nigeria is looking beyond conventional oil production, it is an ideal time to reflect on the full range of impacts of development before reaching a final decision.

What is bitumen?

Bitumen is typically found surrounding sand grains encased in water and clay, which is where it gets its alternative name, oil sands. The bitumen must be removed from the sands and processed before it can be refined like conventional oil. Unlike the light, sweet crude found in the Niger Delta, extra-heavy oil and bitumen are viscous and dense. To convert this tar-like substance into lighter oil, called synthetic crude, that can be used for petroleum products such as petrol, the bitumen must be removed from the sands and processed. Figure 3, right, provides an overview of Nigeria's different types of oil, ranging from heavier unconventional oils to the light 'sweet' crude found in the Niger Delta.

How is bitumen extracted?

Nigeria's former Ministry of Mines and Steel Development has identified three potential methods of bitumen extraction in Nigeria: (1) small-scale surface mining (2) large-scale surface mining and (3) in-situ extraction (see Figure 2). The depth of bitumen below the surface determines which extraction type is possible. Both in-situ and large-scale surface mining operations are most

Fig. 2: Three Different Methods of Bitumen Extraction

	1. SMALL - SCALE SURFACE MINING	2. LARGE - SCALE SURFACE MINING	2. IN-SITU EXTRACTION
Bitumen Depth determines which extraction method(s) can be used	~0-20m	0 - 75m	75 - 400m
Development Timeframe years before oil production begins	3 years	15 years	5 years
Industrial Application determined in part by the scale of operation and market demand	Bitumen used as major component in road asphalt	Bitumen upgraded into synthetic crude oil	Bitumen upgraded into synthetic crude oil

Fig. 3: Oil Types Found in Nigeria

CONVENTIONAL OIL
Light and fluid, presently found in the Niger Delta region

Light Crude
37 billion barrels of crude oil in proven reserves, currently in production

Heavy Oil
Unknown reserves, exploration has found evidence of potential

Extra Heavy Oil
Unknown reserves, exploration has found evidence of potential

Bitumen/Oil Sands
Estimated 38 billion barrels of oil, unknown when/if production will commence

UNCONVENTIONAL OIL
Heavy and solid or semi-solid, requires additional energy and steps to process

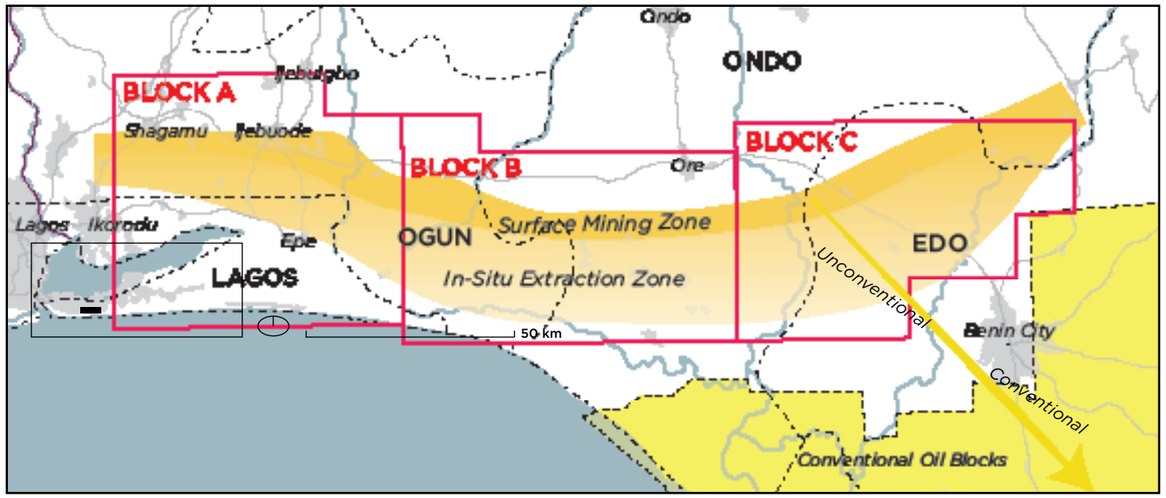


Fig. 4: Nigeria's Bitumen Belt. Bitumen is found across Lagos, Ogun, Ondo, and Edo States. Blocks A, B, and C, were first bid on in 2009.

likely to extract bitumen for upgrading into synthetic crude oil and/or other petroleum products. Bitumen from small-scale surface mining is likely to only be economical to use for paving roads. All three types of extraction are described in greater detail in the next sections.

In Nigeria, the approximate locations of the different types of oil are perhaps best explained as a gradient running north to south, with the heaviest oils generally in the north at the surface and the lightest in the south deep underground (see Figure 4). The bitumen region spans roughly four states - including Lagos, Ogun, Ondo, and Edo states. Much of the area where heavier forms of oil and bitumen can be found remain underexplored, so the precise locations of each resource are unknown. The most comprehensive bitumen study to date is *Geotechnical Investigations of the Ondo State Bituminous Sands* from 1974, and was led by Professor O.S. Adegoke of the Geological Consultancy Unit of the University of Ife. Few significant studies have been carried out since. The extents shown on the map in Figure 4, above, identify the zones where surface mining and in-situ mining are most likely to occur, according to Adegoke's and subsequent exploration work. Some geologists speculate this zone extends all the way to the conventional oil blocks further south.

The Impacts of Extraction

All three types of extraction, (1)small-scale surface mining (2) large-scale surface mining and (3)in-situ sub-surface mining have serious impacts, but these impacts vary widely. For example, while surface mining completely transforms the entire surface of the mining area, in-situ sub-surface extraction mostly takes place underground. Following this section, each method of extraction and the associated impacts are described in greater detail to help decision makers understand which method, if any, should be permitted in Nigeria.

Most environmental impacts will directly affect land-based livelihoods throughout Nigeria's bitumen belt. For each type of extraction, impacts are ranked from 'HIGH', or large-scale, significant impact to 'LOW', or smaller-scale, moderate impact (see Figure 5).

To date, Canada is the only country to exploit its bitumen resources on a widespread scale. For this reason, average impacts of Canadian bitumen projects are referenced throughout this brief in an attempt to gauge the potential environmental impacts of the industry in Nigeria. While bitumen development may bring many economic benefits, learning from the Canadian experience helps us to anticipate what environmental impacts Nigeria could expect if bitu-

Fig. 5: Environmental Impact Ranking. In the following sections, key environmental impacts are loosely ranked from 'high' (red), to medium (orange), to 'low' (yellow).

HIGH

MED

LOW

Small-Scale Surface Mining

Small-scale surface mining could transform Nigeria's landscape into a network of active and abandoned mining pits.

Small-scale surface mining is one of three major extraction methods identified by Nigeria's Ministry of Mines and Steel Development that could be employed for bitumen extraction in Nigeria. This method would be used in places where bitumen is close to the surface, at depths of 0-20m.

Small-scale surface mining requires the removal of all 'overburden', or vegetation and soil above the bitumen layer. Though extraction operations are expected to vary by location and operator, bitumen removal would most likely occur using trucks and shovels in a network of smaller pits. The bitumen would be transferred via road to processing facilities, where they could be used as a major component of road asphalt.

Communities with bitumen visible at the surface would be the most likely location for smaller scale mines. Many of these communities are already aware of their bitumen resources, due both to the visible bitumen at the surface as well as previous studies and tests carried out within the communities.

Of all three bitumen extraction scenarios, the least is known about the potential impacts and processes of small-scale mining. Depending on the infrastructure and investment in the mining operations, the size and number of pits could vary tremendously, in turn altering the scale of environmental impacts. Impacts shown here were based on examples of small-scale mining pits for other solid mineral mines.

KEY ENVIRONMENTAL IMPACTS

- CO_2 — Greenhouse Gas Emissions
- Contamination /Oil Spill
- SOIL LOSS — Topsoil Disturbance
- Water Usage
- Water Pollution
- Air Pollution
- Vegetation + Habitat Loss
- Vegetation + Habitat Fragmentation

Anticipated environmental impacts are shown above, ranked across the three types of extraction from 'high' (red), to 'medium' (orange), to 'low' (yellow).

Affected Communities

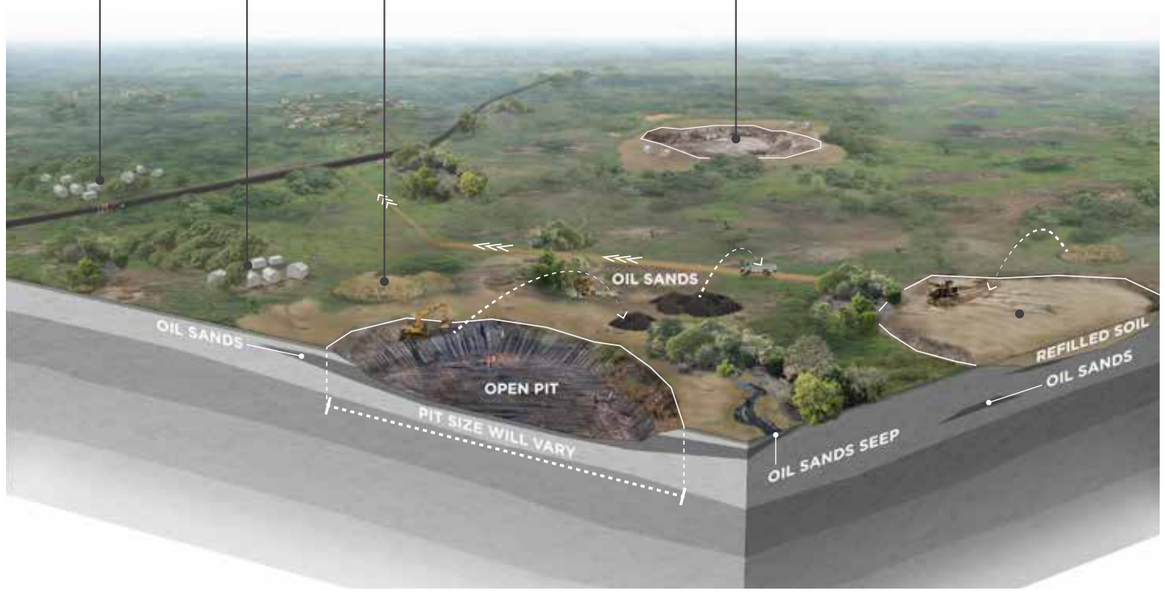
Open pit mines, even if they remain small, **alter the topography and drainage patterns** of the landscape. This can pollute local streams and contribute to flooding in adjacent communities.

Overburden

Overburden, or the vegetation and soil that are removed to access bitumen below the surface, must be removed and stored properly. Failure to do so means **the soil may lose productivity**.

Abandoned Pits

Abandoned, **unreclaimed pits pose numerous dangers to nearby residents**. As the pits fill with water, the standing water can be a breeding ground for mosquitos or waterborne illness. Unstable slopes can cause pit walls to collapse during heavy rains. Pits filled with water also pose a drowning risk to small children.



Large-Scale Surface Mining

KEY ENVIRONMENTAL IMPACTS

Anticipated environmental impacts are shown above, ranked across the three types of extraction from 'high' (red), to 'medium' (orange), to 'low' (yellow).

Large-scale surface mining could transform vast areas of Nigeria's landscape into mining pits and tailings ponds.

The first step of large-scale surface mining requires the removal of all 'overburden', or vegetation and soil above the oil sands layer 0-75m from the surface. The bituminous sands are mined using huge shovels and trucks and transported to a plant to separate the bitumen from the sand. A specialized hot water extraction process is used to create a slurry of bituminous sands and water, which is then processed so the bitumen rises to the surface out of the sands. Some of the water is separated out of the slurry and recycled, and the remaining clay, water, and sand, called tailings, are transported to on-site tailings ponds.

The bitumen is transported to the upgrading plant, where it is upgraded into synthetic crude oil that can be sent to refineries. Due in large part to the extra energy required to separate and upgrade the bitumen into synthetic crude oil, producing one barrel of oil from bitumen emits 3.2-4.5 times the amount of greenhouse gases as conventional oil.†

Of all three methods of extraction, large-scale surface mining most completely transforms the surface of the landscape. Figure 5, on the opposite page, describes the process of mining bitumen from exploration to processing and transportation. Reclamation of surface mining is particularly challenging. While there are some examples of sites that have been filled in and planted, the bitumen industry in Canada is still so new that it is unknown if these highly disturbed sites can be reclaimed as viable sites for wildlife or other uses.

Water Usage

In Canada's bitumen mining sites, the majority of water used in mines comes from the Athabasca river. For every 1 barrel of bitumen produced, 2.1 barrels of water are extracted from freshwater sources. Most ends up in massive tailings ponds.

Mining Pits

Before mining can begin, all topsoil and vegetation must be cleared from the site. On average, 9.4 ha of land is disturbed for every million barrels of bitumen produced.*

Tailings Ponds

Tailings, a frequently toxic byproduct of bitumen production, are stored in massive tailings ponds. In Canada, 1.5 barrels of tailings are produced for every barrel of bitumen.* It is unknown if these ponds can be reclaimed to a level sufficient to support functional ecosystems in the future.

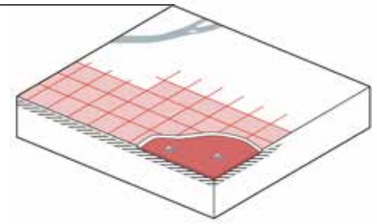
† National Energy Technology Laboratory, Development of Baseline Data and Analysis of Life Cycle Greenhouse Gas Emissions of-Based Fuels, DOE/NETL-2009/1346 (2008).

*Jennifer Grant, Eli Angen and Simon Dyer, Forecasting the impacts of oilsands expansion (Pembina Institute 2013).

Fig. 6: From Exploration to Production: the Large-Scale Surface Mining Process

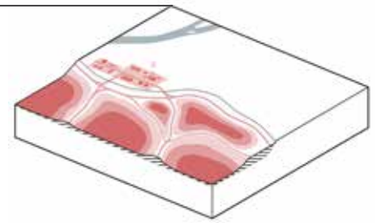
1. Exploration

During the exploration phase, a gridded network of cutlines is used by seismic sounding trucks to determine the depths of oil sands below the surface. At key locations, test well pads are also cleared and used to drill test wells that help determine bitumen depth with more accuracy.



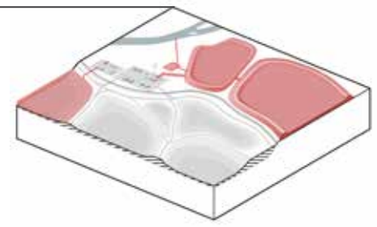
2. Construction

Preparing the site so mining can begin requires removing overburden, or topsoil, from areas that will be mined. In addition, facilities are built to extract the bitumen from the bituminous sands and dilute it with other lighter substances so it can be transported via pipeline for further processing.



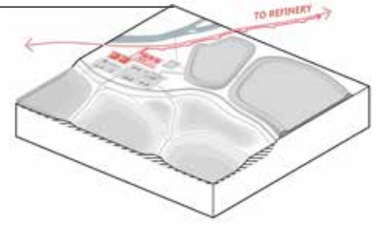
3. Tailings Management

Tailings are the byproducts left over after the bitumen is removed from the bituminous sands and sent on for processing. The byproducts include significant amounts of water, and so are stored in massive tailings ponds until heavier particles like sand settle out from the water.



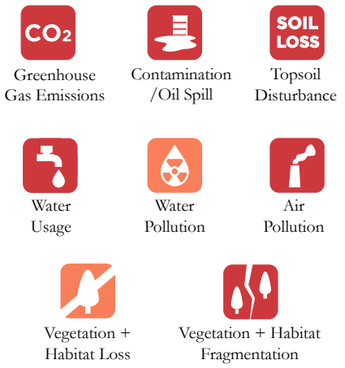
4. Processing and Transportation

Once bitumen has been extracted from the bituminous sands and diluted, it is transported, usually via pipeline, to refineries for further processing into synthetic crude or other petroleum products.



In-Situ Sub-Surface Extraction

KEY ENVIRONMENTAL IMPACTS



Anticipated environmental impacts are shown above, ranked across the three types of extraction from 'high' (red), to 'medium' (orange), to 'low' (yellow).

In-situ extraction could transform Nigeria's landscape into an extensive gridded network of bitumen infrastructure.

In-situ extraction involves drilling wells to extract bitumen 75-400+m below the surface. Canadian projects currently use two types of in-situ extraction methods: (1) Cyclic Steam Stimulation (CSS) and (2) Steam Assisted Gravity Drainage (SAGD). CSS injects hot steam into subsurface bitumen deposits to heat the bitumen until it flows to a production well and is pumped to the surface. SAGD requires two parallel wells through the bitumen deposit (see image below). Steam is pumped into the upper well to heat the bitumen, which then flows to the lower well and is pumped to the surface.

From the well the bitumen is transferred to the central processing facility where it is upgraded into synthetic crude oil. In-situ bitumen production requires an extensive network of roads, pipelines, and other disturbances across a large region. The total area of disturbed land is many times greater than that found on conventional oil and gas fields.*

Each step of the in-situ production process leaves different impacts and patterns on the landscape. Figure 6 on the opposite page is a diagram of how the site is transformed during the life-cycle of the project. As is clearly seen in the illustration below as well as Figure 6, one of the most significant visual and spatial impacts of in-situ development is the gridded network of lines and well-pads that must be cut into the existing landscape.

Water Usage

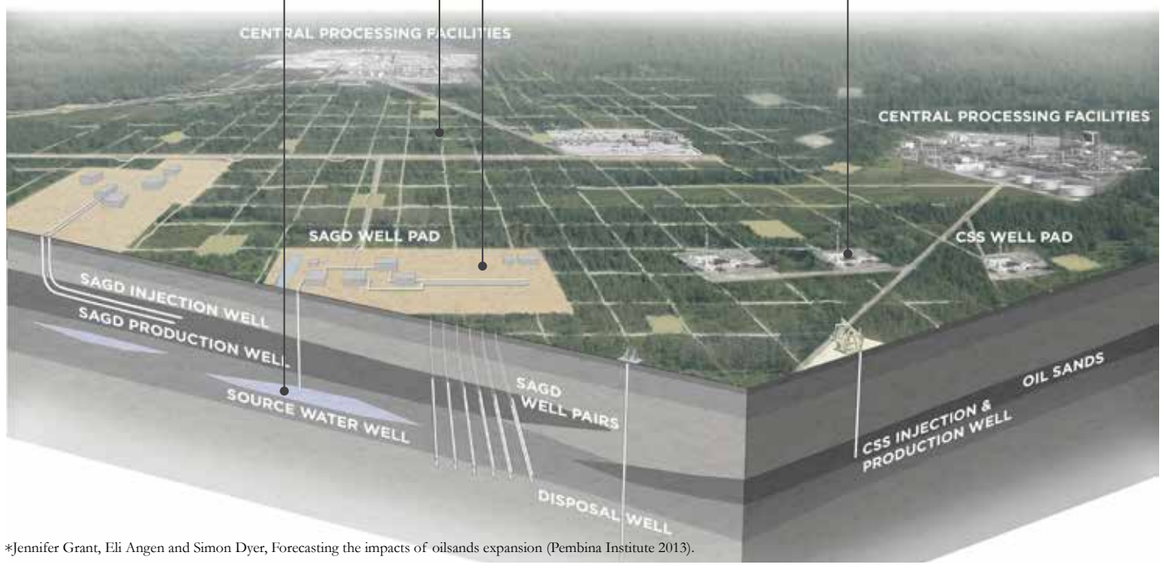
In Canada's in-situ operations, water comes from surface water bodies or from subsurface aquifers. **For every 1 barrel of bitumen produced, 1.1 barrels of water are extracted**.* Typically this water comes from a combination of fresh and saline/ brackish sources.

Exploration Grid

A grid of approximately 3m wide paths is cut into the landscape to allow a seismic sensing truck to drive down each line and better map the location of bitumen deposits. On average, **3.5 square kilometers of pipelines, roads, wells, and other disturbances** fragment each square kilometer of an bitumen lease.*

Well Pads

Well pads are clearings where well-heads are located and bitumen is drawn to the surface. On average, **1.4 ha of land is disturbed for every million barrels** of bitumen produced,* in part due to the network of well pad clearings across the landscape.

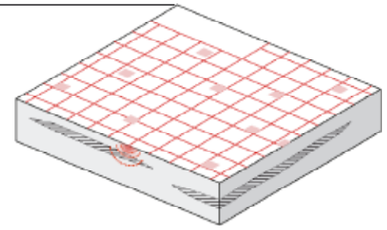


*Jennifer Grant, Eli Angen and Simon Dyer, Forecasting the impacts of oilsands expansion (Pembina Institute 2013).

Fig. 7: From Exploration to Production - the In-Situ Extraction Process

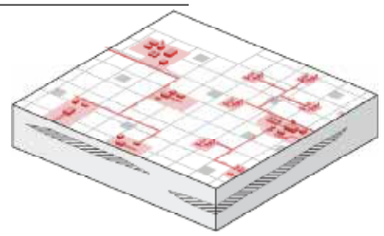
1. Exploration

During the exploration phase, a gridded network of cutlines is needed to deploy seismic sounding trucks that determine the depth of bitumen below the surface. At key locations, test well pads are also cleared and used to drill test wells that help determind bitumen depth with more accuracy.



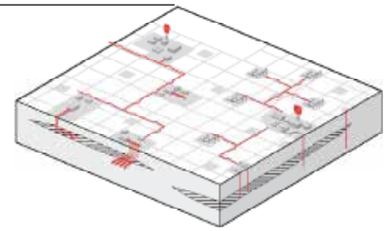
2. Construction

Once the ideal locations for extraction have been determined, in-situ production well-pads, either CSS or SAGD, are built. A network of pipelines is also constructed to transport water, steam, and bitumen around the extraction site.



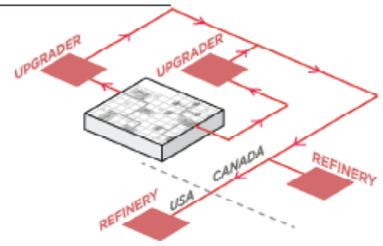
3. Production

During production, hot steam is pumped into the ground to heat the bitumen so it can be pumped to the surface. Once pumped to the surface, it is transported via pipeline to a processing facility.



4. Off-site Processing and Transportation

As in-situ production sites are typically spread out across the landscape, the bitumen is sent off-site for futher upgrading into heavy oil, and then finally are sent on to a refinery, where they become synthetic crude or other petroleum products.



The Present-Day Landscapes of Nigeria's Bitumen Belt

All land near or on top of Nigeria's bitumen belt is likely to be affected by the soil, water, and air pollution associated with extraction. **On sites where bitumen is located near the surface, all topsoil would be removed, making farming impossible.**

As bitumen lies beneath land with existing productive, income-generating uses, these **other productive uses would need to be relocated** in the event of bitumen production. This section features some of the present-day landscapes in Ondo State near Okitipupa, in the heart of the bitumen belt.

Livelihoods and landscapes of Nigeria's bitumen belt This page and opposite show just a few of the many livelihoods in the bitumen belt that rely on the land and water resources of the area. Major occupations include subsistence and cash-crop agriculture, fishing, logging, sand mining, and more. All of these industries would be affected by bitumen development. (All photos by Christina Milos, 2014)

"Our people are predominantly farmers and fishermen. They plant cocoa and food crops like cassava. We know that when they start the exploration it will affect our crops. It will affect both cash crops and food crops. It will kill the fishes in the rivers. It will affect our sources of livelihood."

High Chief Adesanya of Agbabu in Odigbo Local Government, as quoted in Before the Earth Bleeds (Ojo et al, 2004)

The Future Landscapes of Nigeria's Bitumen Belt?

Though Nigeria has a very different climate and a much larger population than Canada, Canada's extraction sites are anticipated to look very similar to those Nigeria would have. This section features images of Canada's bitumen landscapes, as a **glimpse of what Nigeria's landscape would look like** if bitumen exploitation occurs in the future.

In Canada, many of the areas used for bitumen were formerly public lands with few people living on them that are leased to companies for bitumen exploitation. **In Nigeria, the area is much more densely populated and actively used**, and thus many existing land uses would be threatened.

Canada's Bitumen Landscapes - Surface Mining
Opposite page: A site being prepared for surface mining. Prior to digging the large mining pit, all topsoil, called 'overburden' is removed and stored in linear piles.

This page, top: A bitumen processing facility for surface mining is shown inthe foreground, and a tailings pond in the background.

This page, bottom: An active open pit surface mine. If you look just to the right of the yellow mining truck in the lowest level of the mining pit, you can see what looks like a tiny white dot. This dot is a normal sized white pick-up truck. The size and scale of the mining sites is difficult to fully grasp through images alone, but seeing recognizable objects in the photos helps to clarify the gigantic scale of these extraction sites. (All photos, Christina Milos 2015)

Canada's Bitumen Landscapes - In-Situ Extraction The images on this page show the range of patterns that bitumen exploration leaves behind. Each picture shows seismic cut lines and test well pad sites, but on each site, the pattern is slightly different. (All images Christina Milos 2015)

Canada's Bitumen Landscapes - In-Situ Extraction Well-Pads These images show well-pads where bitumen is being extracted from deep underground. It is also possible to see the many pipelines taking steam to the site, and diluted bitumen away from the site for processing. (All images Christina Milos 2015)

Learning from the Niger Delta Oil Industry

The United Nations Environment Programme calls the Niger Delta "one of the most polluted places on earth". Coated in the oil extracted from beneath the delta, **the people who live in the watery landscapes of the Niger Delta have paid a terrible price** for the oil extracted from their lands.

The devastation wrought by the oil industry begs a critical question of decision makers looking to develop bitumen - **is it possible to avoid the mistakes Nigeria has made in the Niger Delta?** Is is possible for bitumen extraction, an industry with an arguably larger footprint than conventional oil, to have a less deadly impact?

The legacy of the Niger Delta oil industry is one of pollution, corruption, and unfulfilled promises. Oil producing communities continue to struggle with widespread pollution, poor health, poverty, and conflict.

Oil was discovered in commercial quantities by Shell-BP at Oloibiri in 1956. As oil revenues began to flow, communities expected to reap its rewards in the form of employment, development and infrastructure. While it is estimated that the Nigerian state has captured nearly 1 trillion dollars from the oil industry[1] since 1956, during that same period an estimated two million tons of oil in the form of hundreds of spills per year has coated communities, farmlands, and fisheries in the Niger Delta[2]. In perhaps one of the starkest examples of the 'resource curse', the communities living in the landscapes producing such immense wealth live in deep poverty, rooted in widespread pollution that has devasted typical livelihoods such as fishing and farming. Disillusioned with the ongoing pollution and corrupt patronage networks that permeate the creeks, residents have employed numerous tactics in an effort to seek justice. Organized protests against oil corporations like Shell, resulting in the military action that led to the death of leading activists in the 1990s, gave way to widespread militancy, crime, and kidnapping of oil workers. Today, an amnesty agreement is in place, however, this tenuous agreement is set to expire at the end of 2015, without a clear plan for what happens next, as of the time of this reports writing in December 2015.

In 2011, the United Nations Environment Programme released a report, *Environmental Assessment of Ogoniland,* documenting the widespread pollution that continues to threaten health and livelihoods in Ogoniland, nearly two decades after the oil industry ceased to operate in the area. According to a 2014 report by Amnesty International, both Shell and the Nigerian government have failed to follow through on the report's recommendations.[3] The government and oil industry have repeatedly failed to fulfill promises to redress greivances of the Niger Delta. This toxic cycle of pollution, corruption, and unfulfilled promises of restitution has continued for over fifty years. This leads us to a critical question - would bitumen exploitation result in a similar toxic cycle?

1. A Tale of Two Gulfs: Life, Death, and Dispossession Along Two Oil Frontier. Watts, Michael in American Quarterly. September 2012.
2. *Curbing Violence in Nigeria (III): Revisiting the Niger Delta.* International Crisis Group. 2015.
3. *No Progress: An Evaluation of the Implementation of UNEP's Environmental Assessment of Ogoniland, Three Years On.* Amnesty International. 2014.

Oil Slick Many sites in the Niger Delta are coated in slicks of oil that leave behind residue on people, animals, and plants. (Image credit : HOMEF)

"The inability of the Federal Government to formulate proactive policies regarding the socio-economic condition of the bitumen area will inevitably lead to a replication of the avoidable violence in the Niger Delta".

High Chief Kayode Iwakun
Chairman, Organisation of Bitumen Producing Areas (OBPA)
as quoted in *Before the Earth Bleeds* (Ojo et al, 2004)

Gas Flare Gas flaring and fires are a common site in the Niger Delta - spewing heat and air pollution into local communities. (Image credit: Israel Aloja)

Should Bitumen Stay in the Ground?

While only the public and decision makers can decide if bitumen should stay in the ground, **the decision to extract should not be taken lightly**. Historically, the Nigerian government has failed to manage oil revenues well and also failed to mitigate social and environmental impacts in the places where oil is extracted. There is little evidence that this lack of governing capacity has significantly changed.

Presently, many people living in the bitumen belt claim to welcome bitumen development, but this may be due to a lack of knowledge of the full extent of potential impacts. **Understanding the true costs of development requires better knowledge** of exactly how bitumen would transform the massive landscape of the bitumen belt.

The Governance Challenge

Many experts agree that the problems of the Niger Delta oil industry reflect a failure of governance, and there is little evidence to suggest bitumen development would yield a different outcome. Over the years, there have been a number of failed attempts by the Nigerian government to redress the grievances of the people of the Niger Delta. The government has created many institutions ostensibly responsible for enforcing oil industry regulations and promoting regional development in oil producing areas. These include the Department of Petroleum Resources (1970), the Niger Delta Development Commission (1999), the National Oil Spill Detection and Response Agency (2006), Ministry of Niger Delta Affairs (2008), and a number of state level development commissions. One 2007 NDDC effort much lauded by the government was the Niger Delta Regional Development Master Plan (NDRDMP). However, as of October 2013, the acting managing director reported that only 37% of proposed projects had been completed since 2000[1]. Dysfunctional institutions like the NDDC often suffer from insufficient funding and overlapping mandates, resulting in piecemeal efforts with little chance of having a lasting impact. The weak governance structures currently in place for oil development provide little reassurance that governance of bitumen development would be any different.

In addition to institutional dysfunction, the existing legal framework governing the rights of Nigerians to their local land and resources make it difficult to ensure that the people who are most affected by resource development have a say in the development process. According to the Land Use Decree of 1978, all land is vested in the state. Additional laws stipulate that all mineral resources, including oil and bitumen, fall under federal control. The result of this legal framework is that the state has the right to appropriate land for industrial development, and the federal government has the right to the revenues derived from that land, leaving little direct control to local communities. While there are legal provisions to compensate people whose land is taken for resource development, these compensation mechanisms have proved highly inadequate not only in the case of the Niger Delta, but also throughout the country when land has been claimed by the state for development projects. Without adequate legal protection and compensation for potential loss of land and livelihoods, there remains an extremely high risk communities will lose their land and livelihoods to bitumen development as well as fail to benefit from future revenue.

1. "Our Journey to Greatness", NDDC News (monthly newsletter), October 2013.

The Technical Challenge

As an industry, bitumen extraction in its present form is relatively new. This means that the long-term impacts of extraction are still being studied and are poorly understood. In Canada, communities living downstream from water bodies polluted by bitumen waste water have been found to have significantly higher rates of cancers, and can often no longer eat the fish and animals in these polluted areas. In addition, as much of the land in Canada is still undergoing extraction, little is known about the long term potential and expense for remediation of contaminated sites. In Nigeria, the government and oil industry struggle to remediate sites despite having the technical knowledge to do so - for the oil sands industry, this knowledge is still being developed. Is Nigeria, with a long history of failing to enforce regulations and a population who depends largely on the health of the environment for their livelihood, really the best place for the oil sands industry to test out remediation techniques which may or may not be effective?

The Global Challenge

With 17 percent higher greenhouse gas emissions than conventional oil extraction, bitumen is often regarded as one of the dirtiest fossil fuel sources[2]. There is a consensus among scientists that greenhouse gas emissions are the primary drivers of climate change and its myriad, largely negative, impacts. Nigeria is already experiencing the impacts of climate change, including drought in northern parts of the country and flooding in the south[3]. Thinkers such as renowned climate scientist James Hansen argue that exploiting particularly dirty fossil fuels such as bitumen will speed global climate change towards a tipping point that will trigger catastrophic global impacts[4].

2. Canadian Oil Sands: Life-Cycle Assessments of Greenhouse Gas Emissions. Congressional Research Service. 2014.

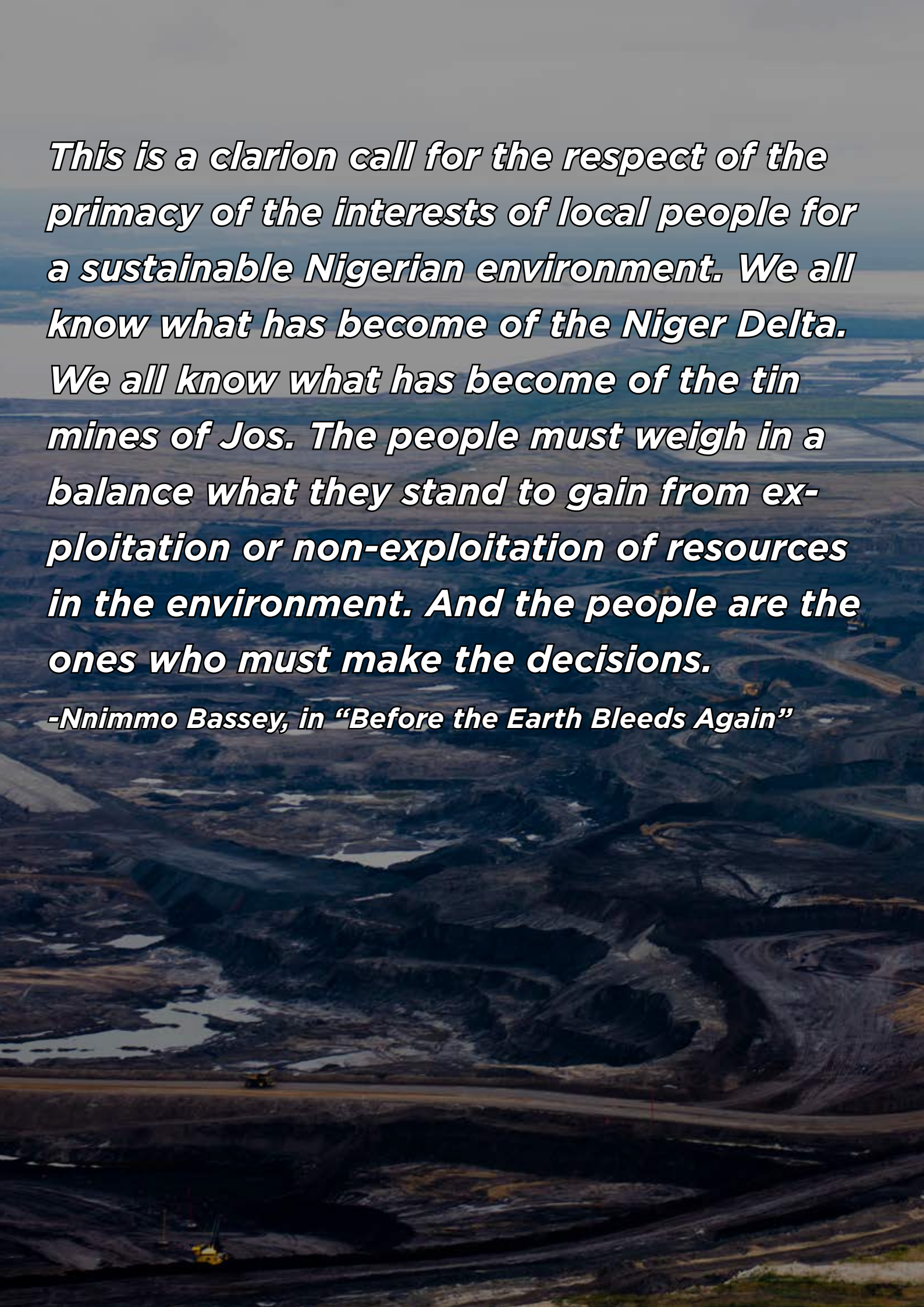
3. Nigeria's Intended Nationally Determined Contribution. The Federal Government of Nigeria. in preparation for Adoption of Climate Change Agreement at the Paris Conference on Climate Change in December, 2015.

Alternative Development Paths

Until dramatic improvements in governance hold industries accountable for their actions and ensure communities are adequately compensated for land and livelihoods lost to industrial development, any promises that bitumen exploitation would yield different results than the Niger Delta ring hollow. The governance, technical, and global challenges to bitumen development outlined in this final section are intended to encourage the reader to weigh the true costs of bitumen extraction.

With such a high risk for potentially devastating impacts, it would be wise for residents of the bitumen belt to consider other potential investment paths. Much of the bitumen belt features rich farmland with great potential for agriculture. Investing in farming implements, inputs, infrastructure, and agroprocessing could help improve yields and increase profits in the existing agricultural industry. In addition, the area boasts rich forest resources which could be sustainably harvested for timber production. Finally, the bitumen belt features other minerals with a much smaller extraction footprint, including ball clay, kaolin, salt, and silica. Silica is a critical material needed for the production of solar panels. While silica mining is still an extractive industry with environmental impacts, the footprint is significantly smaller than bitumen extraction, and it could potentially support the emergence of a solar panel industry and Nigeria's transition to renewable energy. These suggested alternatives to bitumen development are just a few of the many development paths available. Regardless of the path that the people of Nigeria's bitumen belt embark on, it is critical that the people living in the belt are the ones driving the decision making process, and only reach a decision after fully understanding and carefully weighing the true costs of bitumen extraction.

4. "How much will tar sands oil add to global warming?". Scientific American. January 23, 2013.



This is a clarion call for the respect of the primacy of the interests of local people for a sustainable Nigerian environment. We all know what has become of the Niger Delta. We all know what has become of the tin mines of Jos. The people must weigh in a balance what they stand to gain from exploitation or non-exploitation of resources in the environment. And the people are the ones who must make the decisions.

-Nnimmo Bassey, in "Before the Earth Bleeds Again"