

Sub-Saharan Africa: Unconventional Oil Resources

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Resources of bitumen or extra-heavy oil are reportedly present in many countries in Sub-Saharan Africa: Republic of Congo, Madagascar, Nigeria, Angola, and elsewhere.

Some of these countries are now in early development planning phases of the exploitation of these resources with the help of European companies and their technological know-how, including BP, ENI, and Total.

Madagascar

The unconventional oil deposit in Madagascar is located on the Western coast of the island in *Melaky* region. Tar sands resources are found in the *Bemolanga* field, and extra heavy oil resources are being explored at the *Tsimiroro* field. Both fields are approximately 70km² in area. The bitumen content ranges from about 3.5 to approximately 11.0 weight percent, with the effective mineable area at an average of 5.5 weight percent bitumen in the ore (this bitumen content is approximately half of that found in the Canadian tar sands).

The *Bemolanga* block is a 5,463 km² in area and holds a best estimate of over 16.5 billion barrels in place with around 10 billion barrels recoverable. Madagascar Oil, a Houston-based independent company and currently the largest onshore oil operator in the country, estimates that at full production the site could produce 180,000 barrels per day over 30 years. The depth of the *Bemolanga* field is on average 15 metres below the surface; that is close enough to the surface for opencast mining operations (Madagascar Oil, 2009). Given the resource is likely to be mined, exploration and operational costs would probably be lower than in Canada. At an oil price above \$80 per barrel, Total, the operator, has stated that *Bemolanga* could produce 200 kb/d, with mining technology (IEA, World Energy Outlook, 2010).

The *Bemolanga* field could also be more energy - and carbon - intensive than equivalent projects in Alberta. Because the material's bitumen content is lower it would be harder to separate. However, it is thought that a higher proportion of the oil in *Bemolanga* could be recovered than in Alberta, so this would reduce the comparative energy intensity.

Tsimiroro is the most advanced project in Madagascar and holds a best estimate of almost 1 billion barrels (Madagascar Oil, 2009). An independent estimate of the *Tsimiroro* field, however, stated it at 3.5 billion barrels in place, with 900 million barrels recoverable. The depth of the field is between 40 and 300 metres below the surface. This means the oil will need to be extracted through in situ steam-based production techniques as in the Canadian tar sands, requiring significant water and energy resources. It could produce 90,000 barrels a day for 30-40 years and breaks even at just under \$50 a barrel.

The *Tsimiroro* field is 100% owned by Madagascar Oil, while the *Bemolanga* (tar sands) field is 60% owned by Total and 40% by Madagascar Oil.

Total expects to start producing heavy oil at *Bemolanga* by 2019, while Madagascar Oil is aiming at production by 2015 on the *Tsimiroro* field¹. Overall, under the terms of the production sharing contracts, Madagascar is set to receive just 4% of the oil revenue derived from the projects after a proposed thirty-year commercial exploitation.

Higher oil prices make the projects viable and the government is impatient to get production going. An extremely generous tax regime to entice Madagascar Oil and its French partner, Total, has been designed. Operators are being offered 99% of the revenue for the first 10 years while they recoup their costs, with just 1% for the government².

Republic of Congo

The bitumen resource in the Republic of Congo is estimated, by the Italian Company ENI, at least 500 million barrels risked, with the potential for discovering up to 2.5 billion barrels (unrisked)³. The huge 1,790 km² tar sands concession covers two areas, *Tchikatanga* and *Tchikatanga-Makola*, in the south of the country near the oil capital of Pointe-Noire. The huge area stretches from the border with the Angolan exclave of Cabinda to the *Conakouati-Douli* national park bordering Gabon. The resources are deep, in the 100-200 metre range, and so will require in situ technology to develop.

In 2008, ENI and the Republic of Congo Energy Ministry signed draft agreements to invest in tar sands in the country⁴.

Nigeria

Bitumen was first discovered in Nigeria in 1900 and there have been several exploration efforts over the past fifty years. Nigeria's bitumen belt is located in

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the southwest of the country, stretching along 120 km of coastline, straddling the states of *Ondo*, *Ogun*, and *Edo* and the resource is potentially much larger than in Madagascar or Congo. Nigeria's bitumen is estimated at 27 billion barrels of oil equivalent, although proven reserves are only 1.1 billion barrels⁵.

In 2002, Conoco Energy Nigeria carried out a pre-feasibility and scoping study of the bitumen belt and between 2001 and 2008, 40 core holes were drilled. In 2007, the country's new Mining Act created an "enabling environment," including corporate-friendly fiscal and favourable tax regimes to attract foreign direct investment.

Exploitation of Nigeria's tar sands deposits appears to be at a standstill since 2009. However, given the historical level of investment in conventional oil by multinational oil companies in Nigeria, it seems likely that the unconventional resource will be next for exploitation (EU commission, 2010).

Research has also shown that the southeastern region of Nigeria possesses a low-sulphur oil shale deposit. The reserve has been estimated to be of the order of 5.76 billion tonnes with a recoverable hydrocarbon reserve of 1.7 billion barrels.

Democratic Republic of Congo (DRC)

Tar sands in this country are present in several regions including the *Lake Tanganyika Graben* in the east as well as in the western Congo bordering the *Cabinda* province of Angola.

It has 300 million barrels in place of tar sands with a proven reserve value of 30 million barrels. For bituminous, the concession areas total approximately 400 km² in the *Bas Congo* western coastal basin.

In 2009, ENI announced an agreement with the DRC government to carry out feasibility studies for the development of non-conventional hydrocarbons, in the eastern areas of the country.

Ethiopia

Ethiopia has 3.89 billion tonnes of oil shale located in *Tigray* province, which borders Eritrea. However, there is currently a lack of interest in exploring the shale oil, possibly due to a previous dispute over the area which led to conflict between Ethiopia and Eritrea. This conflict continues.

In addition to the region of *Tigray*, there is a smaller deposit of 100-120 million tonnes at the Delbi Moyen coal development, southwest of Addis Ababa, although Ethiopia has plans to utilise this for manufacturing urea fertiliser (World Energy Council, 2007).

Angola

Angola has two natural bitumen deposits located in Bengo province which surrounds the capital, *Luanda*. They contain 4.65 billion barrels of oil in place and 465 million barrels of reserves of tar sands oil. There are currently no plans to develop these deposits, but they will become a more attractive resource once Angola's traditional oil resources start to dwindle (World Energy Council, 2007).

Environmental and Social Issues of Unconventional Oil Development in Africa

Given the particularly carbon-intensive techniques associated with developing unconventional resources, the opportunity for environmental damage is high.

Tar sands production has a very high carbon footprint, on average producing one barrel emits between 17-23% more greenhouse gases (GHGs), depending on the techniques used for production, than a barrel of conventional oil⁶.

It is the fastest growing source of emissions in Canada, challenging the country's Kyoto commitments. Thus, tar sands production poses unquantifiable environmental and social risks to local environments and communities. The expansion of unconventional oil in Africa will likely include countries with weak governance frameworks that are particularly vulnerable to the social and environmental damage associated with careless fossil fuel extraction. In addition, projects are unfortunately located on vulnerable areas such as forests or near residential areas.

In Nigeria the *Ikale* region in *Ondo* state is likely to be one of the most affected areas if tar sands production goes ahead, with displacement of local populations and impacts on the area's fragile eco-systems possible. Given the history of violence stemming from the social and political conflict generated by oil production in the Delta, tar sands development in Nigeria will be particularly sensitive in both social and environmental terms.

Congo has important forest resources (about two thirds of the country is forested) providing livelihoods for local communities and assisting climate protection. However, ENI's tar sands zone development covers between 50 to 70 percent of Congolese rainforest and other environmentally sensitive areas and would thus threaten nearby communities and local ecosystems⁷.

The tar sands concession in Congo includes savannah, tropical rainforest and wetlands that are home

to endangered bird species. It borders a national park described by the government as the “most ecologically diverse habitat in Congo”⁸ and encroaches on the UNESCO-recognised *Dimonika* biosphere. There is concern about the lack of information and lack of understanding about the project on the part of local communities and also, given the limited transparency in the country, that the government may not have an accurate understanding of its potential environmental and social impacts.

Melaky in Madagascar is home to the Tsingy de Bemaraha Nature Reserve, listed as a UNESCO World Heritage Site in 1990 due to its unique geography, preserved mangrove forests and wild bird and lemur populations. Around half of the reserve is designated as a “strict” or “integral” reserve, meaning no development or tourism is allowed.

Environmental regulations are unlikely to be onerous in an island famed for its biodiversity. However, it is vital that any tar sands development starts from the set up of environmental regulation policy. Indeed, the first bitumen development projects in Madagascar are likely to use more energy than the world’s only other existing oil sands projects, in Alberta, Canada. The *Tsimiroro* project will use an in-situ method, which involves injecting vast amounts of steam into the ground to heat up the oil and allow it to surface. According to industry estimates, to extract five barrels of oil at *Tsimiroro* will burn up one barrel of oil.

Conclusion

One new frontier for tar sands development is Africa, a region especially vulnerable to environmental impacts. Tar sands production in Canada has resulted in some damage to local communities and the environment. If this occurs in a country with a well-developed legislative framework and established democratic institutions, the consequences of such investments could be devastating for poor communities with weaker political and environmental governance frameworks.

Footnotes

¹ “Madagascar replaces top oil, mines official”, Reuters, 8 September 2011. <http://af.reuters.com/article/commoditiesNews>

² Platform, a campaign group that monitors oil companies’ activities around the world, said the offer was “unheard of”.

³ Sarah Wykes, 2009. Energy Futures? Eni’s investments in tar sands and palm oil in the Congo Basin, Heinrich Boell Foundation, pp. 7, 18, 20-21, <http://www.boell.de/ecology/climate-energy-7775.html>

⁴ Eni, 2008. Eni–Agreement for exploration and exploitation of non-conventional oil in tar sands, 3 April, <http://www.eni.com/attachments/media/press-release/2008/05/congo-19may-08- eng/ProjectTarSandsIng.pdf>; Eni, 2008. Eni and the Republic of Congo launch a new integrated model of cooperation, 19 May, http://www.eni.com/en_IT/media/press-releases/2008/05/19-05- 2008-integrated-model-congo.shtml?menu2=media-archive&menu3=press-releases

⁵ Nigerian Ministry of Mines, 2009.

⁶ UK Energy Research Centre, Global Oil Depletion: An Assessment of the Evidence of a Near-term Peak in Global Oil Production, October 8, of the Evidence of a Near-term Peak in Global Oil Production, October 8, 2009, <http://www.ukerc.ac.uk/support/Global%20Oil%20Depletion>

⁷ Reports from the NGO’s Heinrich Böll Stiftung (2009) and RepRisk (2009).

⁸ Republic of Congo, 2011. Website of the Permanent Mission of the Republic of Congo to the UN, “Congo’s Biodiversity”.

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