

We Need a Delta!

Pit Arnold

Niger Delta
crude oil
greek letter delta
pore-scale physics
oil pollution
renewable energy

The growth and development of our modern society are strongly connected to the discovery and mass production of crude oil. Each variant of crude oil has a unique composition and physical characteristics, making it an enthralling and multifaceted substance. This intricate nature seems to have percolated into our contemporary relationship with oil. It paradoxically straddles between being an indispensable cornerstone of our daily existence and an emblematic harbinger of environmental degradation.

In contrast, the narrative of the Niger Delta, as portrayed by George Osodi, paints a divergent portrait of the relationship with crude oil. Despite the abundance of reserves in Nigeria, the riches have trickled down to only a tiny sliver of the population. In the early chapters of oil production, the locals were swathed in promises of affluence, which largely proved to be ephemeral. As the hands of time moved, skepticism and aversion, especially among the elders, began to surge against oil production. Fast forward to the present, and a burgeoning number of youths perceive it as a gateway to entrepreneurship. They engage in illegal siphoning of oil from pipelines and carry out makeshift refining operations deep within the forest. While this practice turns a blind eye to the ecological calamities it spawns, it ironically bestows the once-promised prosperity upon those who dabble in the clandestine production and sale of gasoline, with some even forsaking conventional employment.

In scientific parlance, the Greek letter delta symbolizes change and, in this narrative, it poignantly illustrates the stark divergence in the associations and transformations wrought by oil between the Western world and the residents of the Niger Delta.

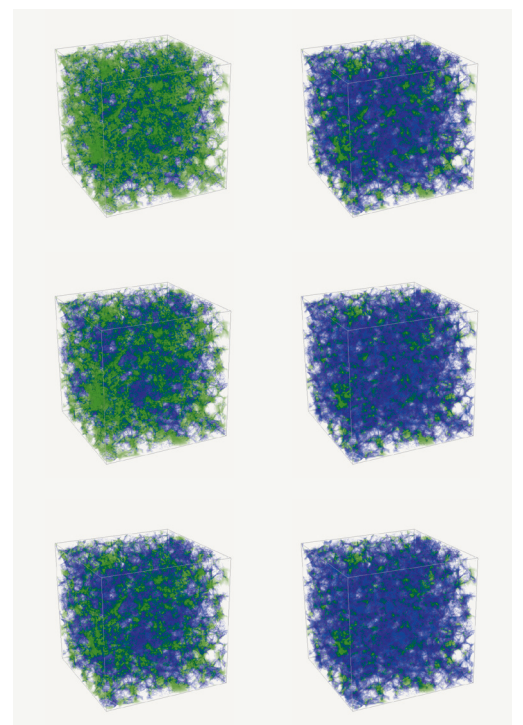


George Osodi
We Crude, 2016

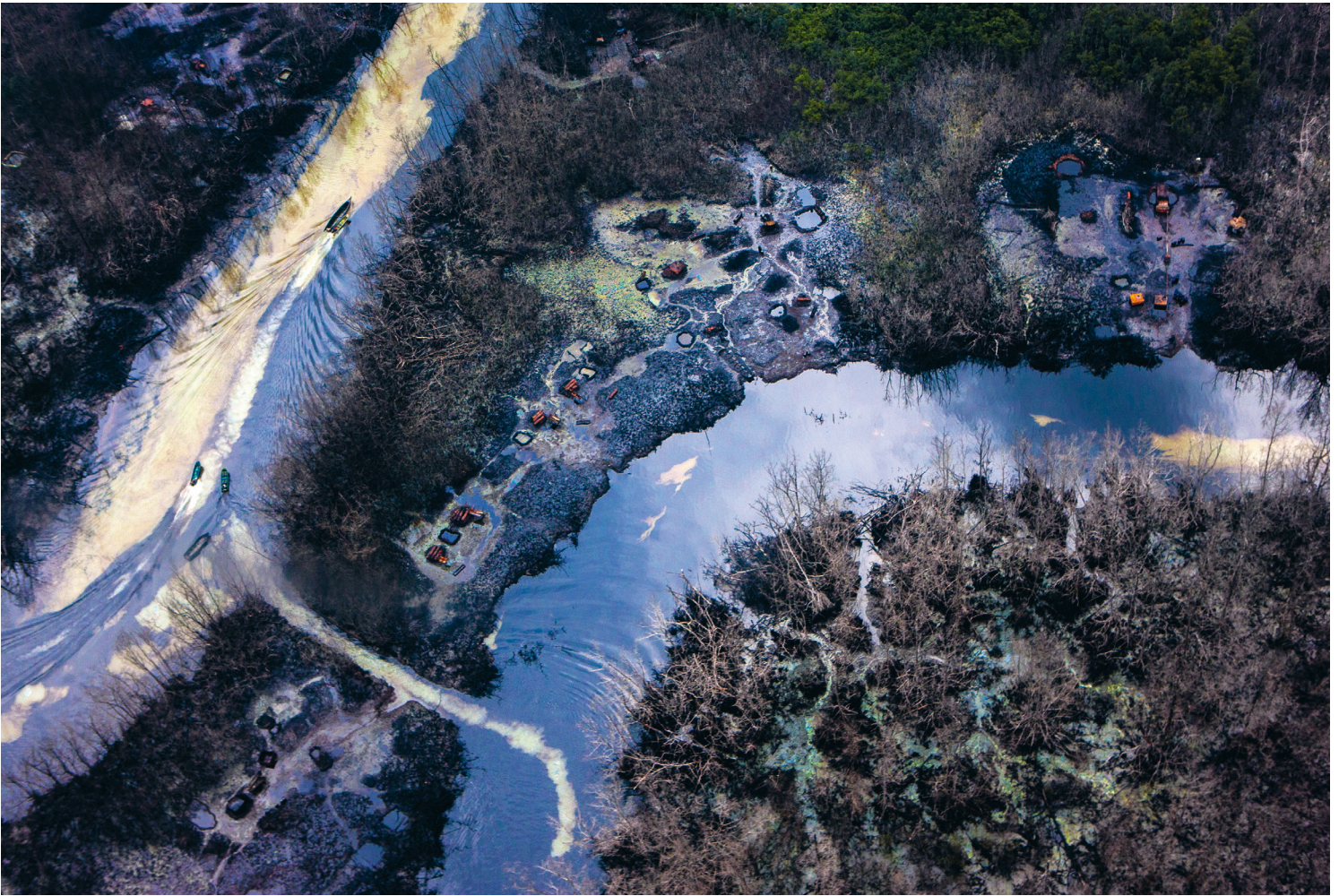
Change has also unfurled its wings among the delta's inhabitants, where oil is now perceived as a conduit to financial ascendancy. Meanwhile, the global narrative is shifting, with a growing yearning to break the shackles of oil dependence. Austria serves as a role model in the realm of renewable energy production, with approximately 80 percent¹ of its electricity being harnessed from renewables such as wind, solar, biomass, and hydro energy.

However, a deeper inspection of the nation's overall energy consumption, inclusive of electricity, reveals that fossil fuels—oil, gas, and coal—still hold dominion over two-thirds of the energy portfolio.

This exemplifies a conundrum: a mere pivot towards renewables is insufficient in the face of colossal energy demands. It is an incontrovertible truth that the specter of energy consumption is an exigent issue that demands immediate attention and cannot be casually dismissed. Additionally, it is imperative to recognize that numerous regions across the globe are still in the crucible of development, ardently pursuing economic growth. In 2020, Scott W. Tinker, director of the Bureau of Economic Geology at the University of Texas at Austin, made a poignant remark: "I work in the oil and gas industry and I lift the world from poverty. What do you do?" While audacious, this statement bears an important truth: access to energy is a catalyst for affluence and, historically, fossil fuels have offered the most economical avenue for energy production. The question that looms large is: what is the true cost of this "inexpensive energy"? The repercussions are manifest in the toll taken on the



Displacement of oil (green) by water (blue) over time in a porous medium.



George Osodi
Oil Theft, 2013

environment. The plundering of nature is incalculable, with every passing day compounding the damage. Osodi's portrayal of the Niger Delta is but a microcosm of the pervasive destruction. Additionally, the insidious effects of daily CO₂ emissions, stemming from energy consumption, might not be as immediately discernible, but pose a more formidable menace.

The challenge lies in the unseen. In the realm of pore-scale physics, our resolution is finite, yet wetting phenomena, crucial to understanding porous media flow, span a broad range of scales. The environmental repercussions of illegal refining processes extend far beyond what a single overhead image reveals. The oil seeps into porous ground, resulting in a lasting formation of oil-filled soils. Even after surface films are washed away and years of rainfall, remnants of oil persist on mineral surfaces within the ground, potentially leading to a change in the wetting state of the soil.

While our goal is to comprehend the mechanisms driving displacement—such as water replacing oil in a porous medium, leading to optimized production—this is a predicament one would prefer to sidestep in the Niger Delta. However, since it is already there, the transport of oil by water depends on the flow velocity of the river, which in turn relies on the river's flow path. This might seem obvious on the surface, but it also hinges on the composition of the riverbed. Similarly, the flow in porous media is contingent on its topology and can only be accurately modeled with three-dimensional information. As in a river, there are faster and slower flow paths, introducing intricacies to the transport dynamics.

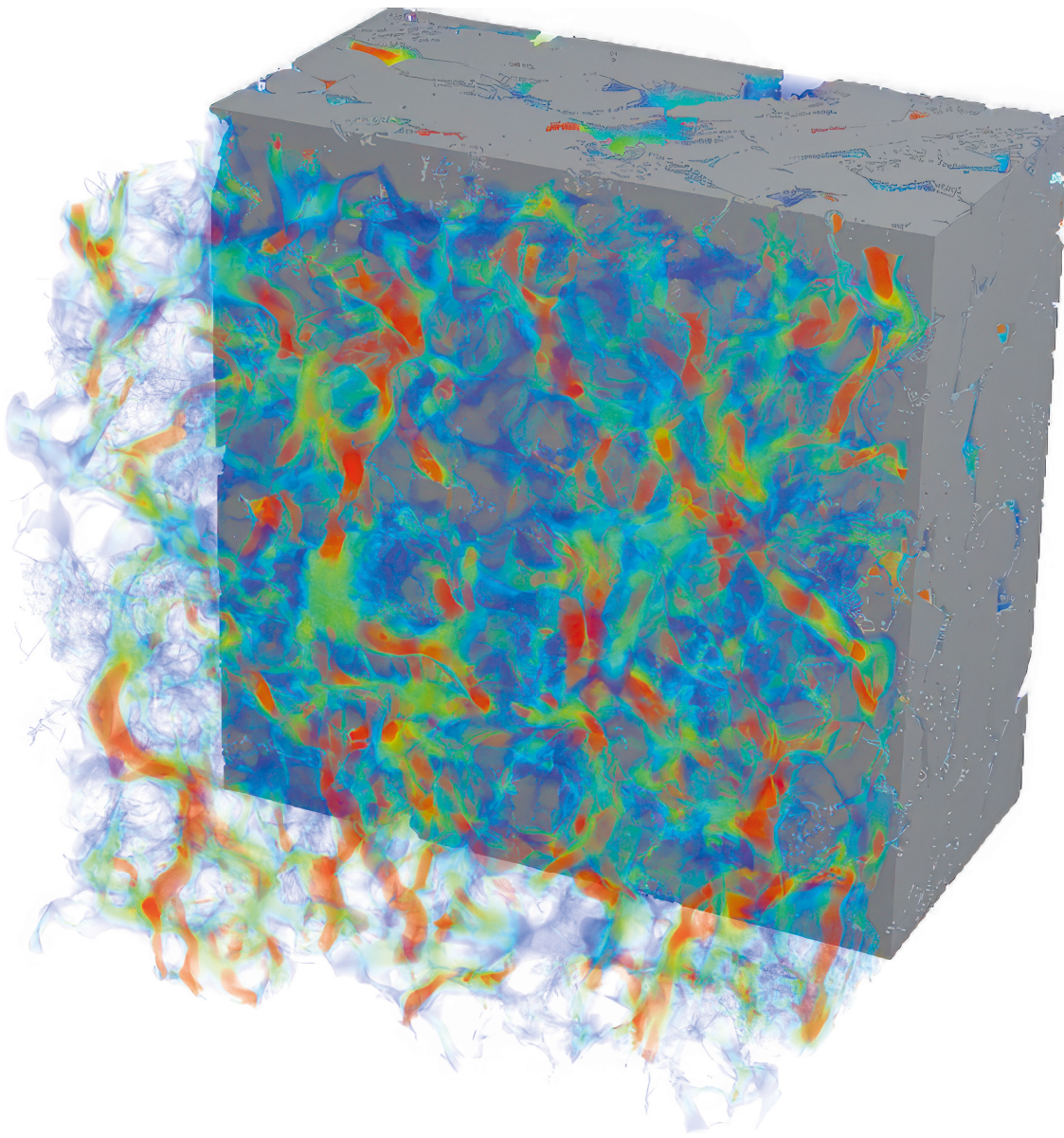


Illustration of flow velocities within a porous medium.
 Red: high speed
 Green/Yellow: medium speed
 Blue: very low or near-zero speed

Hopefully, in the near future, the insights derived from porous media flow research will be applied to soil remediation, offering a means to mitigate the effects caused by oil pollution.

While curtailed consumption and a shift towards renewable energy are laudable long-term goals, they do not diminish the gravity of the current quandaries that demand resolution. These challenges will remain our constant companions in the decades to come, as the global appetite for energy and growth intensifies. For the immediate future, large-scale solutions such as carbon capture and storage, ironically gleaned from expertise in oil and gas extraction, offer a modicum of respite in the transition to a more sustainable future. However, such technical interventions are mired in bureaucratic red tape and remain prohibited in numerous jurisdictions.

What is requisite is a multifaceted approach encompassing sacrifice, the honing of extant technologies, and innovations, all the while not turning a blind eye to the present crises that plague us. The road ahead demands a collective will for transformation, judicious policymaking, and an unwavering commitment to sustainable progress.

We need a change Δ !

1 Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (Republic of Austria), "Energie in Österreich" [Energy in Austria] (2022), https://www.bmk.gv.at/dam/jcr:3820f7e7-4abb-4324-b8e0-aa090325eb4a/Energie_in_OE2022_UA.pdf.