ENERGY FOR WHOM?

SCENARIOS FOR EASTERN AFRICA

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The Society for International Development

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Executive Summary

Eastern Africa has large ambitions, but its energy system still uses the technology of the 19th century. Roughly 80% of all energy used in the region comes from biomass - wood, charcoal and waste - because it is cheaper and more reliable than modern alternatives. However, biomass is unsafe, unhealthy and damages the land from which it is gathered. A reliable source of safe and affordable energy is needed to improve people's lives, strengthen the economy and allow the land to regenerate.

Roughly

80%

of all energy used in the region comes from biomass - wood, charcoal and waste - because it is cheaper and more reliable than modern alternatives.

What will produce that energy? Classic development in the 20th century has been based on fossil fuels like coal, oil and gas. However, the 21st century is a world of limits. These include a limit on greenhouse gas emissions coming from fossil fuels and poor land use, emissions that cause climate change.

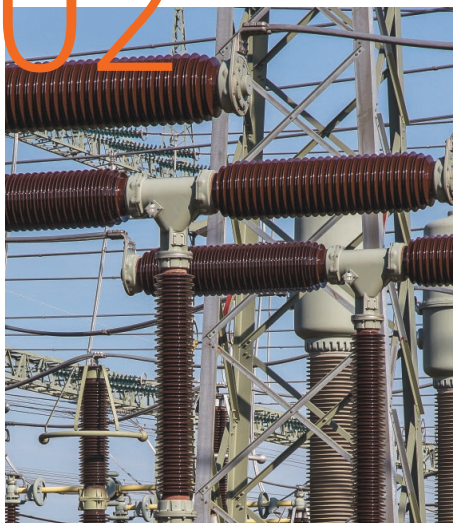
The four countries represented here – Ethiopia, Kenya, Uganda and Tanzania – are at a critical juncture in shaping their energy future. They all need to move away from today's 19th century biomass system. In response, governments have started investing in the high emission technologies that dominated the 20th century. However, ahead lies a 21st century of limits that cannot be avoided.

The analysis and three stories assembled here imagine different ways this conundrum of energy needs, politics and limits might play out in the coming decades to 2050.

01

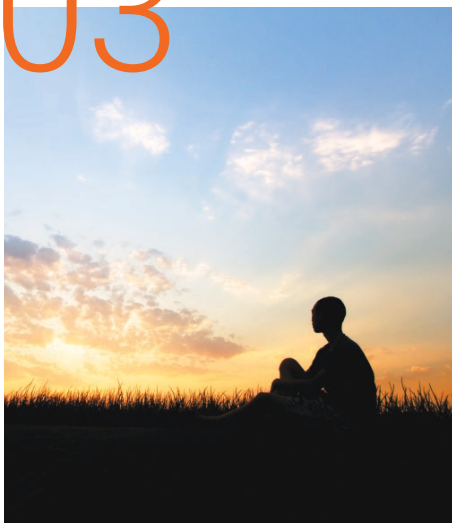
Mitumba is a world in which the big energy technologies of the 20th century take the lead in creating a new energy system. For a while, this looks successful, but forces beyond the control of decision-makers ultimately undermine the gains that have been made. The wife of a successful economist describes what happens.

02



Markets explores the excitement of building a new energy system that responds to the climate limits of the 21st century. This story is told by a young reporter and their older mentor who encourage markets to decide what investments are made and describe who benefits. It is, in many ways, a technological success, but comes at a high price for Eastern African societies.

03



Struggles is the story of an energy engineer and his wife who leave the capital to create a more meaningful life in a small rural city. They describe a life of quiet social innovation, extreme crises and local responses that create a very distributed energy system. It is a political experiment that begins to rebuild the shattered centre of national government.

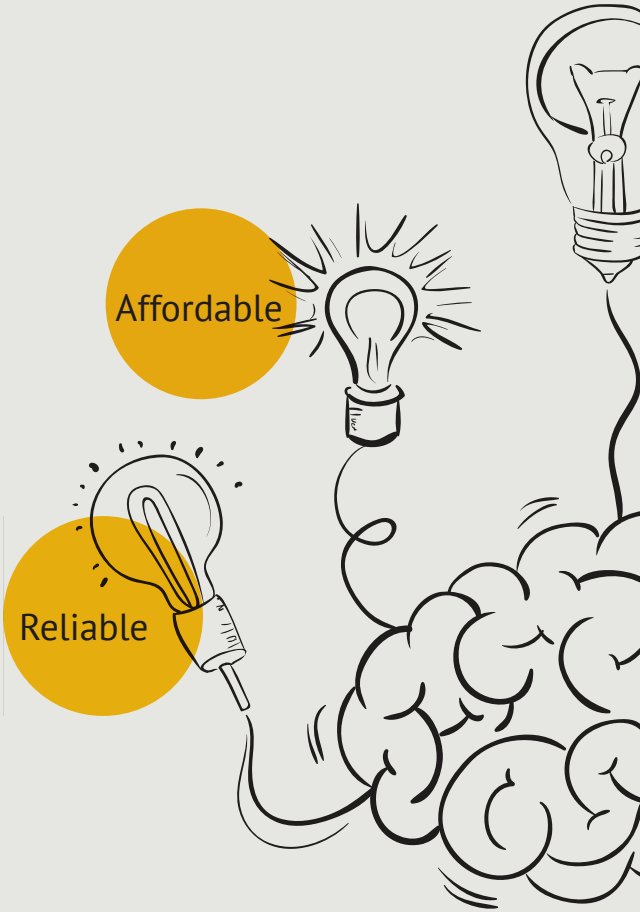
These stories are not predictions. They are tools. They have been written to stimulate conversation about the choices our societies face today. They anticipate possible future events in order to better respond to them. They can be used by any individual or organisation to test their own plans and choices. We offer our stories and analysis here in hopes that they will serve this purpose well. ■

Lessons Learnt

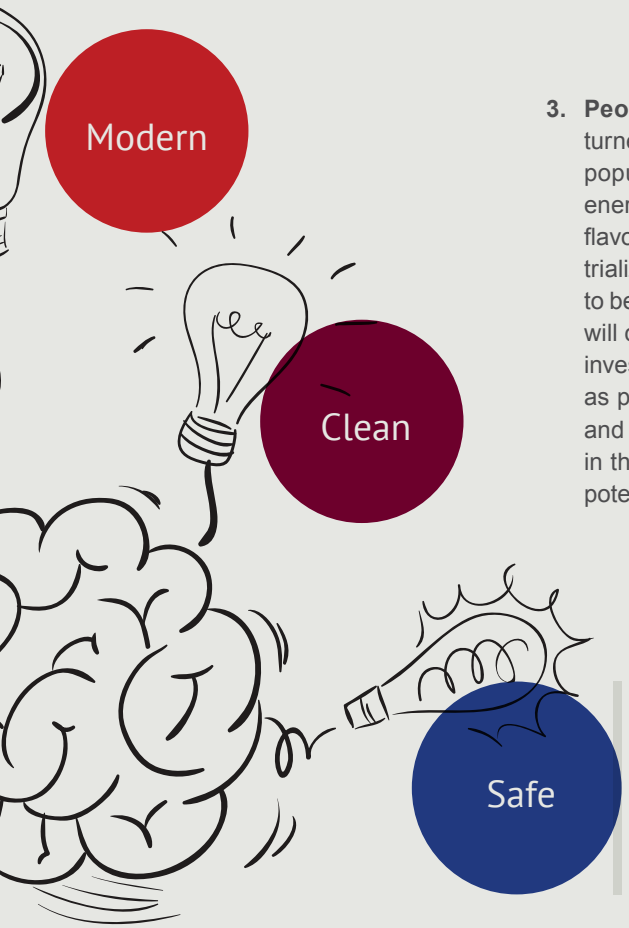
But first, let us share with you what we learned on our way to developing our stories:

1. **A Mismatch:** There is a mismatch between the rhetoric of electrification and the reality on the ground. We must give credit where it is due – much has been done in recent years to increase the reach of the electric grid in our countries. The last mile electrification projects have brought electricity to places that were hitherto dark after sunset. This is commendable, but the quality of power that is on offer still leaves much to be desired. Brownouts and blackouts are still very much an order of the day and leave expensive damaged electrical appliances in their wake.

   Furthermore, the cost of energy from the grid is still out of the reach of many of our citizens. This makes a mockery of the fanfare that has accompanied the electrification programmes. We are unlikely to see nascent industries or economic transformation happening at the micro-level based on electricity if it remains an ornamental aspect of lives rather than a central transformative one for livelihoods. Here again, the emerging reality of smaller micro- and mini-grids that are providing affordable power to local communities offers a point for reflection. Relying mostly on renewable sources for energy generation, they offer an alternative paradigm to the large power-generation projects that are being pushed by the governments.



2. **Rethink the Structure:** To date, many of the conversations and policy inputs around energy poverty have tended to be incremental in nature. They have favoured a 'catch-up' mentality but have rarely questioned how the poor could access modern, reliable energy services. The current plans seem to be built around the assumption that providing these services to the majority of the population which is currently off the grid need not involve any structural change or transformation of the national energy plans. Fundamentally, adding one person to the grid or several millions is treated with the same indifference. From our analysis, without a significant structural rethink of how our energy networks are structured and operated, we will continue to miss our targets around electrification.



3. **People Before Industry:** Energy policies need to be turned on their head - they should put the needs of the population front and centre. The key emphasis of our energy policies today is to favour industrialization in one flavour or another. Yet, it is still unclear what kind of industrialization we would like to promote. Such policies appear to be driven more by an article of faith - 'if you build it, they will come'- than by concrete industrial agendas. Perhaps investing to ensure that the grid reaches as many people as possible and that the energy supplied is both reliable and affordable will offer a better return to our countries in the longer-term as we unlock the vast entrepreneurial potential of our populations.

4. **Transformative Model Needed:** Finally, in all the scenarios we considered, there will be qualitative and quantitative improvements to the energy system, but the goal of eliminating energy poverty will remain largely unmet under all scenarios. The critical message of the scenarios is that it is less a question of technologies making the difference than an issue of governance and how we choose to align resources to meet with the myriad challenges affecting the provision of energy. This resonates with the earlier assertion that what is needed to provide reliable, affordable energy to the majority of Eastern Africans is a genuine transformational model. Our view is that such a model would engage with our proposed production models and respect the limits that climate change and other resources will impose. Our technological solutions would favor an energy mix that is appropriate to the circumstances and needs of the region and probably be one that emphasizes renewables over fossil fuels. ■

Introduction

The world of energy in 2018 is full of uncertainties. While the momentum of economic development in the 20th century depended on abundant fossil fuels (coal, oil and gas) and centralized electric power, countries are now revisiting their energy strategies to reduce the risks of unpredictable climate change.

This is the dilemma faced by Eastern Africans countries as well. Can they - should they - follow the example of those countries that made the transition from agricultural to industrial societies by exploiting fossil fuels and centralized power? Or is a different energy modernization possible? Is it desirable? How will those most influential in determining energy policy decide which investments get priority? Who will benefit from whatever energy system is put into place, and who will be the biggest losers?

In November 2016, the Society for International Development (SID) assembled a group of people from Ethiopia, Kenya, Tanzania and Uganda to address these questions. These four countries were chosen because they are among the most populous and the most energy-poor societies in Africa. They also have a very high energy potential, whether it is the natural gas of Tanzania, the hydro power of Ethiopia and Uganda or geothermal power in Kenya. Oil has also been discovered in the region, and its solar assets are among the finest in the world. Despite this abundance, a majority of people in the region are still relying on the wood and charcoal energy like their grandparents did.

The November 2016 meeting was the start of an ambitious scenario building process to examine the future of energy in this region and how it might be decided. What do Eastern Africa's societies and energy look like now? How might they change over the next three decades? How will this relate to the production, use and distribution of energy in this region? Who will use it and how? What might be the social, political and environmental consequences of whatever choices are made?

To answer these questions, our team developed three stories describing different futures for society and energy in the region. We took a hard look at conditions today and imagined how these might evolve in the future. In the end, there was only one future certainty: climate disorder is inevitable and will be disruptive. Within this central premise, we realised that there was a variety of possible futures facing the region.

An Invitation

We invite you to come along with us on three journeys, each taking us to a possible future for this region.

Our stories come at a time when Eastern African societies have reached a critical point in their own development. They are poised to industrialise using 20th century models just when the global energy system is changing. Policymakers in the region are caught between the pull of success seen in Asia last century, and the excitement of adopting new energy systems more suited to the lives and geographies of this region and this historical era.

Our stories explore this tension and where it might lead. We offer them here as a set of tools to stimulate discussion about our energy choices today. The stories can be used to test policies and investment proposals. They can help us rehearse our reactions to surprising events and facilitate informed discussion around fractious dilemmas. We hope you will use our stories to think and talk through these dilemmas; we look forward to hearing from you with any comments you might have. ■

> **Despite the abundance of energy potential, a majority of people in the region are still relying on the wood and charcoal energy like their grandparents did.**

The Picture of Now

Energy in Eastern Africa today

To put it simply, energy is the lifeblood of any society. Without energy, many essential processes needed for life and our communities would simply come to a halt. We use energy for practically everything that we do as humans, from growing our food to facilitating our livelihoods.

Throughout history, energy has taken many different forms, whether it is human energy to walk from place to place, mechanical energy to lever a rock from the ground, charcoal to cook, coal to power factories, water to generate electricity, or solar panels and windmills to collect the energy of the sun and air. Energy, in all its forms and uses, is so ubiquitous, that we barely notice how critical it is.

Today, we are examining the role of energy within our development context. We want to understand exactly where Eastern Africa's[1] energy system is today by looking at what fuel is used, how it is used by different people and how it moves from place to place in order to understand its influence on our state of development. This provides the foundation for considering what future energy systems might develop and how they might shape, and be shaped by,the choices we make.[2]

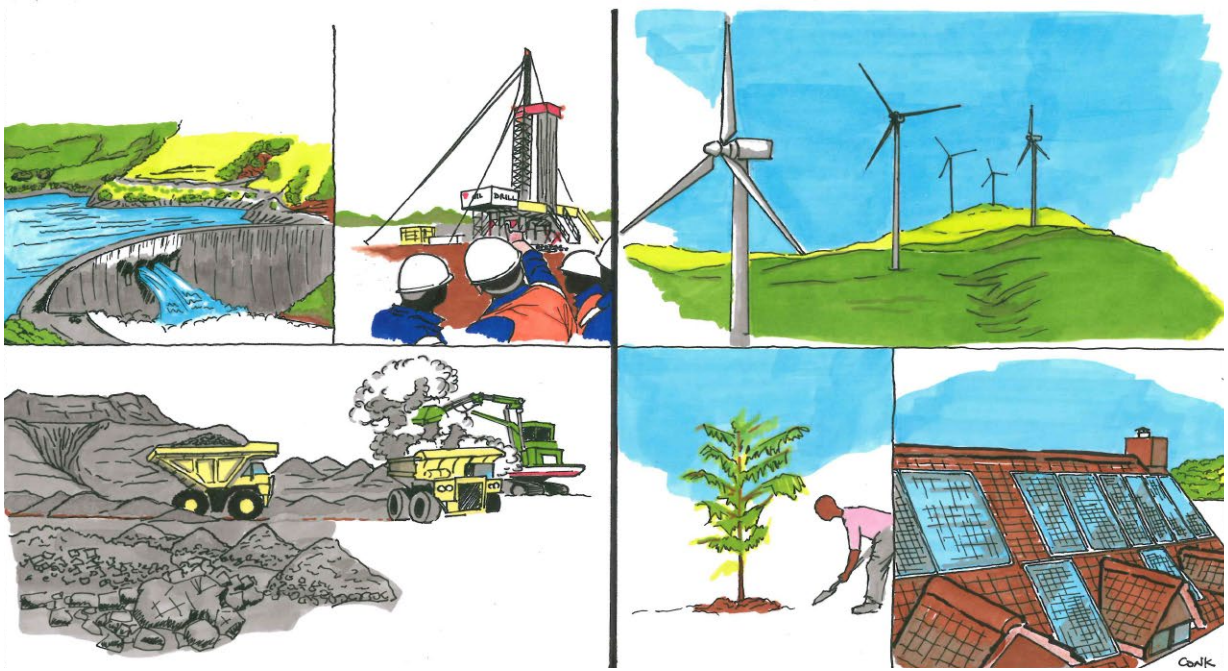
Eastern African Energy Today

If one were to take a look at the news headlines across the region, there is currently a lot of enthusiasm around the recent discoveries of hydrocarbons and the potential that lies within them to transform our societies. Eastern Africans are excited by oil and gas discoveries as well as the construction of new energy sources – be they wind farms, solar farms, geothermal complexes or traditional hydro-electric dams. From this perspective, Eastern Africa stands on the cusp of a great energy revolution that will propel the region into a different development context. With more abundant energy, leaders talk of industrialization being around the corner; of the wealth to come from energy exports and of how the revenue earned will be ploughed back to transform society.

But the energy reality of very many Eastern Africans is quite different. In 2014, biomass provided 80% of the total energy consumed in Eastern Africa and met the needs of up to 97% of the population. With the majority of Eastern Africans still reliant on traditional sources of energy such as wood and charcoal, especially for cooking, we are nowhere near the modern energy system imagined by our leaders.

This means that, unlike the majority of countries in the world, many Eastern Africans still live in energy poverty, lacking access to cleaner, more convenient fuels. Where families rely on biomass, women (and girls) are often required to spend long hours collecting firewood to take home. Thus, energy poverty in Eastern Africa also has a very female face.

That is why we are investing vast sums of money to modernize Eastern Africa's energy systems. The bulk of the investments being made are in what we term '20th century energy'. They are heavy on transforming hydrocarbons, like coal, as well as on constructing dams to generate electricity. They seek to extend the reach of electricity to the furthest-flung corners of our countries – hence the various 'last mile electrification' schemes that cannot be rolled out fast enough. We also have big plans to link up our national networks in the East African Power Pool (See Box 1) to ensure that we have sufficient energy supplies for our development and industrial needs.



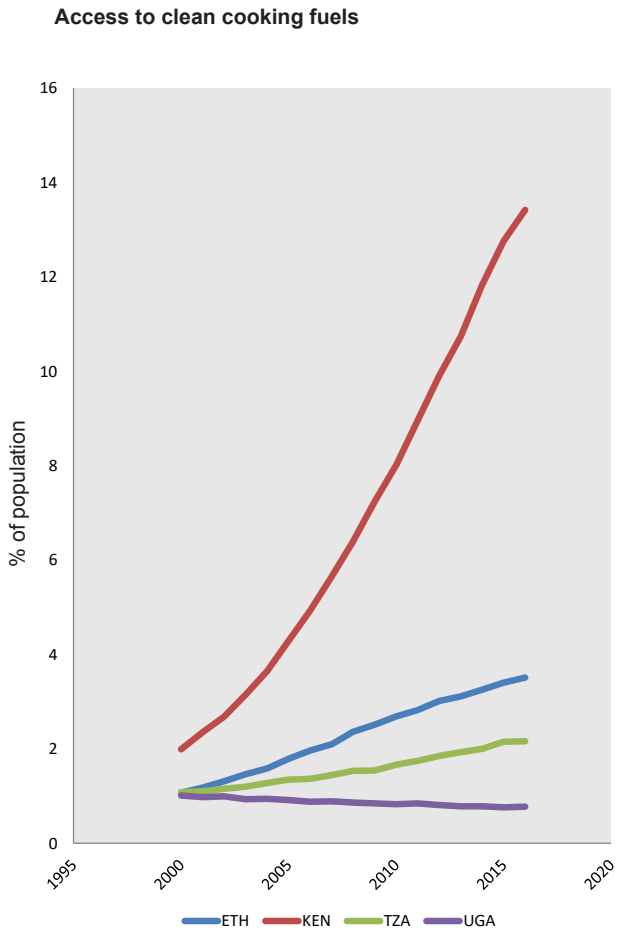


Figure 1: World Bank, Sustainable Energy for All (SE4ALL) & WHO Global Household Energy Database

Box 1

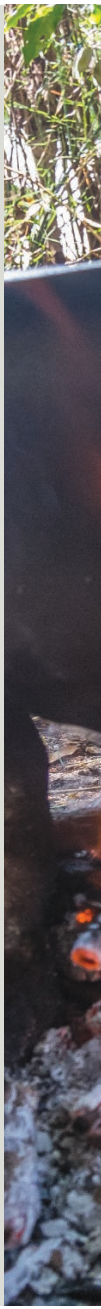
Gender Dynamics of Energy in Eastern Africa

Women are increasingly finding their way into national parliaments and other decision making spaces, but energy poverty means that very few women have access to clean cooking fuels and technologies while lighting is often provided by kerosene.

With charcoal and wood being the principal fuels for cooking in urban and rural areas, women and girls suffer from respiratory illnesses caused by smoke and kerosene fumes. Women are also responsible for collecting firewood as well as water for domestic use. This burden comes on top of farming, domestic work and running informal businesses, especially in urban areas.

In this context, something as simple as a solar lantern can have a huge impact. Detailed interviews with Solar Sister's customers in Tanzania found that children's education had improved and there was more time to work in the evening, thanks to better lighting. The money once spent on kerosene could be put to other uses, and families suffered fewer burns and fewer symptoms of respiratory ailments caused by kerosene fumes. In this particular project, small solar appliances also provided incomes for the women who were the sales force and repair service for the solar technology. (See: https://www.solarsister.org/impact/turning-on-the-lights-2/executive-summary)

Finding a clean, affordable cooking fuel remains the biggest challenge, but could have a huge impact on women's lives.

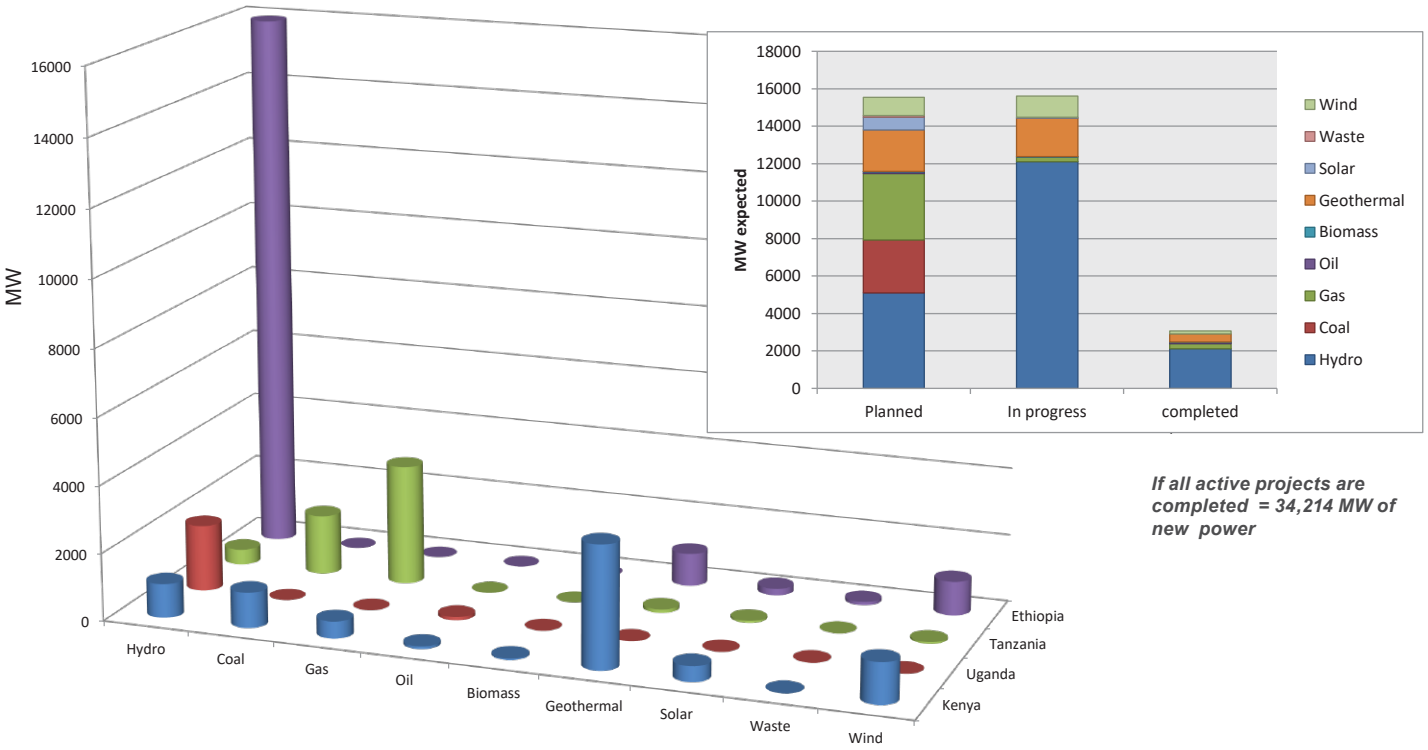


> **With the majority of Eastern Africans still reliant on traditional sources of energy such as wood and charcoal, especially for cooking, we are nowhere near the modern energy system imagined by our leaders.**

Energy scholars talk about a historical pattern of 'energy transitions'. During the first transition, global energy use shifted from a reliance on biomass to relying on fossil fuels (first coal, then oil and natural gas), with a small percentage coming from nuclear energy and hydro power. Since 2000, there has been growing talk about another transition, this time from fossil fuels which emit the greenhouse gases causing climate change, to cleaner energy provided by solar, wind, geothermal and nuclear power. According to Vaclav Smil, about half of global energy use shifted from biomass to fossil fuels by 1900, with global biomass use falling to less than 10% of all energy by 2000[4].

Eastern Africa, however, has not yet followed this pattern. Today, with biomass providing roughly 80% of regional energy use, our energy system is still akin to that prevailing in the mid-19th century. It will probably require significant financial resources as well as skills and time to make our own transition to modern energy.

New active power projects in East Africa
by primary fuel & location; BMI database, April 2017



If all active projects are completed = 34,214 MW of new power

Figure 2: These are all projects to produce electrical power. In the same database were 59 projects exploring for, or producing, oil and gas in the region. Source: BMI, April 2017.

Today, the bulk of Eastern African energy investments are in what can be called '20th century energy systems'. These make heavy use of fossil fuels like coal, oil and natural gas, as well as constructing mega-dams to generate electricity. These investments promise to extend the reach of electricity to the furthest-flung corners of our countries – hence the various 'last mile electrification' schemes that cannot be rolled out fast enough.

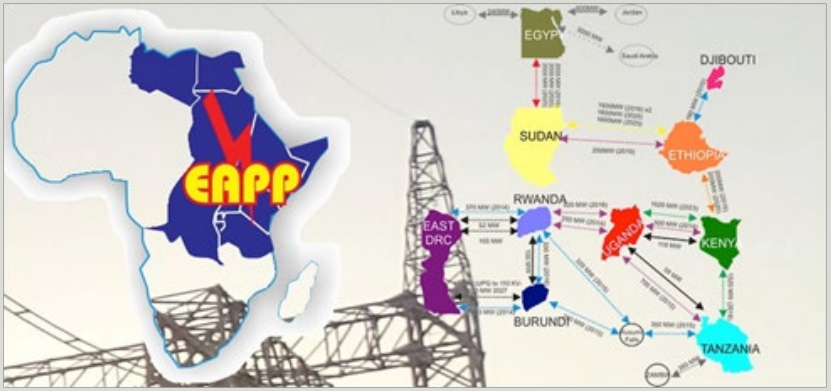
Eastern African governments also have big plans to link their national electricity networks into the Eastern Africa Power Pool (See Box 2) to ensure the region has sufficient energy supplies for its development and industrial needs.

Box 2

The Eastern Africa Power Pool

The Eastern Africa Power Pool (EAPP) was established in 2005 by seven Eastern Africa countries: Burundi, Democratic Republic of Congo (DRC), Egypt, Ethiopia, Kenya, Rwanda and Sudan. It will connect the electrical systems of its members in order to optimise the use of power in the region.

See http://eappool.org/



Despite these investments, it is an open question whether all the people in rural and even urban areas will actually be connected to the grid or be able to afford the cost of connecting and using electricity. Today, many people in the region are still far away from any kind of electrical connection. Even though they might be close to a power line, many cannot afford to connect to it or pay for the electricity it carries.

The net result so far is that Eastern Africa remains a region where there is a significant mismatch between the people's energy needs and the investments that are being made. Why is that? The majority of the population is dependent on biomass for their energy needs, yet the investments that are being made are largely focused on big hydro power projects and fossil fuels. These investments focus more on chasing energy for export or industry rather than servicing the needs of domestic users who consume approximately 75% of all energy that is produced today in our countries. Despite its promise, the "20th century" energy systems being developed are more expensive, less reliable and still inaccessible to the majority. By comparison, the "19th century" energy systems based on biomass are dependable and widely available at an affordable price.

This mismatch between investments and energy needs is based on two major assumptions: first, that industrial demand will continue to grow, justifying large investments in new energy sources; second, that the future is electric, with increased demand for electrical power in homes, transport and industry.

But are these assumptions as viable and as watertight as they are imagined to be?

A 21st Century of Constraints

Behind those two assumptions is a bigger one: the belief of late 20th century energy professionals, now widely accepted as false, that there are no serious constraints on our energy use. There are certain limits that cannot be breached without incurring significant (and often unknown) social, ecological and

Domestic users consume

75%

of all energy that is produced today in our countries

economic costs. If the 20th century seemed to be a world where limits did not apply, the 21st century is limited by clear boundaries humanity must recognise and adapt to appropriately.

Perhaps the most important of these limits –which has a direct and pertinent link to energy production and consumption – comes from the increasing risk of serious climate change.

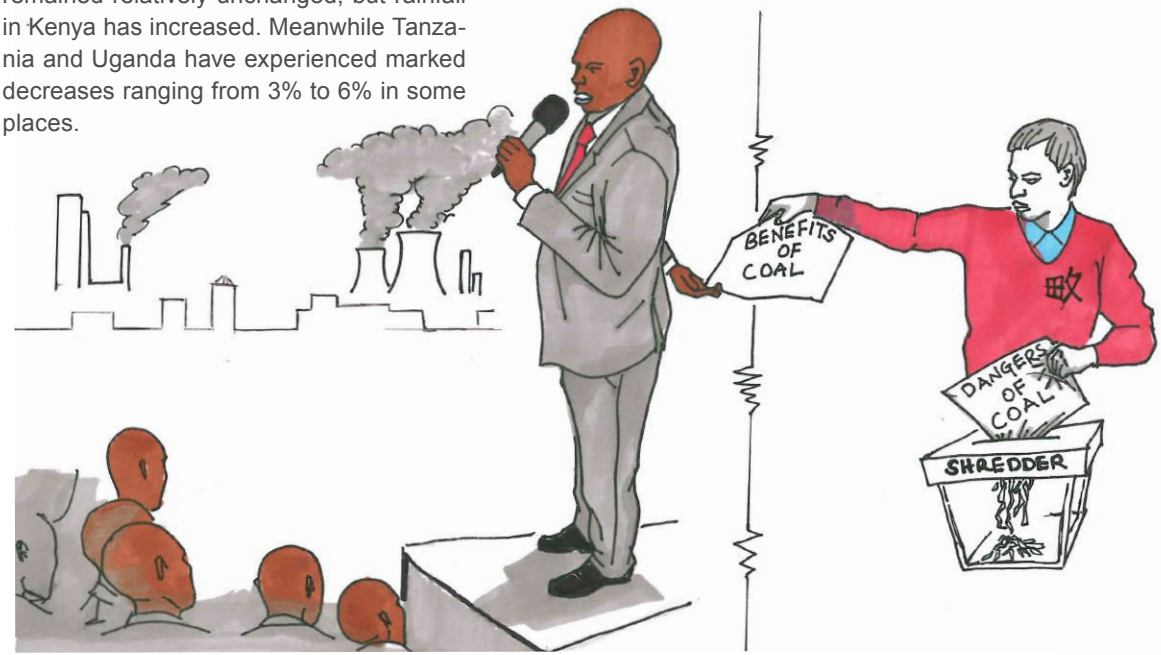
Here, there are three things to keep in mind:

- **Eastern Africa's climate is already changing:** Across the region there has been an observed increase in temperature since the 1960s ranging from a relatively low increase of 1.0°C in Kenya and Tanzania to a rise of 1.3°C in Ethiopia and Uganda. Rainfall observations have been a mixture of increases and decreases in different countries. Annual and decade totals of rainfall in Ethiopia have remained relatively unchanged, but rainfall in Kenya has increased. Meanwhile Tanzania and Uganda have experienced marked decreases ranging from 3% to 6% in some places.
- **Eastern Africa's climate will continue to change:** Current predictions show temperatures in the region could continue to increase by 1°C to 5°C by 2090s. Rainfall across the region is expected to increase by up to 48% in some places, but these rains are expected to be irregular, characterized by both heavy rainfall events and erratic episodes of serious drought.
- **The costs of climate change could be very high.** They come on top of an exceptionally rapid increase in population that has forced agriculture into marginal areas and people into the cities. Pushing the land to its limits while experiencing climate change is potentially a formula for widespread hunger and disease, as seen in England in the 14th century.

Rainfall across the region is expected to increase by up to

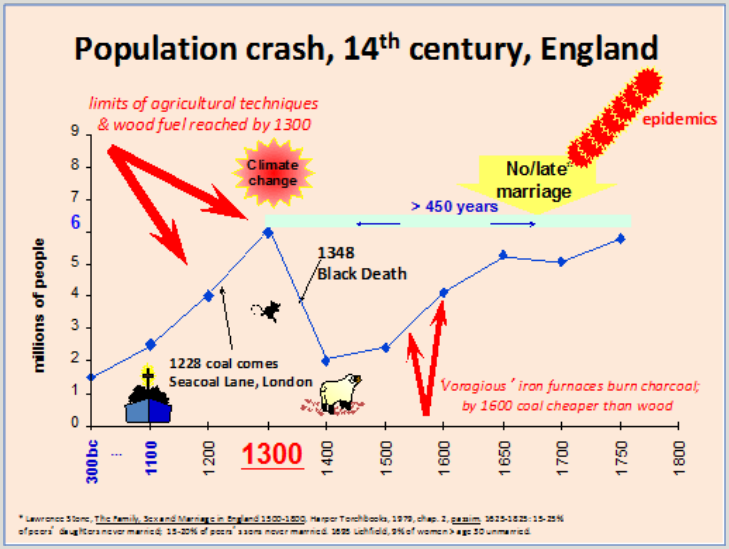
48%

in some places



Box 3

Could the population crash?



Between 1100 and 1300, the English population grew from two to six million people, helped by an exceptional absence of disease and mild weather. Then, the climate began to change, bringing colder, less predictable weather. Crops failed, farm animals died, and people went hungry. When the Black Death arrived in 1348, 30-40% of the English population died in two years. By 1400, the population was 2 million, and did not reach 6 million again for 350 years.

Already, Eastern Africa's rainy seasons are noticeably less predictable so that historical rainfall patterns can no longer be taken for granted. Some rainy seasons are exceedingly wet while dry seasons are becoming longer. As these changes continue they will have significant implications for the region's energy plans because the bulk of today's energy relies in one way or another on climate.

Rain fills the hydro-electric power dams and supports the growth of biomass for charcoal and firewood. There is also a link between biomass and hydro-power: overuse of biomass reduces vegetation which reduces the amount of water for hydro-power and increases erosion leading to high siltation rates. Adding climate change, with its dynamic ramifications, will only complicate matters further.

Given the constraints of climate change, there are two important questions addressed in our scenario stories:

- Can development based on fossil fuels, which emit the carbon causing climate change, succeed without high costs? and;
- Can Eastern Africa build a new, low carbon model of modernity?

These questions lead us into the first critical dilemma we face in making energy choices for this region's future. This dilemma has global dimensions and is driving the logic of the global energy transitions that are currently unfolding. Can humanity reconcile the growth in demand coming from our modern lifestyles and growing populations with the environmental limits we now recognise? Finding a response to this dilemma is neither easy nor immediate. It is challenging all governments, despite the ever more sophisticated tools and resources at their disposal.

Energy Justice & Energy Technologies

To make matters more complex, most of us would want to see a future energy system that reduces today's energy poverty. Can we therefore imagine a future that includes greater energy justice by providing the weakest segments of the population with access to clean and reliable energy at an affordable price?

Eastern Africa's ability to achieve that goal will depend in part on what energy sources and technologies the different countries adopt. Within this region, there currently is a patchwork of energy systems that are overlapping each other; biofuels, fossil fuels and renewables (small scale and large scale) are all currently in use somewhere in the region. Our geographic location ensures that we have a high solar potential, yet this potential has often been discounted in favour of investments in fossil fuel energy sources.

However, this solar blessing could be an opportunity for the region to leapfrog into a new energy system more reliant on renewable energy than on fossil fuels. This would take a radically different conceptualization than is the currently the norm. So, we have an additional dilemma. Will the societies we envision be powered by large energy producers and centralized distribution of electric power (arguably, the approach taken to date), or do we want to create a future in which energy is provided through decentralized generation and distribution?

This choice illustrates the fact that the region's energy future is up for grabs. What therefore are the realities, paradigms and potential that Eastern Africans would need to work with (and around) in rethinking potential energy futures?

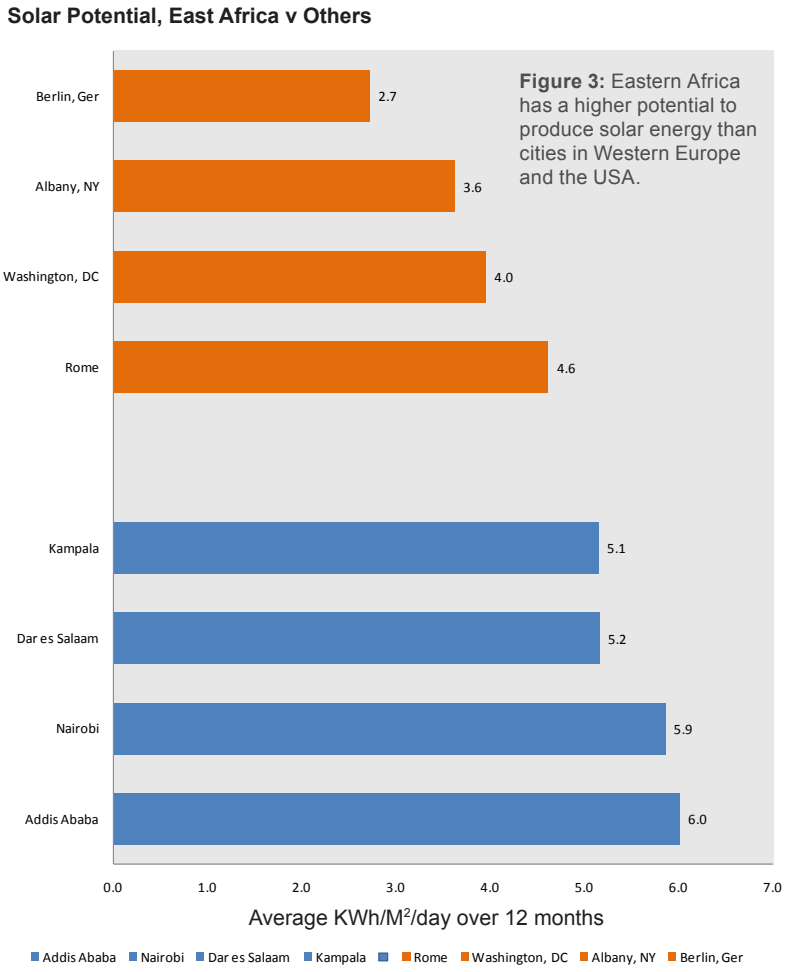


Figure 3: Eastern Africa has a higher potential to produce solar energy than cities in Western Europe and the USA.

Box 4

Emerging Energy Technologies

In the West, there are numerous articles about emerging energy technologies. For a while, there was great excitement about "cold fusion", a new type of nuclear energy, while others are researching more efficient ways to capture solar energy. Cars are attracting a lot of innovation. The Japanese are investing heavily in hydrogen fuel cells while others are betting on lithium batteries for electrical vehicles and rapid charging stations. Many cars already use a hybrid mixture of petrol and electrical energy.

Finding new ways to reduce energy use is another technological area. LED lights use much less energy than incandescent light bulbs. Building design is also changing. "Passive solar" homes in cold climates capture winter sun through their windows, while buildings in hot climates use louvers to keep the sun out.

In Eastern Africa, emerging technologies could come from any of these innovations, but also include technologies that are not yet in use here, whether they are hybrid vehicles or nuclear power or energy generated from sewage.

Today's rapid changes in energy technology are another symptom of the global energy transition. Eastern Africa's challenge is to pick the technologies that will best serve the interests of all.

The Economy

The countries in this region all have small open economies with rapidly growing populations, 60% of whom live in rural areas and work in the agricultural sector. Each country is still mostly exporting raw, unprocessed materials and importing a large number of consumer goods. Whilst these economies have been growing, the fruits of this growth have not been felt by the majority of the citizens.

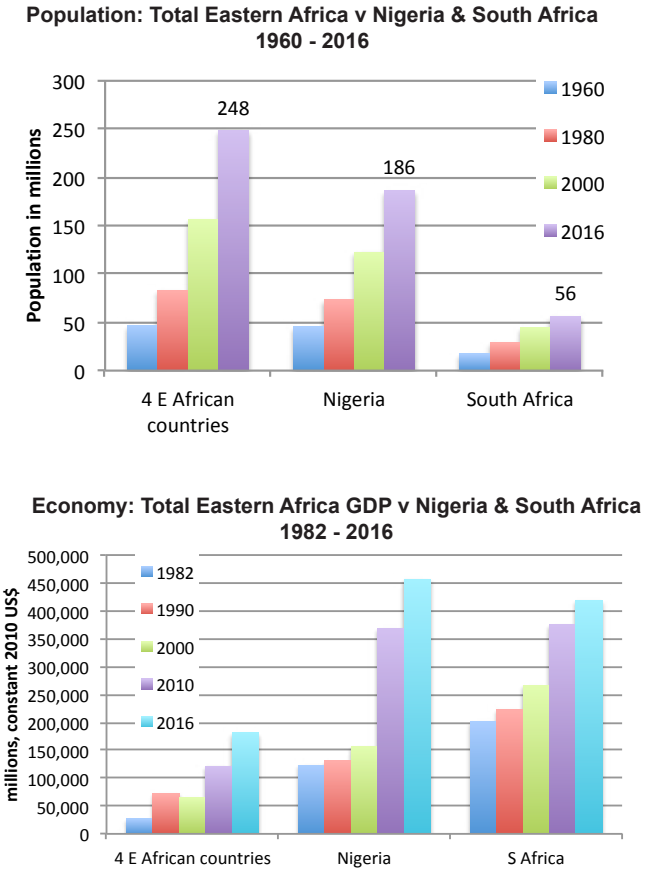


Figure 4: Eastern Africa has a larger population, but much smaller economy, as measured by GDP, than Africa's two largest economies: Nigeria and South Africa.

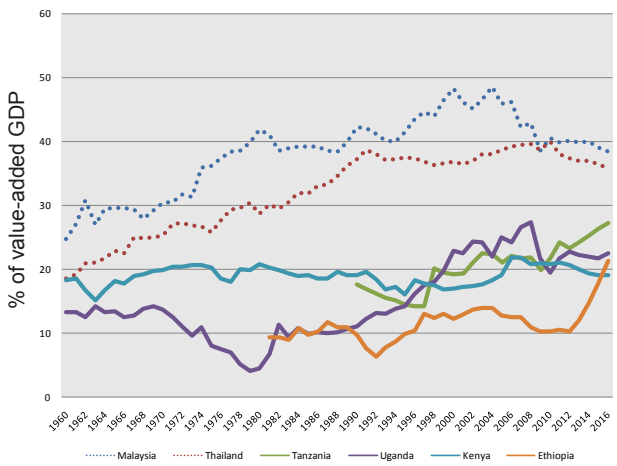
Collectively, these four countries have a larger population than the two sub-Sahara Africa giants, Nigeria and South Africa, but a much smaller GDP, implying a high potential for greater economic growth. In the expectation that such growth is possible, EA's energy policies have followed an Asian development model. This model assumes the need for abundant energy to fuel a nascent manufacturing industry that will grow much larger and employ many more people. But what is the evidence that a comparable industrial miracle will actually come to pass in Eastern Africa? So far, this region is still a long way from emulating the Asian model (See Box 5).

Box 5

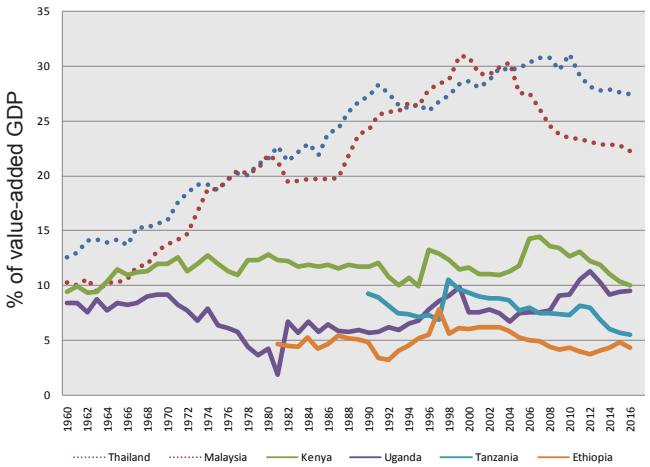
Will the Asian model of development come to Eastern Africa?

The Asian model of development was based on exporting manufactured goods produced by low-cost workers. These graphs show that Malaysia and Thailand produce a bigger share of their GDP (Gross Domestic Product) from both industry and manufacturing than Eastern Africans do. Ethiopia and Tanzania are investing in hydropower and natural gas, but manufacturing's share of GDP is falling everywhere. Labour-intensive, manufacturing has not yet come to Eastern Africa and it's time may simply be over throughout the world.

Industry as % of GDP 1960 - 2016
Eastern Africa v Malaysia & Thailand



Manufacturing as % of GDP 1960 - 2016
Eastern Africa v Malaysia & Thailand



(Statistics from World Bank World Development Indicators, 2017)

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Whether it is the myriad merry-go rounds/informal savings and investment schemes, or education grants or coding new world-beating apps, Eastern Africans have demonstrated a flair for entrepreneurship, a legacy that is perhaps born out of necessity.

There is, perhaps, a different economic potential for the region. We have a relatively young population that is more literate, more connected and increasingly urban. We are adept at using and innovating the mobile telephony infrastructure built in recent decades. Lots of people today are also caught up in personal networks of initiative, innovation and mutual aid. Whether it is the myriad merry-go rounds/informal savings and investment schemes, or education grants or coding new world-beating apps, Eastern Africans have demonstrated a flair for entrepreneurship, a legacy that is perhaps born out of necessity. These personal networks could be the harbinger of something new and different, if harnessed appropriately and given the necessary support.

The larger question: will this potential be encouraged or neglected by future leaders and circumstances?

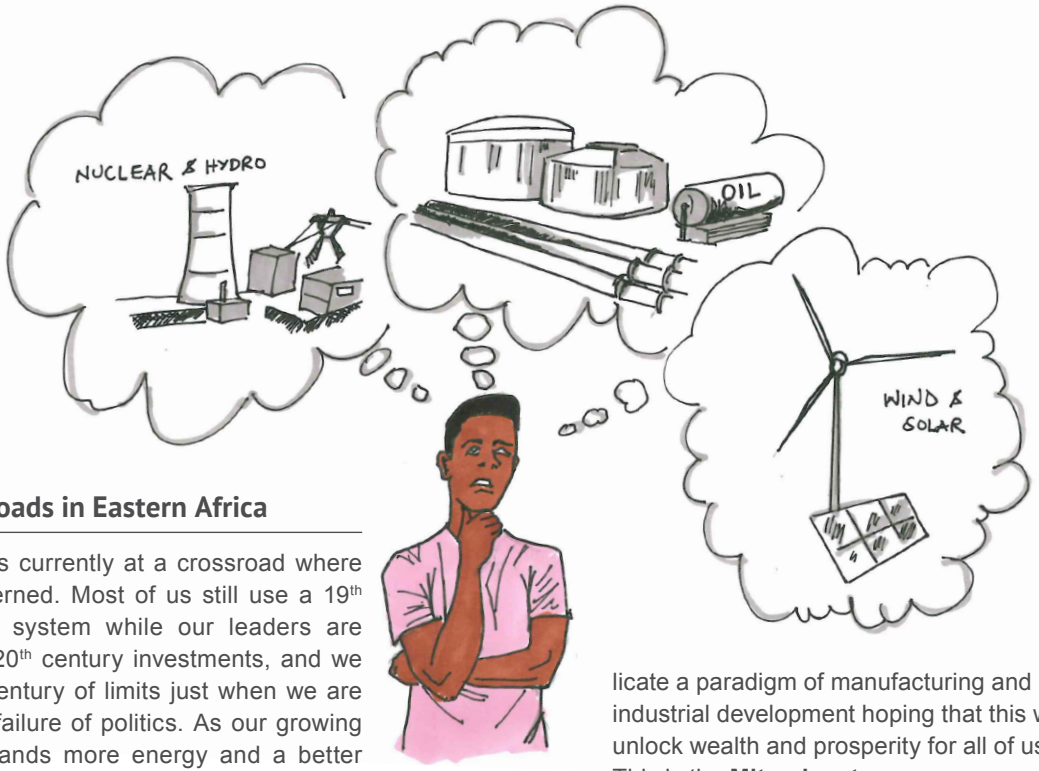
The Failure of Politics

With all its latent potential, the region has experienced what can only be described as the failure of politics. This is not about pointing a finger at a single individual or group of individuals, but rather seeks to reflect on the collective failure to establish a process that builds on the region's strengths and benefits the majority of citizens of our countries.

At the end of the day, politics is the process by which priorities are decided and scarce resources allocated. Today, the majority of politicians appear to be largely disconnected from the priorities of citizens and more in thrall to outside forces. Consummate amounts of effort are expended to snag 'foreign investors' and lavish them with incentives, but little attention is spared for the poorest and weakest within our societies, let alone our own entrepreneurs and investors. 'Deals' with outsiders whose benefits to the region's citizens are questionable are commonplace. This leads us to contemplate a third question: who really controls the land and resources of this region? Different answers to this question will shape the future of our society and energy.

The energy systems today are influenced multiple actors with different interests and goals. It is not clear that there is a transparent, shared process that seeks to untangle the conflicts of interest, decide the priorities and resolve conflicts. Instead, energy policies and processes seem to be stuck in a perpetual traffic round-about.

With so many actors involved, who decides? And on the basis of what goals, beliefs and needs? All of this remains unclear – even to insiders – and leads to the question: is politics working as it should? If not, can it change?



Energy Crossroads in Eastern Africa

Eastern Africa is currently at a crossroad where energy is concerned. Most of us still use a 19th century energy system while our leaders are obsessed with 20th century investments, and we all face a 21st century of limits just when we are saddled with a failure of politics. As our growing population demands more energy and a better standard of living, we must confront this confusion while also managing the harsh and unpredictable costs of climate change.

As we think about our energy system for 2050, we must ask ourselves:

- What energy systems will we see in Eastern Africa? and;
- What will be the consequences of these energy systems for Eastern Africans and the natural world?

These are the two questions have helped us explore possible future scenarios for energy in the region. Our scenarios describe three possibilities:

1. Will we remain wedded to outdated but proven energy systems? Will we continue to invest in fossil fuels and seek to replicate a paradigm of manufacturing and industrial development hoping that this will unlock wealth and prosperity for all of us? This is the **Mitumba story**.

Or ...

2. Will we blend old and new paradigms as governments offer light-touch regulation and let finance and carbon markets offer energy systems that allow many to get connected to the grid? This is the story of **Markets**.

Or ...

3. Will we have something new emerge as younger generations retreat from our overcrowded urban spaces? Will they join a process driven by crises and local needs to create new social and economic paradigms that exploit new technologies and nurture new leadership in our societies? This is the story of **Struggles.** ■

Endnotes

1 For the purposes of this publication, the term ‘Eastern Africa’ refers to four countries: Kenya, Uganda, Tanzania and Ethiopia.

2 An ‘energy system’ includes the fuels, energy technologies, distribution networks and policies that provide energy for society. These systems both shape, and are shaped by, our social structures, policy choices and economies. Different types of energy systems could emerge in the future.

3 See the Statistical Appendix, using IEA data from 2015.

4 A graph developed by Vaclav Smil of this transition appeared in Pulse, 31 November 2016, a publication of the Linnaean Society of London

01

Mitumba

2020

My best friend used to say I should end it. “You have nothing in common!” she would tell me, and I’d agree. “But we get along very well,” I would argue, “and I like his company. I like the things he brings me.”

She was right, though. He and I still see the world in very different ways. He’s an economist and believes that if we just get our policies in order, our region can be as developed as the countries of Asia. We could be like Malaysia and Thailand and all the rest, even bigger. And to do that, he would say, we need a lot of energy. “People still need shoes and clothes, so why not produce them here and sell them world-wide? It’s possible!” I would counter, “No, times have changed. What Southeast Asians could do, we cannot do, because the world won’t allow it. The climate won’t allow it, the trade barons won’t allow it and the robots won’t allow it. So stop dreaming, it just won’t happen the way it happened before.” Then we’d change the subject.

2020 – 2025

I didn’t tell him at first, but for me, the turning point was the climate conference I attended as a Youth Representative in our last year of college. When we left, we were ready to change the world, beginning with energy policies in our own countries. Then we discovered it wasn’t about energy, but about political power and money. It was really about who owns the land, who decides what gets developed and what does not.

At the conference, I had heard from communities being pushed aside to build another pipeline or moved away from their villages because a new dam was going to flood their valley. I had also spoken to people who had been promised compensation when their trees were uprooted and their houses knocked down. These villagers never got more than a fraction of the money they had been promised; now they had nowhere to live. That’s how I found my calling.

Once I graduated, I and a handful of friends founded a small organization dedicated to this fight. I travelled from place to place, listening to grievances, supporting strikes and protests, talking and organising with many of those who were expected to move aside so these big energy projects could proceed. I visited all the international NGOs, looking for support. “How can we let this injustice happen?” I would ask.“Can’t you do anything? Can’t you put pressure on your governments?” The INGO staff said nothing that gave me confidence. I walked away with their moral support and a few reports on human rights violations they had submitted to the UN.

I began to see-saw between radical anger and profound despair. I joined rallies, created big posters, got teargas in my lungs and blockaded any government department I thought was making a bad decision. I was fixated on every social media post calling people out to demonstrate or attend meetings. I responded whenever I could. I held hands with all the others who were working to the same ends. I exhausted myself with the effort. We all did.

“Why do you bother?” asked my boyfriend when he saw what I was doing. “This is the way things have always been done.” His arguments went on: the big projects give us economies of scale, he told me. Lots of little projects are actually more expensive, because each one is trying to do too much. “You want a large centralized distribution system so you can share power between places. When we are short in our cities, we can buy in electricity from our neighbour’s hydro or their natural gas power stations. That just makes sense. And if we have a surplus, we can sell it to them. We all share the power and everyone moves ahead. That’s development,” he said.

“You’re living in the 20th century,” I argued back. “Don’t you see how much damage those systems have done? Don’t you worry about where we will get our food and water when the climate gets worse? And look at how many habitats have been destroyed! Don’t you realise that our wildlife is disappearing? That was our greatest wealth!”

“What does it matter if we lose a few species,” he countered. “We need to feed people and give them jobs now. So what if the grey parrot goes extinct? It never fed anyone. We need an economy that can compete in the world by building and selling the things people want. And for that we need energy, lots of energy. Where are we going to get it? And don’t tell me that the wind and sun will do it for us. Neither is reliable enough to support the economy we need. You can’t store it and you can’t ship it very far. You only have it when you have it. What factory can run on that basis, never knowing if the power will be there?”

“Our electricity is unreliable now!” I argued back. “How many times this month have we lost power right here in this flat? Besides,” I said, “where are you going to get the money to build these big projects? If you borrow it, how will you pay it back?” “These are investments,” he said. “They will earn the income we need to support our people and pay our debts. You’ll see. That’s the way it has always been done. “

I was furious. He was so damn patronizing when he spoke like that, patting me on the head with a ’there, there little girl,’ tone in his voice. I walked away and slammed the door.

2025 - 2030

In those early years, we were a growing group of climate activists. My friends and I focused on a few symbolic projects throughout the region, staying in touch electronically, working with local people. Do you remember the Bujagali dam in Uganda? The Lamu coal-fired plant in Kenya? The Mtwara gas deal in Tanzania, all those dams on the Omo River in Ethiopia and the fights to save Lake Turkana? We fought these energy projects with everything we had. We thought if we can just stop one of them, it would change the perception of the rest. It would make all the difference. And, we argued, there is an alternative: small scale distributed solar and wind, connected in mini-grids, serving local communities.

“Save your breath to cool your porridge,” said my boyfriend. “Don’t you know that the deals are not made in public? The companies, the banks, the government departments don’t care what you think, because you are too small to stand in their way. What real power do you have to change anything? What bribes can you and your little gang of hotheads offer? You should accept

what you cannot change and focus on those things where you can make a real difference. You should take up teaching again. You are a great teacher!“

“If I do,” I said, “I will teach rebellion; it is the only lesson my students will need.”

We had some early success as activists. Social media was our friend and our organizer. We often had good publicity in the international press and even locally, but in the end, all we did was slow things down. It became increasingly hard to find the resources to do the work. We ourselves were barely making a living. My partners were burning out, getting married, getting “proper” jobs and starting to have children. The state became increasingly aggressive towards us; we faced threats that frightened all of us and internet outages made organizing more difficult. Our group had chosen to be non-violent, but when non-violence is one-sided, it is a martyrs’ victory with the spoils going to those for whom violence is just another tool. We had no choice, but to step out of the game. I was one of the last to give up.

“So,” said my boyfriend, “Will you marry me now?”

As I prepared for our wedding (no, it was not extravagant), I followed the energy news. I watched as our governments agreed to one bad deal after another. The Lamu coal-fired plant was one of the first to start up, but multiple oil drilling agreements were also quickly put into place, especially once the dispute over the Ugandan refinery had been settled. I despaired every time a new hydro-electric dam was proposed, often in places of exceptional environmental value like the Stiegler’s Gorge in Tanzania. I was also outraged by the nuclear agreements that were signed with China and Russia. I was prepared to accept my husband’s arguments that we needed more energy, and I knew we needed to move beyond the wood and charcoal that so many people relied upon. But why were these the solutions our governments chose? They may have been the best technologies fifty years ago, but now, at the start of the 21st century, was this really the best we could do?

My husband agreed that we were buying second-hand technology, like the coal-fired power plant the Chinese government were putting into Lamu, or in the refinery in Uganda. But, he argued, these were likely to be the cheapest technology on offer and would give us energy independence. As for the hydro projects, they were also a technology so well-established we already knew the damage they could cause, the different ways they could fail and how to control those risks, and hydro had no greenhouse gas emissions. (”Unless you count the concrete they use...” I muttered.) We are also, he reminded me, societies with only a small number of educated people, so it is better to use tried and tested equipment.

“So what if they are second-hand technologies? There is no shame in that! If it works, let’s have it. And, because they are centralised, they can bring power quickly to the cities which are growing faster than rural areas.” Reaching the urban poor, he reminded me, is as necessary as reaching rural populations.

I confess I was, and still am, more cynical. I think these older technologies were being bought because they cost more than the multiple small renewable systems I thought more suitable for a widely dispersed population. With more money involved

controlled by a small number of people, the bribes are bigger and easier to arrange. Centralized systems also suit people who want to feel in control, and facilitate the reaping of political benefits. Looked at it this way, said the cynic in me, there is no contest: let these deals proceed.

There has long been a big demand for second hand clothes here in Eastern Africa, the cast-off former fashions of the richer world. The Kiswahili speakers describe these clothes, as *"Mitumba"*. Now, I told my husband, we have a Mitumba energy system to match our clothes. He just laughed. "So long as it works," he said, "who cares?"

2030 - 2035

It is hard to remain angry all the time and once married, we both settled into the routines of children, home, family and work. I did take up teaching again after the children were old enough to go to school, but continued to keep in touch with the old networks, helping people I knew who were displaced by the big energy projects. I organized a small charity offering assistance in finding places to live, settling children in school, or securing any small jobs I could find. It was never enough, and always depressing to see their new dire living conditions - cramped, dirty and dark. I couldn't travel much and as I slowly ran out of ways to make any real difference, I lost touch with many of them.

By this time, my husband had been in the private sector for several years, working as chief economist in one firm after another, always moving to a bigger position. He also joined the association of manufacturers and often travelled to encourage foreign investors to come to our region. He had some success and there were more jobs created. For a while, things were looking good. A number of cities in the region set up export processing zones and were making the most of the international markets. Coastal areas, near the ports, were also thriving- economically anyway. From time to time, I would point out to my husband that the increased marine traffic and coastal construction was killing corals and fish stocks, while ruining the lives of anyone in nearby fishing villages. But it was an old argument; neither one of us had the strength to fight. Daily life took up most of our attention. Instead, I quietly joined the opposition, looked for the handful of politicians still speaking out for my old ideals, and sent them what little I could to support their campaigns. Not that it seemed to make much difference.

Some of our friends had started small businesses and did well. For a while there was a lot of work connecting urban households to the electricity grid, but that came with repeated scandals on pricing. I was outraged that the larger electricity users paid less for their power than we did, but my husband argued that was the way it was done. Whenever I passed the slums, I noticed that the number of wires tapping into the main lines seemed to be increasing, and wondered how that worked financially. Somebody must be getting something for that.

Overall, urban energy was better than ever before, at least in the major cities. Addis Ababa had been the first city in the region where women primarily cooked with electric power rather than charcoal. The rest initially focused on gas, but gradually electric cookers became the norm. My husband was quick to point out that charcoal use in the cities had gone way down and that some forest areas were now recovering. Surely I could celebrate that, couldn't I?

Yet, whenever we drove up-country I could see that the bush had not recovered as much as I had hoped. For one thing, people had planted crops where the charcoal mining had cleared the land. I also still saw bags of charcoal for sale along the side of the road, even though it had been banned in our country, as elsewhere in the region. We stopped to buy some for my mother-in-law, who preferred charcoal, and asked them if they ever had trouble with the police. Not much, they said because no one ever enforced the ban and everyone still needed the cash.

It was also clear that the rural areas were suffering badly. Wherever the large projects had been built, people had been forced to move, but many were also leaving the countryside because life was too hard. More critically, entrepreneurial and government attention was fixed on industry, manufacturing and urban areas, not rural agriculture. Whatever rural people did, it was never enough; there was little innovative research to support them, and no economic policies to encourage or support wise land use or facilitate the production of high value crops.

So people left the countryside to move into town, hoping to create a better life. They worked hard, starting small businesses, building whatever they could, or starting some small hustle, but it was a chronic struggle. Housing was especially difficult, forcing people to move often. That is one of the reasons I lost so many of the relationships I had formed during the energy fights. After people moved to the city, they quickly disappeared.

Throughout Eastern Africa, we were becoming very unequal societies. Men and women constantly came to me looking for work, but nothing I did felt like enough. If I heard of a new factory opening, I would send people there and ask my husband to let me know whenever someone was hiring. But there were always more people than jobs and the young ones broke my heart. What future were we offering them?

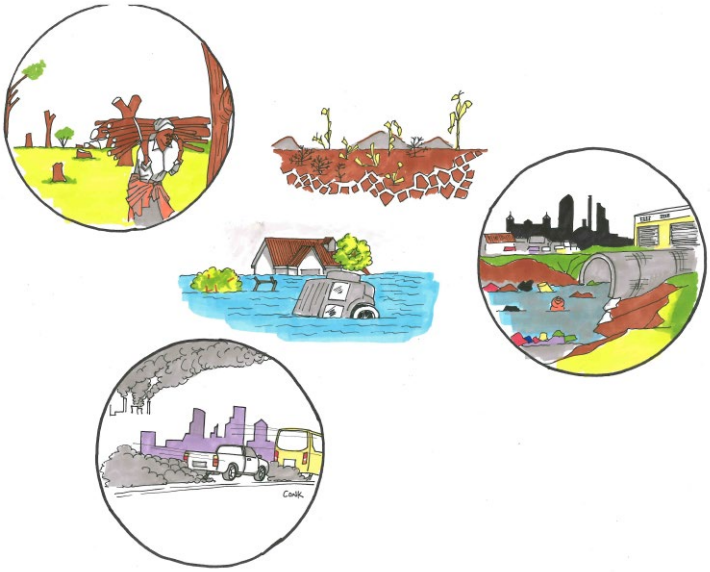
I kept thinking of the big celebrations when the last major link of the Eastern Africa Power Pool was put into place in 2030. My husband and his friends had thrown a big party. Then, we were exporting oil and manufacturing was growing as a share of the economy. Despite my own doubts, people were getting jobs and many lives were getting better. The great development dream seemed to be working. But by the end of the decade, I wondered what exactly we had done to so many people for whom the dream had turned out to be merely a mirage.

2035 - 2040

For it was all too good to last. For some reason, when all those deal makers had been planning their coal and oil projects, they forgot the risks of climate change - or assumed they would only be a problem much later in the century. That assumption was wrong. Throughout the 2020s, weather was becoming more and more dangerous - not just peculiar, but threatening.

New diseases were also spreading more quickly, as were the old ones like malaria which kept moving into the higher altitudes of our region.

The Paris Agreement by now was ancient history, but more and more countries had approved taxes on CO_2 and applied them to imported goods, not just the energy they used in their own countries. As we produced so much of our exports using fossil fuels, the price of our manufacturing exports rose to cover the tax and



found it difficult to compete. It was also harder to sell the oil we had so proudly pumped out of the ground. Not only the carbon tax reduced demand for oil. The switch to electric and hybrid cars and lorries had happened more quickly than expected. There had always been a market in the region for second-hand vehicles, but now more and more of them used electricity and didn't need or use much petrol. We rewired our house to plug in the car. As the need for petrol fell, the price of oil dropped, driving out any oil producers whose costs were too high. That included many of the businesses in our region.

If the carbon tax wasn't bad enough, our manufacturing goods were also finding it harder to compete with the robotic factories in Asia, the USA and Europe. We hadn't kept up with that technological change either and were unprepared. Many of our businesses were starting to shut down and people were thrown out of work. There was rising anger in the cities to the point where we rarely left our own neighbourhood for fear of the violence we might meet.

And then there was the weather. It wasn't just bad policies that were ruining farmers in our region. The climate itself had become more foe than friend. It was hard to know when to sow or when to reap. People were trying all kinds of new crops; looking for ways to be drought tolerant when that was required, and flood tolerant when that was the nature of the season. The swings between extremes were becoming more and more violent, as if the whole system were running out of control. As the gardener in the family, I rarely knew from one year to the next what would survive the growing season, and my troubles were small compared to people who depended on their farms for everything. Pollution was also increasing, especially around the factories where all sorts of ugly waste was being pumped into our ground water and local streams. It was disgusting, but inspectors were easily persuaded that they hadn't seen any really serious problems. We all knew the game...

2045 - 2050

By the time my children were ready for university, the digital economy was the main employer in town. It had begun to make a difference in the region in the mid 2020s, and was dominated by younger generations. This is where our energy investments paid off because the digital world - for all its virtues - is a heavy user of power. Some of the new digital businesses were quite legitimate, others had more obscure notions of success and quickly vanished.

Here is the thing though: when the carbon tax came in, many of our Mitumba energy investments lost their value and shut down - the oil drilling, the refinery, the coal-fired power, etc. Even Tanzania's natural gas suffered, despite its lower CO_2 footprint. All we had left were the debts we created to pay for these projects. As for hydro power, the climate was a fickle mistress, distributing its rainfall in a careless haphazard fashion. Many dams rarely stored enough water to be viable, while others, especially the smaller ones, silted up before they were useful. Dams in some countries

were forced to shut down, largely thanks to irregular rainfall. That left many of us dependent on the few countries with still viable large dams as our main source of power, radically changing the regional political balance. The electricity networks that had once brought the region together now became a major source of frustration and resentment, especially whenever prices rose. I began to hear from some of my old colleagues, now consumed by worry that this could lead to conflict between our countries.

That's when I dug out my notes about small scale distributed energy systems. It was unnerving to live with the very real threat of an energy war, so I knew I needed to help find a solution to change the imbalance. My old notes were mostly useless; still they reminded me of the basic framework. As I did more research, I saw that the technology had moved on and was much more reliable. It was being used throughout the world, in both urban neighbourhoods and rural communities. I kept thinking: we could have been a leader, but now we were once again trying to play catch-up to the front-runners.

That isn't my biggest regret, though. I still think a more distributed energy system would have created a more equitable society. Am I dreaming? Perhaps. But I know that I hate the world around me now. I hate feeling like a prisoner in my middle-class enclave, surrounded by complacent people who believe they made their own success. I want to shake them. The policies we chose, the energy systems we built back in the 2020s, the corruption we tolerated, were better at serving the few rather than the many. You, I want to say, just drew one of the lucky straws in a rigged system.

I've stopped arguing with my husband about this. We know each other so well, we can speak each other's lines in our sleep. As for my children, they ignore me. Except perhaps for my last born, they are too comfortable to think deeply about anyone less fortunate than themselves.

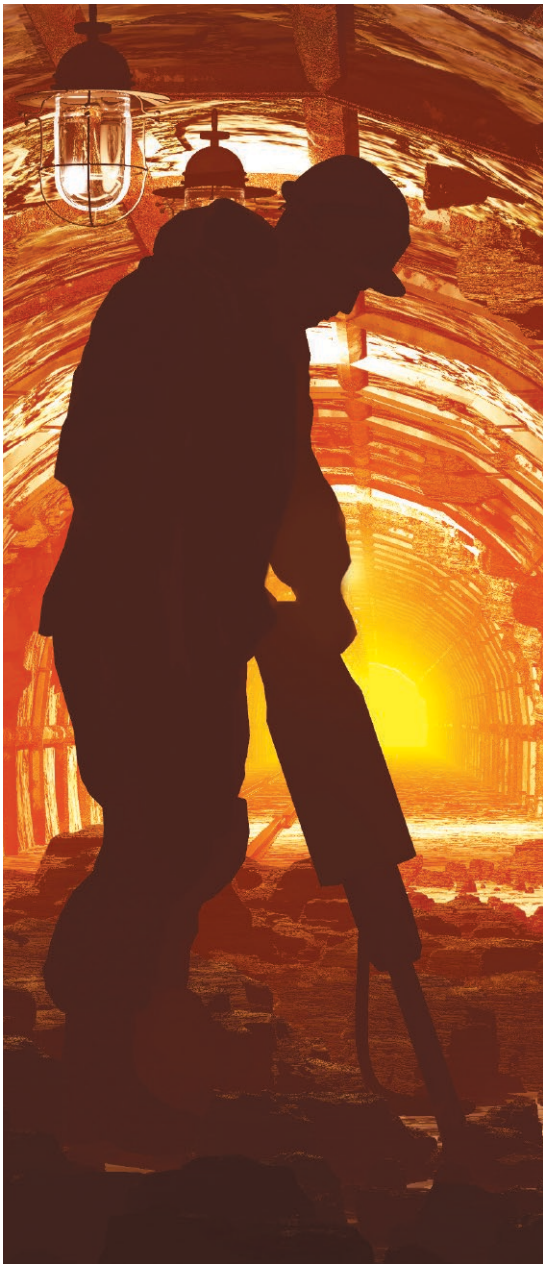
But I whisper in the ears of my students that resistance is an instinct that never goes away. I promise the wild ones that one day, things will be forced to change because too many are suffering. "Be ready," I say, "for the next revolution." ■

02 Markets

2050

It's fascinating, looking back through my diaries and journals over the last thirty years. I'm finally sitting down to write the book my mentor, and I always said we would write together in 2050, chronicling decades of conversations where we have traced the changing fortunes of our region. At the time things are happening, you focus on what is right in front of you, and you don't quite see the big picture until the puzzle pieces are all in place, and you realise how it all came together. When we first started this in 2020, I had just graduated from my Masters programme in journalism and was excited that one of the region's best brains in the area had chosen to mentor me. For me, these early years were filled with excitement as I familiarised myself with the region, began to make my own way through life, buying my first car and settling into a nice new apartment. But the highlight was definitely our monthly lunches: Prof would pay for the lunch and I would bring my portfolio of articles for that period; and we'd spend the afternoon analysing and discussing what was happening in the region.

Prof can no longer write this book with me. I still make time for our monthly lunches, but illness has caught up and our discussions are no longer what they used to be. This book will be a final tribute to that sharp mind that turned me into a believer in markets: in their efficiency, their dynamism and their ability to transform Eastern African societies. I'll publish it under both our names. It will track the experiences we went through in this region and reflect on where they have led us. This was supposed to be the story of how Eastern Africa finally took off to become the economic powerhouse of the continent. But is it?



2020 - 2025

Without Prof's guidance, I might have missed the quiet efficiency of the exploration companies that come to the region looking for gold, copper, cobalt and rare earth elements - minerals now essential for practically everything we do. I also probably wouldn't have noticed how our leaders kept dissent down by carefully doling out their limited largesse or applying discreet force when they wanted to keep people quiet.

Because the newspaper had to downsize and I was already following events around the region, I was asked to also write features for the Environment Desk. That's how I began to notice that the weather was becoming more dramatic - sometimes too hot and dry, sometimes too rainy and flooded. I wasn't much of an environmentalist initially, but I began to see how decades of charcoal

mining and clearing for new crops were denuding the hillsides of their cover, so that they held nothing back when rain and mud destroyed everything they found, creating deep crevasses in soils that had been as hard as concrete in a drought.

The weather occasionally blessed us with exceptional harvests that paradoxically forced food prices to fall. In the cities we cheered; but I was aware that the farmers were losing money. To make ends meet they would sell their surplus to buyers from the Middle East who were exploring the remote regions of Eastern Africa looking for produce to send home. Their countries were hit by multi-year droughts so they kept buying, even when our harvests were poor and our prices were high. As the food trade grew, food prices rose in Eastern Africa's cities, but most people could still get by.

Truthfully, I was much more interested in the energy story. It was the big business frontier in the region, buzzing with new technologies, new ideas and new money. All of us who followed the industry knew the reality we were facing - it came at us with every extreme weather event or episode of volatile energy prices. I loved discussing this story at the monthly lunches; immersing myself in the excitement of big daydreams as we discussed and analysed the unpredictable drama of big money, bad weather and technologies. Prof was deeply invested in canvassing for coherent energy plans, but, frankly, our leaders were paralysed. Policy was a distraction, even for the policy makers. It is only now that I am beginning to really understand, that the cups of sweet tea in government offices that I witnessed swing big energy investments from one country to another were about money being made, but not for the people. Sometimes, I'd be working on a story about a deal being signed on…say a coal plant… only to hear days later that someone else's sweeter tea had decided in favour of a different technology or investment. And there was the added seduction of new roads, new rail systems or bigger deep water ports. Such projects were often so quickly approved; we barely had time to understand what they were about, before we were in the middle of discussing the next one.

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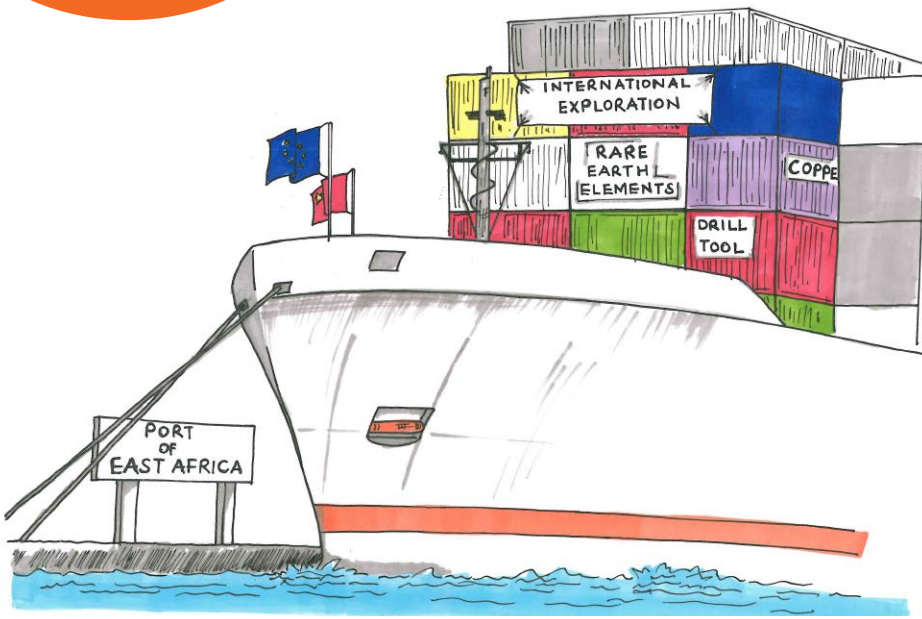


2025-2040

Our strategic emptiness was exposed by the 2025 financial crash. The rich nations were the first to go down, but we were all living on borrowed money. Our personal debts, especially those we racked up on our smart phones with 500-600% interest rates, were overwhelming us, while governments' debts were off the charts. Then there was the crash and the tide went out. We were stranded, naked swimmers in an empty sea.

We looked to our leaders for guidance, but those most responsible for the mess had all already served their terms and retired, or simply resigned and disappeared from accountability. The elections swept the board and brought in a new crop of political leaders but there wasn't very much they could do really. The new leadership tried to look powerful, but they were unable to help anyone but themselves. As for the rest of us, we floated from place to place, job to job, or 'prophet' to 'prophet', but nothing stuck. We drifted. That's the word I would use now: we were all drifting. By this time, we could just about keep our heads above water. A sucking vacuum of leadership and ideas kept pulling us down. So that's how it happened. One minute, it was all about "Development", "Economics" and "Entrepreneurs". The next, we saw the world start to crumble into unpredictable pieces.

My stories about the environment were increasingly dominated by climate change, as it became a frightening reality everywhere that no one could ignore. That forced people to give the Paris Climate Agreement stronger legal force - in the rich countries anyway - and motivated a more rapid shift to low carbon energy systems. Exceptional turmoil in the Gulf States spilled over into the Horn of Africa, bringing more security forces into our region, "to hunt terrorists", they said. It also increased the instability of global oil prices, accelerating the shift to electric vehicles in the rich world. It was an exciting time to be a journalist; but a very scary time to be a citizen of this region. We were just waiting, wondering what it might mean for us. We keep drifting, open to anyone who would tell us what to do. That's when those prospectors came back - the ones who had been looking for all those vital minerals before the crash.

> **"We looked to our leaders for guidance, but those most responsible for the mess had all already served their terms and retired**

The first invasion: minerals and natural gas

In our monthly debates, we'd speculate about what was the primary influence in our decision-making in this regard. I'd argue it was the climate emergency. Prof insisted it was our debts. You see, we had started to invest in some big fossil fuel projects, spending a lot of money we didn't have. Then the rich nations offered us large pay-outs to shut them down, so that's what we did. We took the money, but there was a catch: the wealthy ones now were investing in renewable energy, and that meant they wanted the minerals and rare earth elements required by renewable technologies. Electronic companies were equally keen to secure their own vital supplies.

Suddenly, all the exploration companies that had been poking around before the crash were back like vultures, ready to exploit their mineral rights or find new ones. They came from everywhere - Canada, USA, Europe, India, Korea and especially China. Everyone wanted to have access to some supply of critical minerals, and the Great Rift Valley with its rich volcanic past was promising new territory. China's near monopoly of rare earths had been used as a political weapon too often, so the push was on to find other sources. Prospectors even went into forests at the top of Mt. Elgon, Mt. Kenya and Mt. Kilimanjaro, to the disgust of the environmental crowd; and, as I discovered in writing those stories from those who know these things, the spirit world. Where oil had been the scarce resource of the fossil fuel age, minerals became the prize of the renewable age.

Our own elites suddenly woke up. As Prof had been arguing they needed to do, they sent delegations to the major business capitals, inviting companies to invest here, pointing to the new deep water ports along the coast that had been built before the crash. Tanzania and Ethiopia took the lead, using their gold deposits to attract more investors. Uganda was offering cobalt, needed in all the smart phone batteries, but hard to come by outside the Congo. Kenya had already sold off its deposits of niobium and rare earths in Kwale on the coast, but was ready to look for more. Ethiopian hydropower was attractive because it could support more sophisticated mining activity and industry. Its leaders also promised that resistance to gas exploration in the Ogaden would soon die down. Gas, they reminded anyone who would listen, is a great transition fuel.

As the prospecting companies found better and better deposits in Eastern Africa, we said to ourselves: this is our new oil. All investors wanted a stable region, minimal oversight, good ports and export facilities to reach their markets. Our governments could offer that, and left the doors wide open, trusting the market to sort out which investors would stay.

That's how the great minerals invasion came into Eastern Africa. Property rights were tricky at times, but most people could be persuaded to let the mines proceed. After the 2025 crash, people wanted work, and believed that schools and health facilities would sprout around the mines, benefiting everyone. We closed our eyes to the land grabs and dangerous work conditions. There were more paying jobs and development was reaching our more remote regions. Our headlines on the business pages shouted that a low carbon energy future was taking off right here. Over our evening beers, we made bets on which big boss would get rich first and hoped that some of that wealth would head our way.

The second invasion: agricultural lands

My discussions with Prof influenced my embrace of the benefits of big business entering agriculture. Who else would have the wealth to manage climate change risks and make our land more productive? We were largely indifferent whenever the question of ownership came up. Land, we would say, is just a commodity like everything else. If the foreigners will pay for it, let them do so! So, I did not write about the travails of hard-pressed farmers cheated out of their small holdings. I preferred the stories of tycoons and corporations paying our governments large sums "to develop" fertile land in the remote areas of our countries. I was the first to praise Saudi Star Agricultural Development's commercial rice fields in Ethiopia and the donor-led commercial farms in Tanzania, admiring their increased production of food. I also reported on the changed lives of labourers given new jobs, and on the careers of educated East Africans managing those farms and businesses. Looking at my articles, I am amazed at how I missed the link between the food we produced for export and the hunger our people experienced here. Like others, I was busy looking after my own family and just watched as more small farmers were forced to sell out or move, unable to compete with the commercial farms.

This was our second big invasion: foreign corporations spending millions of dollars 'turning swaths of bush into farms each the size of 20,000 soccer pitches.' I applauded the success of East Africa's Green Revolution and dismissed those who protested the takeover of our land and food production. When I saw these prosperous businesses, I didn't understand why they said we had become a controlled people again. I ignored the anger of the ones we had abandoned.

The third invasion: carbon markets

The search for land and minerals were major new investments in Eastern Africa and kept GDP growth rates relatively high. However, in the rapid shift to decarbonize the global economy, there was also a push to take as much CO_2 out of the air as possible by restoring degraded lands or (more fashionably) protecting healthy habitats and spectacular wildlife. A high global carbon price reinforced the will to de-carbonize. Despite some cheating around the edges, creative investors found new ways to use the global carbon markets to reward any corporation that had restored forests or grasslands capable of storing CO_2.

Prof remembered writing about the initial excitement with which Eastern Africans had opened Africa's first Carbon Exchange in 2011 in Nairobi. But low profits caused by high transaction costs and small trading volumes had put paid to all that. By the 2030s, I was reporting the bankruptcy of many local carbon traders; and the buyout of local firms by their larger foreign counterparts. Gradually, they were taken over by the international traders who invested in larger forestry projects to sequester significant amounts of CO_2. This helped to stabilise global emissions, but the financial profits did not go to Eastern Africans. The money went to the foreign traders who offered carbon offset credits to industrial firms and high polluters in the wealthier world.

By then I was privately advising partnerships of foreign philanthropists and businesses investing in land restoration and carbon sequestration. They wanted to use community forests in my home area for sequestration. They focused on the climate emergency and dismissed as irrelevant what the people had to say in our consultations regarding the importance of local needs and cultural traditions. I saw my people lose control of their forests and land. My grandfather wept when he saw what was happening. That forced me to re-think what was going on. I'd thought I could influence their thinking, but I was so wrong. That is still one of my deepest regrets.

And so, yes, we could celebrate the fact that global carbon emissions had peaked by 2035. What I know is that Eastern Africans paid dearly for that success. That is when I started writing about the 'invasions'. What made it worse was that the climate was already so wrecked that troubles were still pouring down on our heads, making it hard for ordinary people to work the soil and herd their animals the best way they knew.

The fourth invasion: exporting power

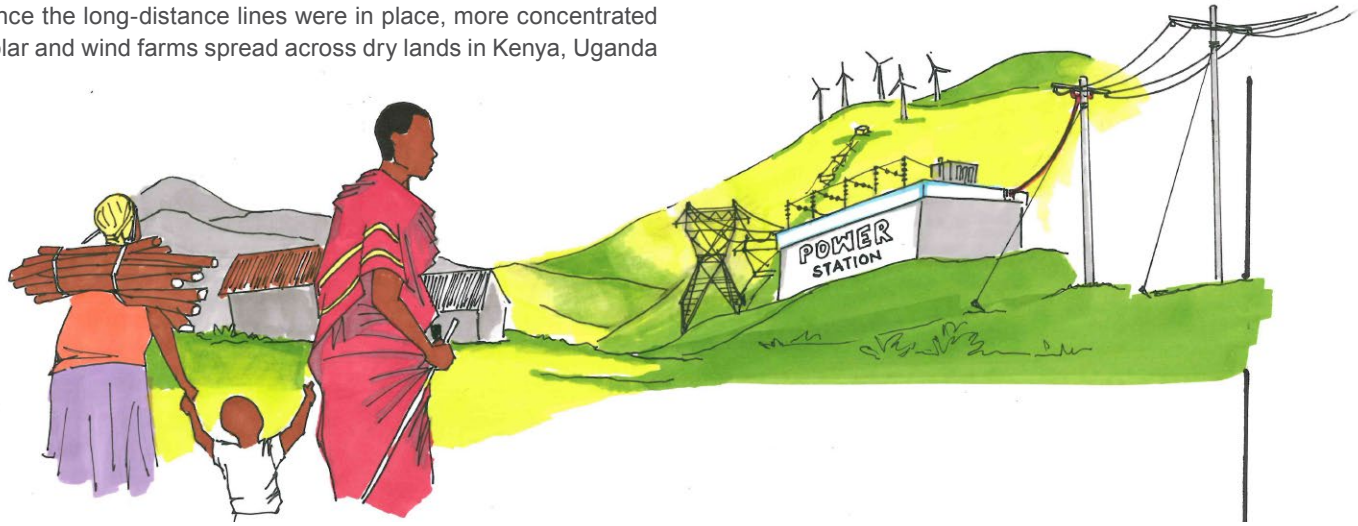
Our development plans had all called for more manufacturing, but apart from mining, there was very little industry in Eastern Africa. As a result, the large-scale power projects in hydro, gas, solar and wind built in the 2020s to serve industry were now producing more electricity than Eastern Africans could consume or afford. The Eastern Africa Power Pool (EAPP), once a grand ambition for sharing electricity regionally, never won the trust and backing of regional governments. Instead, it had remained an engineer's day dream on a dusty shelf.

Then, in the late 2020s, Chinese investors saw a ready market for clean power in North Africa and Europe. They raised the money to connect Eastern Africa's excess power to the European grid using Ultra High Voltage lines, which reduced line losses over large distances. They promised that Europe would be able to retire both nuclear and coal-fired power stations by using cleaner Eastern African energy. The system now linked Tanzania's power plants in Mtwara with geothermal in Kenya and hydropower along the Nile River in Uganda and Ethiopia, including Ethiopia's Grand Renaissance Dam. What was less urgent was linking this power to our homes, so the "last mile" of connections was often neglected, especially in remote areas or poor neighbourhoods.

Once the long-distance lines were in place, more concentrated solar and wind farms spread across dry lands in Kenya, Uganda and Ethiopia. While these projects were marketed as "energy for Africa", they limited themselves to serving Eastern Africa's mining industries and wealthy urban areas. Most of the power went north, while the investors earned valuable certified emission reductions (CERs) that could be sold for profit or used to meet the Paris Agreement's targets, which were becoming more stringent every year.

Prof was delighted to see the EAPP back in business, but it wasn't due to any great regional cooperation. Our regional organisations had become little more than overseers for foreign interests. Instead, this was a market-driven decision by private investors financed by major international lenders. These were led by China's Asian Infrastructure Investment Bank, but included the European Investment Bank, African Development Bank and the World Bank.

This was the fourth invasion filling the vacuum around our own leadership. Once again, land that had been previously managed by local people was turned over to outside investors with most power exported or used only by major African businesses and wealthier households. Local people objected, but government leaders just saw good deals, reduced deficits, new industries and a more comfortable life for themselves. Any downside was just the price of development.



2040-2050

Four invasions building slowly over two decades, taking our minerals, our agricultural land, our trees, grasslands, sunlight and wind. It was so gradual, we just gave and gave. Now we face the long-term consequences, which have become more and more manifest in this last decade. Prof retired in 2040. The dream of leaving the city to go “back home” became impossible when the family’s ancestral land was taken over for a mining concession. And the tone of our discussions changed as we began to take stock of where we had come to as a region.

The mining jobs were often well-paid, allowing one person to support many others, but the working conditions were harsh and exploitative while the land was left badly damaged and polluted, often unable to support agriculture. Agricultural land grabs were more of a mixed blessing. Farming jobs provided a regular income (if the salaries were paid properly), and employees could take home any food that was good, but unsuitable for shipping. Farming and herding were also riskier in these years of changeable weather patterns which is why people were ready to allow their land to be used for renewable energy and carbon sequestration schemes. But leaving was never easy; it hurt to abandon our land, our ancestors, our homes, and the ideal we had of a good African life.

You know, we did all that we did because we wanted the best energy system possible. Well, by 2040, both coal and oil had largely faded from our energy systems. A high price on CO_2 emissions drove out coal, while the global switch to electric vehicles and the development of American shale oil, drove the oil price down, wiping out any profits from Eastern African oil production. Many of those big oil projects wrote about in such excitement in those early days never saw the light of day or were half built and then abandoned. The Lamu coal-fired plant proceeded long enough to be destructive, but not long enough to be profitable; while the Uganda refinery never earned a real penny.

So now, our Eastern Africa’s energy system has moved in two very different directions. In one, there is a large scale, clean energy revolution based on electricity coming from geothermal, hydro power, concentrated solar and wind, all backed by natural gas. This is the world of global business, serviced by a low carbon economy and energy system efficiently meeting the needs of those ready to accept and pay for what it delivers. It’s Prof’s dream come true. Its champions have embraced the new world of highly profitable renewable energy and its supply chain, backed by limited fossil fuels. They are our elite, and live as well as the best anywhere in the world. They are the lucky ones - or just born to the right families, which is luck by another name. They lead large companies or well-placed government departments; they are the local owners, or at least shareholders of major Eastern African businesses.

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Farming and herding were also riskier in these years of changeable weather patterns which is why people were ready to allow their land to be used for renewable energy and carbon sequestration schemes

And the other system? It is a mish-mash of whatever works. The poorest can no longer afford even the smallest handful of burnable dust. They burn whatever rubbish is found in the alley ways of their slums. Many of these people have been pushed out of their land in rural areas and even in cities. I haven't written about it before, but I have watched women and children crying each time they were forced to move until it became just a normal part of their lives. Slums are growing and strung with dangerous and illegal electric wires. Without significant investment in social services they are also ready sinks of infectious disease.

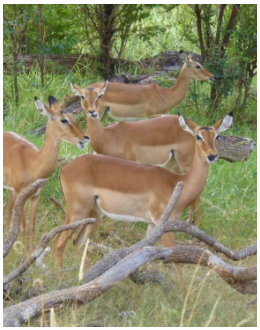
As our urban areas grow, they foster a hard economy of micro-enterprises as people, even children, use small amounts of money to "hustle" their way to a better life. These are the working poor, who cope with cheap solutions: solar and wind installations that rarely work long enough to pay off the debts used to buy them. They rely on charitable efforts to give them more efficient wood stoves or create methane gas from urban sewage and toilets. They rarely succeed. They work hard but move often; disrupting relationships, schooling and families in a never-ending search for lower rent, better incomes or safety. Over the past ten years I have watched as the relationships and personal networks that once offered many people some security have frayed in the face of chronic hardship. In these places, "getting by" and "getting ahead" are miles apart, but that hasn't been a story I can write for the business pages, which I still do from time to time. This book will tell it.

A good number of people are caught between destitution and modest security. We are the corporate citizens, all of us who became good employees, and supporters of the new export economy. Rather than running away from the foreign establishments that had invaded our lands, many of us ran towards them, hoping for work - or to live with someone who had work. Some of these companies were just "snatch and grab companies" making a quick profit before getting out of town. The best corporations have opened clinics, offered secure places to live and even supported good schools. They are sophisticated businesses and need a competent workforce, so at least they do some good work. We use them to educate the next generation to a better standard than we enjoyed and to provide our medical services. To be honest, corporate welfare is an improvement on government's social services. These businesses are long term, paternalistic and strict, but orderly. If you respect the rules, you do well. They are proud of what they do, but conversations with them often carry the echo of rose-tinted stories about colonial times, a subtle arrogance that makes me grit my teeth when I hear it.

We have slowly grown accustomed to using gas, especially methane gas from household scale bio-digesters which have come down in price. Small propane gas canisters are another good business. Local entrepreneurs have also set up 'off-grid' gas distribution in estates where they can offer a regular supply of gas for cooking and heating. In the end, price and entrepreneurial effort decide which energy supply gets used for what purpose. For this middle class, there are multiple renewable energies on offer, including a few local technologies that show promise. Most renewables are small scale and off-grid, rarely integrated with each other. Some work well; others are cheap second-hand technologies from Asia and the West. The weak ones rarely last. They serve their purpose for a little while and then break down. Some bright mechanics have the skills to fix them, but such people are expensive and hard to find.

In transport, we remain the best market for all the cast-off vehicles the rich energy-transitioning countries no longer want. Old internal combustion engine vehicles are selling for knock-down prices, with some of the first electric vehicles following behind them. Old generators are another big item, suddenly selling for little money. Frankly, we are nothing but a dumping site, but it is good business for the middlemen. Eventually, all these cast-offs end up in some rather shady recycling operations, back street businesses that extract whatever can be profitably sold again. Few notice the strange illnesses that affect our workers and their children, or can track how much pollution is leaking into local water and soils.

It is ironic. The global energy transition to a low carbon world is thriving in 2050, but here in our region, the transition is incomplete, rarely reaching the poor while the rich boast of their green credentials.



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Without much notice, many of our plants, birds and animals have vanished or been driven away.

Final thoughts

So how do I want to end our book?

First, I want to make to make manifest the impact on the environment. Yes, I’m back to that after these many years. All these changes and invasions have created a queer patchwork across the land. I have drone pictures of the ugly scars of mining operations, showing clearly the downstream damage that spreads the impact beyond “their” land. I have pictures showing vast grey areas where roads, houses and shanties spill out of the old city centres; shanty towns covered in rusting tin sheets, tucked over and under each other like one large compound roof, next to wealthier neighbourhoods boasting a rich garden green canopy. And I have contrasting pictures of rural areas with tidy crops parcelled out in neat lines between farm roads and regularly dotted with packing houses along rivers and valleys. The rivers here are often a bright sterile green of fertilized algae which sucks out the oxygen fish need. The large tree plantations are a different green. Carbon investors have planted great mono-crops of fast-growing teak or other exotics offering good wood and fixed years of carbon sequestration.

By the way, our indigenous plant species are now rarely seen. The supply chains of local tree nurseries that were once thriving have now all but disappeared. Funding dried up for basic research in native plant species as well. Where they have regenerated on their own, you can see spots of wild bush, often in areas once stripped for charcoal. But these areas are few and far between. Without much notice, many of our plants, birds and animals have vanished or been driven away. There are the remnants of the great wildlife parks, ancient islands in the newly simplified land, but we are biologically impoverished. I keep hearing my grandfather’s voice talking about the abundance of life - of all life - in his childhood. In allowing the four great invasions, we have unwittingly stamped out our most valuable spaces and habitats, reducing the real wealth of Eastern African life to an ancient, even magical, mythology.

Something else the book must address: all these busy enterprises have private security firms keeping order and reducing theft. Even the plantations are guarded against unauthorised charcoal burning or stealing. No one really likes the private security forces, but many of us like having a job because there isn’t much else to do. My sources in the security firms tell me that they have often helped the foreign military units who are based in the region.

There are also private security people around all the ports and major transport hubs. I’ve interviewed managers explaining why. “You can’t be too careful” they tell me. “We need to keep our own people safe.” “Our own people?” Who does that include? That kind of question increasingly came up in those last discussions with Prof. We’d never seriously talked about it before, although we’d joked that all these businesses are the new colonial Tribal Chieftains. They control the land and decide who gets which benefits. They offer security, for those who join them, and ignore the rest. They negotiate with each other to decide what we need and who will provide it. If you start a good business working with these firms, you became part of their tribe. That is the deal: we work with foreigners to export our crops, minerals, energy and carbon, and then buy their consumer goods to brighten our homes. It seems so very orderly, so very rational. And, I have to admit, I have written about it in the past as proof of our development, which is the way I think Prof sees it: a great suite of new technologies that took off here.

Why haven't we fought back for our rights? Well, who do we protest to? Our leaders are clearly complicit in this new world; and what can they do? They've voluntarily signed the international agreements that have handed our region over to those our ancestors fought to liberate ourselves from. As for workers, even professionals, they could strike, but are easily replaced; so strikes do more harm than good. We have learned to be docile and seen enough violence - official and popular - not to want anymore. As for walking away, who would take us in?

So that's the book. Our world is "enjoying" this fragile new world order, this "development".

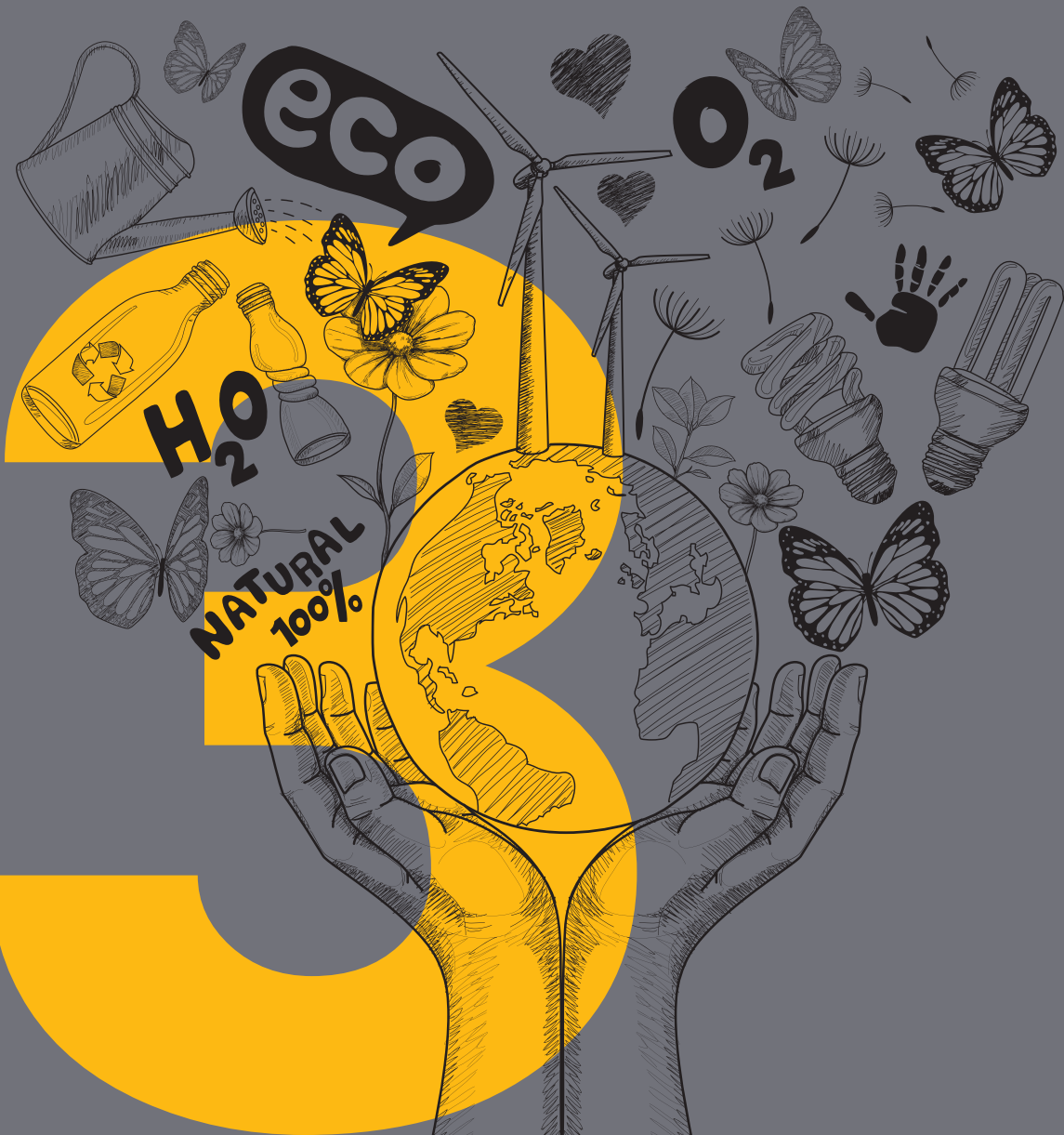
Me? I'm very ambivalent about it. ■

Endnotes

1 Kwale:http://www.theeastafrican.co.ke/news/Kenya-hits-USD100-billion-rare-earth-jackpot-/2558-1920964-ma895tz/index.html

2 Ethiopia: https://ig.ft.com/sites/land-rush-investment/ethiopia/ Tanzania: http://africanarguments.org/2018/05/15/there-isnt-any-tanzanias-land-myth-and-the-brave-new-alliance/

Struggles

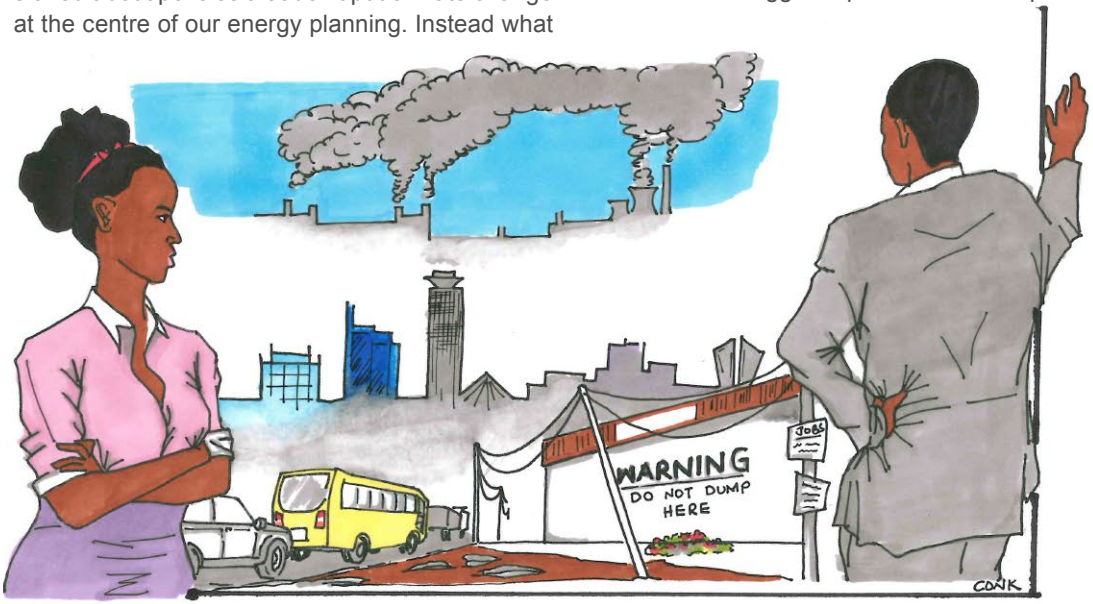


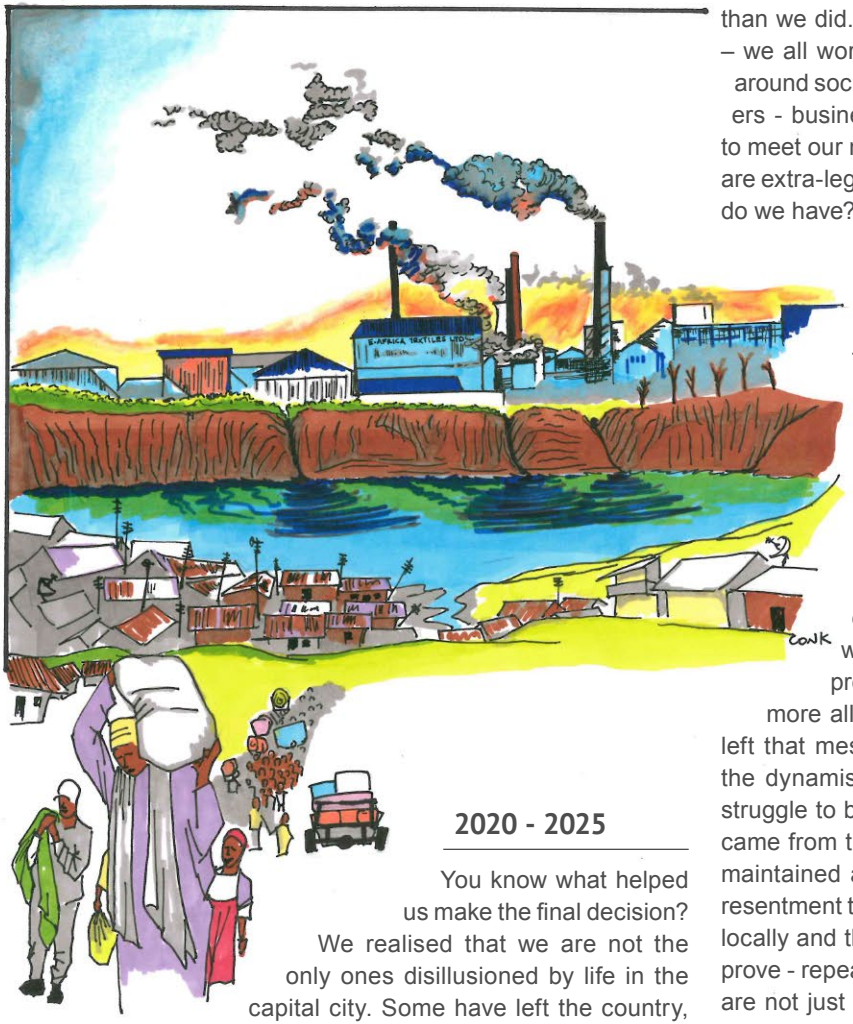
2020

My wife and I have been arguing about this for months - she wants to leave, I want to stick it out. Then we change positions: I want to leave and she wants to stick it out. Look, we are both professionals. We worked hard to get our education and find these jobs in the civil service. We did our best to make a difference, but we can't take it. The city is unliveable. You can't move anywhere without being blasted by auto fumes on overcrowded roads where reckless public transport just pulls out any which way. You know what I mean. Once upon a time we would marvel at the changing skyline. Now, it has been blotted out by a layer of smog that rarely moves. And what kind of life is this for our children? We want something better.

My wife works with the Ministry of Health and worries about what the air is doing to the children's lungs. I work with the Ministry of Energy. I'm disillusioned about policies that don't put climate change at the centre of our energy planning. Instead what are we doing? Investing in big hydro and still chasing fossil fuels. Tanzania is exporting gas and starting a new dam in Stiegler's Gorge with advice from the firms building Ethiopia's Grand Renaissance Dam. Uganda is exporting oil before its own refinery is finished, while Kenya is hoping for a bigger oil find and ramming the Lamu coal-fired plant down everyone's throat. Despite local and international opposition to these projects, no one listens when we ask how this new energy will help the majority of families who still use charcoal and wood to cook their supper because that is all they can access or afford. Will such expensive projects bring affordable energy to them?

So we've decided. We will rent out the house in the city and move. Not back to the village - that would make the children crazy - but to one of the smaller towns away from the capital. Life is easier and cheaper there and we both want to do something that matters, that makes a difference. We think that we can have a bigger impact in a smaller place.





2020 - 2025

You know what helped us make the final decision? We realised that we are not the only ones disillusioned by life in the capital city. Some have left the country, but most, like us, have chosen to go to smaller towns or return to their rural homes. One thing we are all realising is how different life is out here. When it comes to services like water, electricity or security, the government doesn't even pretend to offer them in many places. Instead, we are discovering community as we never experienced it in the city, although people in the informal settlements probably worked things out like this much more than we did. People here don't much have choice – we all work with our neighbours, and coalesce around social networks or find local private providers - businesses, charities, self-help collectives- to meet our needs. Sometimes, those connections are extra-legal or downright illegal. But what choice do we have?

I'll be honest: I'm homesick. We're all homesick. This move has not been easy and we miss our old routines. The children are resentful and unhappy, missing their friends and schools. My wife and I are struggling to find our feet and create new occupations for ourselves that can pay the bills and provide some sense of purpose. She has chosen to go back into public service but I am determined to make self-employment work. Our city training is not always appreciated around here, but we are finding more allies. Apart from others who have also left that mess behind, we've come to appreciate the dynamism of many of the local leaders. We struggle to be accepted, even though our families came from this part of the world and have always maintained a connection. Some of that is simple resentment that we have more choices than people locally and that we have more money. We have to prove - repeatedly - that we can be trusted; that we are not just thinking of ourselves, but of the people around us. It was all much simpler in our day dreams ...

My wife found her place first, working at the local clinic as a volunteer. That was a good place to find acceptance, especially when people realised that she was a reservoir of knowledge, built up at the Ministry of Health. She now works with the local council, helping to translate national policies no

one knew about into workable solutions that bring people real benefits. I've begun with a small solar business - something that was affordable. I have to credit the children for this. I needed a way to ensure we had dependable electricity to give them access to the internet and some of the things they were so used to. It's also helped us ensure that their education doesn't suffer from being here. The children now run a computer club for their friends, and that has helped them not only build new friendships, but also discover the things they can do here.

The business is barely beginning to break even, leave alone make a profit, but I can see interest picking up. I already have my entire neighbourhood connected in a mini-grid, which I hope to replicate as more people catch the vision. The hard sell was finding people to sign up early, so I could get enough capital to begin. Banks were not very sympathetic, so we began with family and friends; then the neighbours came in and even some acquaintances. As I said before, we are truly living the word 'community' as never before.

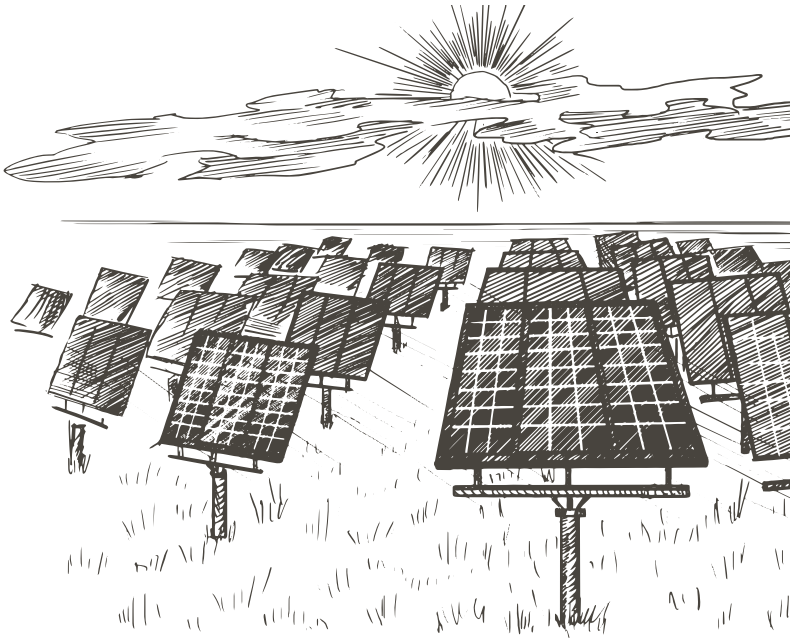
2025 - 2030

My big break came after we helped bring electricity to our children's schools. The local church sponsoring the schools is now fully invested in the project. The bishop invited me to speak at a meeting and the parishioners actually set up an energy fund. I can now demonstrate that it is possible to use renewable energy to challenge the bigger companies who had created pay-as-you go systems. Those are the ones where people pay a small amount at a time, but when you add it up, the rates are very high. That isn't fair. It has been a real boost to my confidence to be able to convince people we can do better.

What I hadn't expected was the big fight with central government who accused me of undermining the energy providers authorised to distribute power to our region. After someone from central government abruptly cut off an entire neighbourhood I had wired up with renewable electricity, there were such huge protests, we made the national news. Since when is bringing affordable energy to people a crime? A lot of people have come out to support us on this one; and now we have a movement!

We were inspired by the Save Lamu coalition who prevented that coal-fired plant from being built. Do you know what has pleased me most? The children and their friends have plunged headlong into the campaign. They have worked tirelessly to publicise it, using social media and all kinds of arts. My wife showed them how to put together publicity materials, and her women's group, fired up at the prospect of accessible and affordable energy, has used its networks to host meetings for the team all over our sub-region. And guess what? The government has backed down.

It has been a hard struggle. Not everyone was supportive of us at the beginning and some local politicians tried to warn us off, but it has been so worth it. We are creating jobs, right here, in our own town. The young people are so invested that we have decided that our service teams - the ones who maintain the renewable systems - will only hire from local youth groups. Many tell us this is their very first paying job, and it's been amazing to see the impact it has on them.



2030 - 2035

We have just accomplished something really big - not just me and my family, but all of us: the people like us who left the capital, plus those who have always lived here and all the people in the smaller urban neighbourhoods who get ignored by the state. Together, we've realised that making things relevant for local communities works best when public officials are directly accountable to the people of those communities. Public servants, we said, should serve the public. A lot of people said that local government can only do the small things, because only the national government is capable of real management. We disagreed and joined forces to create a movement to hand more power to the people by giving our local councils the responsibility and resources to provide services to us.

It has been a huge struggle and I don't want to dwell on the violence I have seen, because that has happened. But today, we have truly put in place the legal and policy frameworks to make it happen. My wife and I are now determined to do our part to make the new system effective. Our experience working in the national government has served us well in translating processes to the local level. My wife's energies are now invested in creating effective public participation processes that are not just rubber-stamp rituals to validate useless politics. We proudly claim that the days of both the strong central state and the lazy local council are numbered! Of course, there are those who fought us all the way; having benefited from the system for so long, they cannot believe everything has changed. But we are ready to defend our gains with our lives if need be.

We are trying everything these days. We have to. The changing weather means we must find new crops, and grow many different types of food that can survive whatever comes our way. We need to harvest water, to slow it down, to plant trees for our timber, food and fuel. We need to build schools and hospitals that stay cool and keep out the rain. We want the housing people need.

As we experiment, we create different kinds of jobs and different ways to pay people for what they do. Not everything is reduced to money. Young people find work doing reconstruction and repair, or in informal manufacturing, or planting once forgotten crops now more suitable for changeable weather. They create and support local seed banks and exchanges, even restoring local forests. We are learning to educate the children so that their school work makes sense in the world they live. I am proud that my own children often lead these efforts in our town, teaching us to embrace the dignity of labour we once scorned back in our city days. We are all learning to live as if all living things matter.

The young people are also our masters of the digital world, using it to provide the social glue that keeps us working together. They circulate information rapidly, help with the payment systems that keep goods and services moving, create local currencies that reinforce community trust. There are many failures along the way, but each mistake is another lesson, each success a cause for celebration. Raw determination and rapid learning is the rule, supported by laughter as the only response to often frightening hazards.

In my renewables business, we are now selling energy to local computer servers as well as households. This earns good money, helping to pay for new equipment, but I need to find more partners I can trust. That is usually harder than sourcing the right technology. Energy storage has improved a lot, but a mix of technologies is still more reliable - solar, wind, biogas, etc. with some back-up fossil fuels.

Most of my time these days is spent in negotiations. I am one of the elders now and get brought in to conduct many mediations. I have learned a lot from my wife, whose years of experience in public service have given her a wisdom and patience we all treasure. Slowly, we are accepting the many compromises of everyday life. We can spend days hammering out agreements on everything: rules of the local market, sharing the costs of new energy systems, agreeing on public maintenance. Across the country I hear friends complaining that negotiations are endless but necessary - whether they concern water, grazing, street sweeping, begging rights or who paves the road in front of urban homes. Many are exhausted by the effort. The strong keep going.

2035 - 2040

Have you ever watched a storm approach? The sky is clear, but far away is a smudge on the horizon. You think that maybe the wind will blow it in another direction, but it keeps coming towards you until half the sky is dark, then the air around you goes black and a few drops of rain fall, just a few dots on the ground. You think that maybe the rain will head off somewhere else, but instead it falls faster and faster until the heavens are pouring buckets of rain on what was once dry ground, clattering on the roof so loudly you cannot hear yourself think.

Ten years ago, in the mid 2020s, our troubles were like those few drops of rain on the ground - just a few dots here and there: a flood that swept through a village somewhere else, or a drought that killed many animals in a remote county, or violence between gangs of young men in the city or the countryside. Often it seemed far away, but recently these troubles, have moved closer and are coming more often. It is now one crisis after another, one shock after another. A lot of it is caused by the extreme weather and people's attempts to find new places to live, families who are forced to move to places they are not wanted. The Europeans are still slamming the doors in our faces, so we struggle to take people in - or we see people searching for a welcome in new places they never called home. At times I fear we are disintegrating, because there are only so many shocks people can take before everything falls apart. I am sure that some places will never recover. We have always had food on the table in our house, but some years, drought means that our farm does not produce enough to feed us and we have to supplement by buying a lot more than we are used to. Yet, we are fortunate. Those we have kept in touch with in the cities tell us good food is more or less unaffordable.

We've been reminded that there is only so much our small communities can do. These climate shocks affect everyone, so we need the national government to play its part, as well as the region and the world, all of us working together. We appreciate anew the importance of solid national, regional and global policies and yet that cooperation is becoming scarce. Foreign aid workers are leaving because their budgets are cut, or their funding appeals raise very little money. Wealthy nations are scrambling to pay for their own recovery with little left over for suffering Eastern Africans.

More than ever before, we are forced to rely on ourselves, our neighbours and our kin. The best leadership we have encourages everyone to share the load, cajoling us with humour, exasperation or stern and forceful looks. My cousin is particularly good at that look, you know the one! Thank goodness the children are now all done with their formal education, at least for now. My wife is retired; but is still deeply involved with community organising.

“What brings respect in these difficult times? A bigger house or a small one? Many children or just a few? Many things or a clean river and clean air? Which is more important: the ability to own or the ability to share? Maybe it is just an old man talking, but my thinking is different now.

2040 - 2045

I lost my wife last week. I want to find someone to blame. I want to cry out and weep and groan with the pain of this calamity. To the very end, my wife was working on solutions. Perhaps if she had not been, she would still be here today. Our last-born is also very ill. Perhaps the work that my wife and those she worked with were doing will be what helps us find the cure for this new epidemic that is killing us. It is the worst ever seen in my lifetime… we have lost many thousands already, and surely many more will perish before we see the end of this. I don’t know how I will keep going. I must distract myself, find help, offer help to others who are worse off than I am. We have to keep going. Together. Somehow.

I want to believe that better times will come, but I don’t know what ‘better’ means any more. What do I really want for me, and for my family? My grandchildren and my great children? For my neighbours and kin? What is enough? What brings respect in these difficult times? A bigger house or a small one? Many children or just a few? Many things or a clean river and clean air? Which is more important: the ability to own or the ability to share? Maybe it is just an old man talking, but my thinking is different now. All our troubles, and especially the epidemic, have changed us. We feel the ground beneath our feet as something alive, something that is a part of each one of us, just as each one of us is a part of everyone else around us. We cannot, should not, be separated again.

I just don’t know what that means, practically speaking. And I am a practical man.

Losing my wife has been a blow that I have really struggled to get over, even after the epidemic finally subsided and we began to settle into our new normal. I’m thinking so much more now of the importance of legacy. I’ve decided to totally hand over the energy business to the children. I guess we all know how hard that is ... I want to separate the pieces, and match each business to the child with the best potential for improving it. I should do it while I can still be around to guide them, though I doubt they want my guidance. We’ll see.

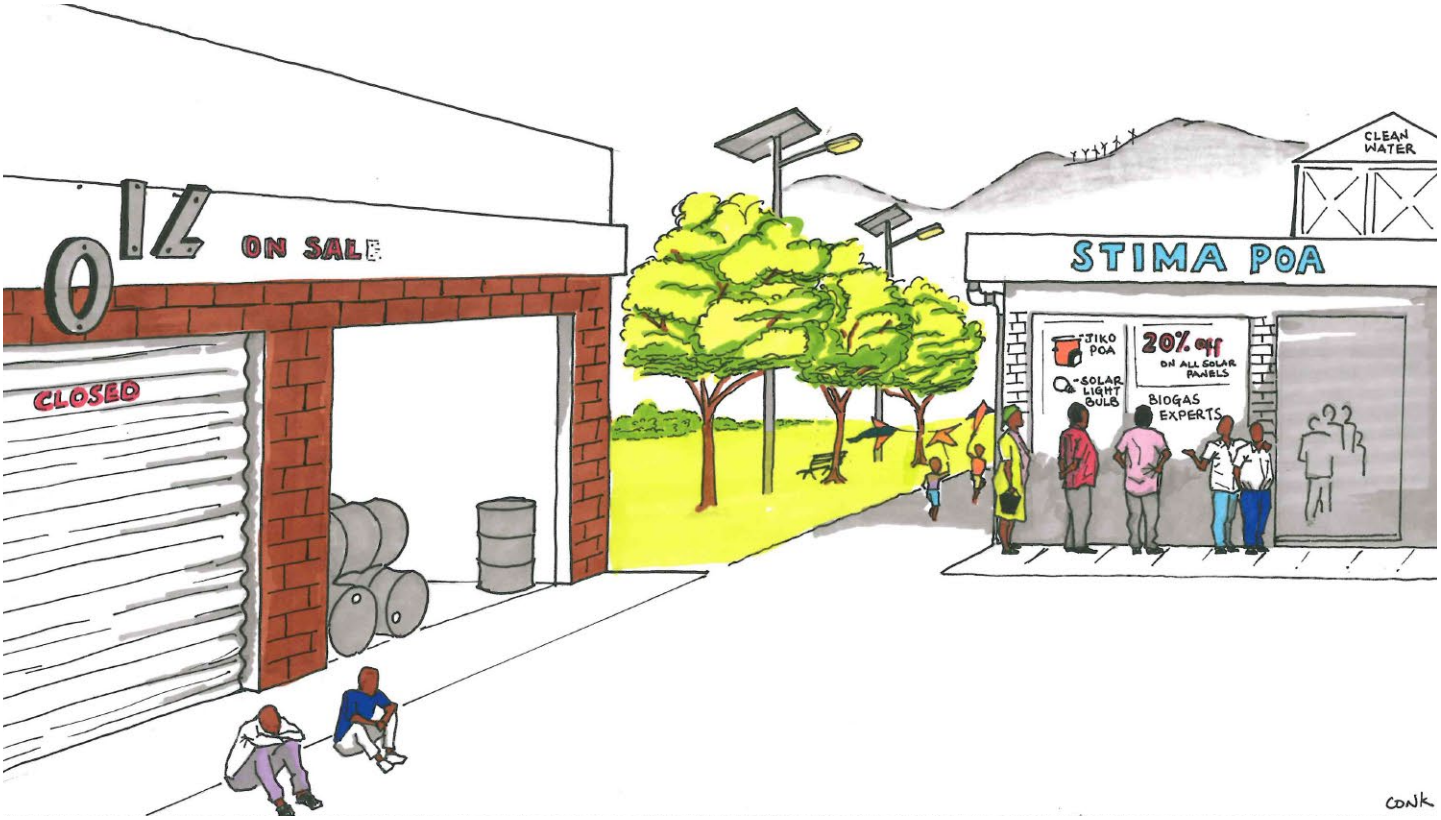
It is an interesting time because so many of the bigger projects are declining. That opens up the space for the smaller energy systems like ours to multiply. With so many electric and hydrogen cars in the rich countries, no one needs much oil anymore. The glut that has created has driven down the global oil price. And that happened just as our heavier Ugandan and Kenyan crude really hit peak in terms of production, so we had to sell at a loss. Putting a global price on carbon has also killed off the coal-fired power plants. Natural gas is just about holding up worldwide, but many of the big dams are struggling. The Stiegler’s Dam in Tanzania dried up almost as soon as it was built, while several Ethiopian projects failed to deliver the power they promised. Building the Eastern Africa Power Pool has also proved to be difficult. It was meant to link our national systems together, but only serves the major urban centres. Tanzanian gas and Kenyan geothermal have become the most reliable sources for the remnants of the central grid, but most of the old power projects have become white elephants, big wasted investments without a future.

Have you ever seen a hyrax? It looks like a large rodent, but its closest relative is the elephant. In the energy world, the white elephants have been slowly shuffling off the scene, while the small, nimble hyrax are increasing in number. They don’t seem to do much, except lie in the sun or scramble into difficult corners, walking like acrobats along rooflines. Hyrax are like the many small-scale technologies that run the micro-grids and district energy systems of the region. As the cost of these technologies

keeps falling, I see them spreading throughout the region. New financial tools to support both the provider and the energy consumer have also come into being, out-competing the big energy projects financially while requiring more maintenance people to keep them up and running. So now you know why we named our business “Hyrax Energy Solutions”. Our ‘hyrax’ energy systems are growing because they are more technologically suited to the dispersed populations we now have.

My younger son would secretly like to work on one of the big projects, but this is a world of small installations. I try to tell him that small installations can make a larger network. Perhaps he’ll put his engineering brilliance into that idea: connecting these systems into a resilient, adaptable grid based on organic local solutions.

As for me, I spend time on community matters. We had a hard case come to the resolution room today. It all grew out of those new carbon payments. There was a mixture of private and clan land, and volunteer and paid labour, with a history of verbal agreements that everyone remembered slightly differently. It was all about land rights, really, with accusations of land grabbing flying in all directions. In the end, we reduced it to a series of decisions on who owns the land, who owns the trees, who has the right to harvest them and who owns the income from sequestration services. With a dozen people involved, one way or another, plus their relations, we kept scratching our heads as we searched for answers everyone accepts. We got there in the end, I think, but we’ll see how long it lasts.



2045 - 2050

About five years ago, I was asked to chair the Regions and Federations Council. What's that? you ask. Well, remember the regional organisations we had earlier on? The East African Community (EAC), the Intergovernmental Authority on Development (IGAD), and so on? Well, those were far removed from our realities, especially when our local communities were struggling to make central governments hear our needs. We began by creating local networks to serve our interests. Sometimes our networks crossed national boundaries. That happened here about eight years ago, when a group based in a town just across the border invited us to a meeting to set up what has become the Council. I particularly appreciate the way the Council facilitates collective efforts on common problems at the local level, while also serving as a place where we develop pragmatic approaches to our shared challenges, drawing on whatever knowledge is useful. It proved its worth during the big epidemic when we needed to coordinate a rapid response in the local hot spots based on an understanding of the specific factors contributing to the disease's rapid spread. For me, this is part of my wife's legacy; that's the work she was doing when she took ill. Since then, it has continued to meet regularly.

My youngest daughter, the one who barely survived the epidemic that took her mother, has now decided to take on the central government and run for office. When she got better, she took up her mother's role in the community and built up a good reputation, but says there are limits to what can be done locally. She wants to make central government effective again. We had become so immersed in what we were doing locally that we really had stopped investing in national affairs. I tell her she is dreaming, but see her point. Perhaps if the national government had developed the same responsiveness to issues that we had nurtured locally, the epidemic would not have exacted such a heavy price.

A lot of others in her generation are doing the same thing. They have cut their teeth in their own local spaces and now want to bring their skills into the centre in order to be more effective. Besides, she says we need a respected currency for international trade, better management of the trunk roads and rail lines, plus a rethinking of how we do security and diplomacy. So there we go. We had turned our backs on the control of the centre, but society as a whole will be more effective if we have an effective centre that can represent us all. That is the key, though. We need people who represent us, rather than wandering off in their own sweet directions after putting our wealth in their pockets ...

I have to say that I am amazed by this new generation. They are the children of hard times. They have learned that if they want a job, they have to create it themselves. They use their education and pragmatism to find unusual opportunities for themselves in this odd and unpredictable world. They are pioneers of the climate economy, having quickly understood that clean air, not energy, is the scarce resource of our times. They have helped to develop the global software and businesses that can take advantage of international carbon payments to penalize polluters and rewards those who sequester CO_2. They know how to navigate the urban/rural divide by creating visible inter-dependencies while building better food systems, healthier ecological services and trusted digital payments that reward people for doing the right thing, rather than penalizing them for doing the wrong one.

I think about my sons, the ones who took over the business once I retired. I wanted to break it up but they refused; and have kept it together while finding ways to maximise on their various strengths and mediate disagreements amongst themselves. I smile whenever they report back about those; they learned a lot

from their mother, I see. They've grown the business substantially. They made one of the first agreements with a big hydro power company. They persuaded the management not to invest in engineering to increase water in their dams, but to pay villagers to replant their hillsides and forests. This, they said, would raise the water table, slow down the release of water into the rivers, and could encourage better rainfall. Just last week, we learned that the satellites that track carbon storage and release show the system is working. What father wouldn't be proud of all that? Can you blame me?

2050

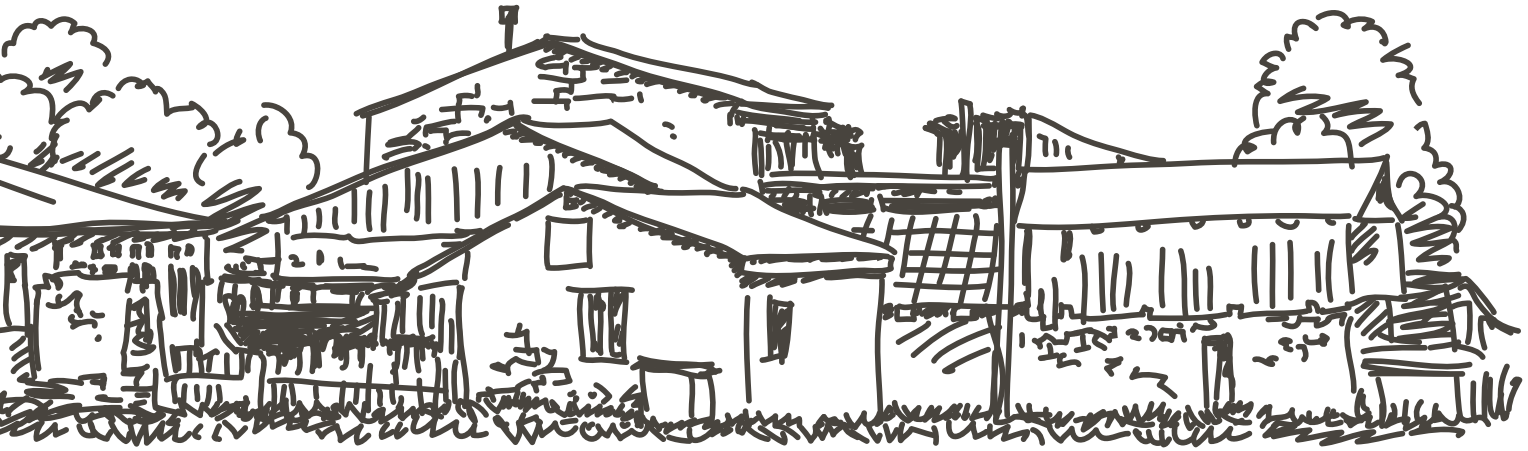
I live with my eldest now. Of my eight grandchildren, six have survived, but we are still battered by the weather and unusual diseases. Can I say that things have improved? I think so. We have more control over our own affairs and have begun to create a new relationship with central government as our people have started the process of reform. The reforms have gone a long way to create, organically, a government that serves the needs of the people, rather than the other way around.

The scientists tell us that the burden of CO_2 in the atmosphere is no longer increasing, so maybe the worst is behind us, although many still fear we have unleashed a climatic change that cannot be stopped because we began too late.

I don't walk very quickly now, but when I wander around our town, venturing into its neighbourhoods, I see a lot less smoke coming from firewood and charcoal and many more houses with electricity and biogas stoves for cooking. The big energy projects still function; my younger son did find his way to work on one of them, as he wanted, but their role is less important than the network of small scale energy sources that are in most homes of the region. We have not quite linked every one of the small local systems to each other, but maybe we'll learn to do that one day. For now, it is good enough that we can power our own towns, villages and neighbourhoods at a price most people can afford.

Much of the big power goes into transport, where it is has been harder to replace oil. Besides, petrol costs so little these days, and we have all these second-hand petroleum cars, that we might as well use them, although the petrol is still imported.

I still miss my wife. She and I ran away together with our young children to this small town so many years ago. Now I cannot remember what our life was like before we came here; it has become our home in every sense. I am proud of our small contribution to making it what it is today, and of the hybrid economy and mixed energy system we have built here and in the Eastern African region. Who would have thought we were part of something that big? We just knew we had to start over. We didn't have any great plan, but just started with what was there and what was needed. Now look at how far we have come! ■



Comparing the Scenarios

Issue	TODAY, 2018	MITUMBA 2050	MARKETS 2050	STRUGGLES 2050
i. Character of the story		The inertia of an old system	Control of scarce resources	Crisis & emergence
Main driver of scenario		Imitate success of 20th century development	Imposed response to climate change from outside	Crises force social invention & experimentation
Who leads?		State leaders imitate Asian development paradigm	Outside investors lead, coopt national leaders	New leaders emerging organically as influencers during community hardships & crises
Defining goals & aspirations	Material & familial	Economic development with abundant energy & manufacturing	Reduction of global emissions; protect global economy	Resilience in the face of crises
ii. What capacity to agree?	Limited. Contest of cultures, personalities, power & systems	Agreement imposed through authoritarian power & force	Capacity to agree atrophies as outsiders take charge.	Capacity to agree breaks down then recovers, starting locally.
Who decides	People well-connected to ruling elites & bureaucrats	State-driven. Influenced by external investors. Limited citizen participation in governance & decisions.	International markets driven. External investors make most decisions. Elites participate, others comply.	Citizen driven. State facilitates people-driven approaches to solving common challenges. External investors are peripheral.
Rules of the game	Mixed - formal & informal	Formal existing rules apply, but often broken by informal private agreement	Mixed rules apply, shaped by priorities & skills of managers.	Rules in a state of flux as different arrangements are tried, depending on the situation. Large variations.
National & regional stability	Frequently threatened	Chronic tensions, elites manipulate social and ethnic divisions to stay in control.	Resource conflicts are common (water, land, minerals, best business sites, etc.) Foreign security forces infiltrate more areas.	Stability is frequently tested. Confrontations between central and local authorities; and can spill over to involve other states within the region.

Issue	TODAY, 2018	MITUMBA 2050	MARKETS 2050	STRUGGLES 2050
Regional bodies (EAC and IGAD)	Establishing credibility and mandate to act in relevant thematic and geo-political spaces as well as mechanisms of cooperation amongst the bodies	State-driven. Prioritise the interests and agendas of the various national governments. EAC and IGAD focus on coordinating large scale regional projects	Foreign driven. Prioritise the interests and agendas of the foreign investors. EAC and IGAD focus on attracting foreign investment to the region, and become a conduit for safeguarding foreign interests at the expense of local.	State driven. Have limited importance outside representing the region's unified interests in foreign, not local, matters. Within the region, their functions replaced by various bodies such as the Regions & Federations Council.
iii. What kind of energy system?	Largely based on 19th Century systems focusing on biomass; transport dependent on fossil fuels; limited use of 20th century technologies, except in cities & town.	Dominated by second-hand 20th century energy systems from abroad serving wealthy urban areas & manufacturing. 19th century systems persist in rural areas.	Largely based on 21st century energy systems but beneficiaries are primarily major urban areas & foreign markets.	Low cost & renewable technologies using mini grids and distributed energy systems. Fossil fuels and centralised power serve as back-up & in cities. Little integration of local & national grids. Biomass shrinks.
Primary energy mix	Biomass dominates. Hydro, geothermal, solar & wind for electricity; oil for transport; some bottled gas for cooking.	Reduced use of biomass. Coal & gas fired power plants + old & new hydropower and geothermal for urban areas, especially for industries. Fossil fuels for export & transport. Better distribution of gas to households + domestic solar & wind. Limited use of solar & wind, mostly small scale renewables supplied by small local businesses & NGOs.	Reduced use of biomass. Large scale, renewable energy derived from concentrated solar, hydro & geothermal energy. Households (both rural and urban) use simple renewable technologies and fossil fuels (bottled gas & petrol) plus biomass, including methane digesters. More electricity also available for households. Collected rubbish burnt in urban poor areas.	Reduced use of biomass. Surviving large scale electricity generation serves urban areas and acts as backup power. Small scale renewable technologies dominate the mix, linked through a mesh of mini-grids. Gas used for most cooking.

Issue	TODAY, 2018	MITUMBA 2050	MARKETS 2050	STRUGGLES 2050
Electrical distribution systems	Biomass trading networks + centralised power lines offering limited access to population. Household solar & wind; oil & gas pipelines under construction	Centralised electric distribution reaches urban & wealthy areas plus industrial sites. Gas & oil pipelines largely for exporting fossil fuels, some local use. Urban poor often tap electric wires illegally.	Centralised power distribution of clean energy (large scale wind, solar, hydro & geothermal) for export, mining and wealthy urban areas. Small scale energy systems reach middle class. Illegal electric lines to houses & businesses are shut down.	Urban areas depend on old centralised grid system Mini grids grow, with increased linkages creating mesh of mini grids where population density is high, serving the range of both rural and urban communities. Links to longer grid lines eventually balance supply & demand.
Eastern African Power Pool (EAPP)	Network planned, but not completed; work started	EAPP network completed, but rarely reaches the poor.	High speed EAPP network reaches urban areas & Europe, but not rural areas	EAPP network is never completed.
Is energy affordable?	Electric & fossil fuel energy affordable by wealthy, but biomass is more reliable, affordable & accessible for the majority of everyone else.	Access and affordability have improved for a larger number of people, but both the rural and urban poor still lack ready access to clean & affordable energy. Price of biomass high, but canister gas is fairly affordable.	The elite can afford and readily access power, but energy poverty continues for the rest. The price of biomass rises. The most impoverished of the urban poor are forced to burn rubbish.	Energy access is fairly widespread, but at a low level of use. Gas canisters fairly affordable & accessible in urban areas and rural towns. Cost of renewables much lower than that of biomass, which is very costly.
Impact on women & children	Rural women & children gather wood for cooking. Poor lighting limits study time. Smoke affects health of households. Little money for safer fuels.	Increased inequality limits opportunities for women & children in poor households; their lives continue to be impacted by the search for energy. While wider accessibility to bottled gas improves health for the majority, the most impoverished, do not benefit from this.	Larger middle class enjoys benefits of ready access to affordable energy. Poor women & children continue to bear the brunt of energy poverty There is continued reliance on dirty household fuels that cause many health problems & interfere with children's education.	Improved access to affordable energy in both rural and urban areas. Women and children benefit, but energy is never very abundant.

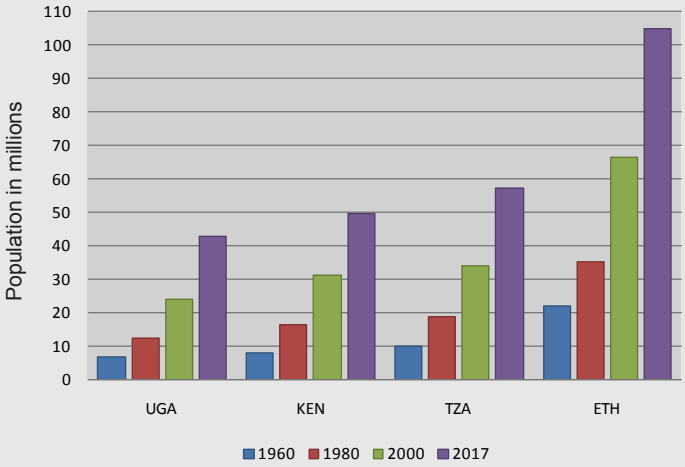
Issue	TODAY, 2018	MITUMBA 2050	MARKETS 2050	STRUGGLES 2050
iv. Who invests, who benefits?		Investment from foreigners with local elite partners. State is primary facilitator for the projects and custodian for local interests, which usually align with those of the local elite; China leads as builder, lender and operator of major power projects in electric generation, including nuclear; oil & gas dominated by Western firms.	Foreign corporations from around the world invest in resources for own use. State facilitates foreign investment and safeguards foreign interests. Benefits from East African land, minerals, carbon sequestration and export of power primarily go to foreign investors, with the local elite also getting a share.	Networks of local trusts assemble funds needed for priority projects. Diaspora investment is often critical. Local leaders learn to negotiate with foreign investors offering finance or technology, with local interests as the priority. National governments only have a limited role.
Economic growth & jobs		Economy slows, then grows with manufacturing investment, then stalls again. Global carbon price hits energy industry. New jobs created, then lost, but unemployment remains high.	Economy suffers a crash in early years then grows rapidly based on high investment that benefits corporations and managers. Some new jobs created, but unemployment still high.	Economy is slow throughout scenario, and worsens during times of crisis. It is an economy of "making do". Jobs are created to meet the needs and priorities of local communities.
Carbon price	Some trading of carbon emissions permits, but no tax on carbon or any global carbon price.	Carbon tax in export markets applied to goods produced in Eastern Africa. Export manufacturing suffers.	Global carbon markets reward those who sequester carbon - in trees & grasslands or underground storage. Major investors benefit.	Younger generation develops payment systems that reward people who restore ecosystems and sequester carbon, improving livelihoods.
V. Capacity to adapt & restore damage to environment	Neglected capacity to adapt. Skills increasing around local experiments, but these only exist in small, isolated areas & are usually ignored. Restoration is spotty.	More frequent environmental crises and reduced capacity to respond as land & resources are degraded. Fatalistic attitudes encourage degradation. Movement of peoples exacerbate local conflicts.	Landscape taken over by large projects tackling climate change. These projects homogenize the landscape, reducing biodiversity & environmental resilience. Social resilience depends on skills of managers in investing companies.	Region frequently goes to the edge in the face of multiple crises, especially political & environmental. People retreat into trusted groups, and work to respond to hard times. Conflicts are frequent, but dispute resolution becomes a valued skill.

Issue	TODAY, 2018	MITUMBA 2050	MARKETS 2050	STRUGGLES 2050
Population growth & stability	Population has grown 2.8%/yr since 1970 It has increased 5-fold since 1960.	Population growth slows to 2.5%/yr. Migration to urban areas accelerates as rural areas are more degraded. Increased political instability.	Population growth slows to 2.6%/yr. People driven off their land shift from place to place looking for a good living. Social networks breakdown.	Population growth very slow at 2.3%/yr. Population growth is held back by hard times, more limited food & higher mortality. Stronger communal networks.
Environmental damage & crises	Loss of forests & watersheds, degraded pastures; less predictable rainfall patterns, increased flooding & drought	Biomass energy markets reduce forest cover & shrub land,affecting watersheds. Some recovery as biomass is replaced by new energy investments, but global-CO_2 rises leading to more climate trouble.	There is both major damage and recovery of damaged land. A simplified and high managed landscape scarred by mining & industrial agriculture. Some areas are protected, but biodiversity declines steeply.	The long degradation of Eastern African lands bites hard for most of the scenario period. Climate shocks are earlier, more extreme and more frequent. Skills of landscape recovery develop, but slowly.
Responses & environmental recovery	Migration from degraded rural areas to cities & abroad	Rural migrants head to cities; forest & savannah cover starts to come back, but with new mixes of species in altered climate. Reduced biodiversity, reduced reliable water for irrigation & drinking; and high erosion is rarely corrected.	Heavy migration away from areas taken over for clean energy, industrial agriculture and mining, except where jobs are available. Some recovery plus new forms of damage. Protected areas of the landscape begin to recover.	The particular needs of each place define adaptive responses, based on traditional & modern practice. Trial and error build new skills; technologies are less useful than practical management agreements.
International treaties & impact on climate	Paris Agenda emissions commitments stated by all four Eastern African countries	Eastern Africa's Paris Commitments are not met. Emissions exceed worst projections of 2015 Climate turmoil exceeds all projections	Eastern Africa's Paris Commitments met thanks to Global Climate Emergency measures. Climate disruption continues, but does not get worse.	Eastern Africa's Paris commitments are met & exceeded, but global emissions peak in 2035 causing trouble. Climate disruption gets worse before it begins to steady.

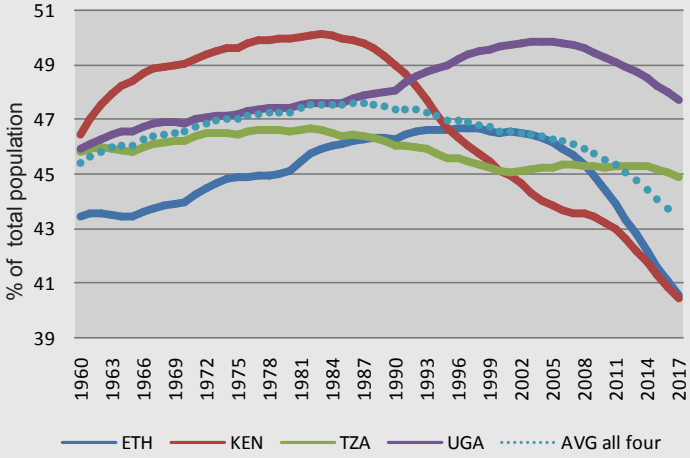
Statistical Graphs:

Eastern Africa's past & present

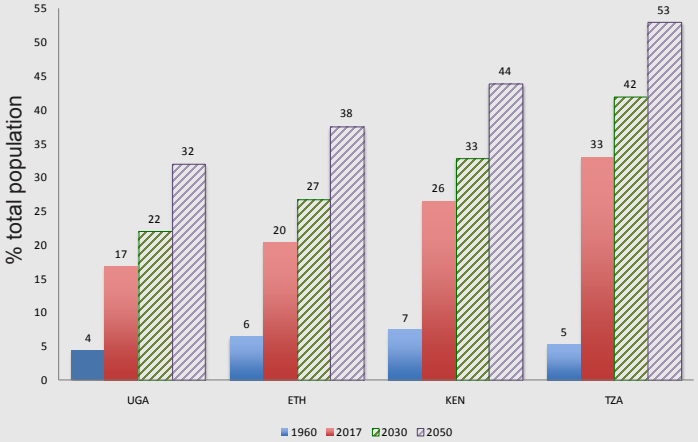
Total population 1960-2017 in millions



% Population age 0-14 yrs 1960-2017

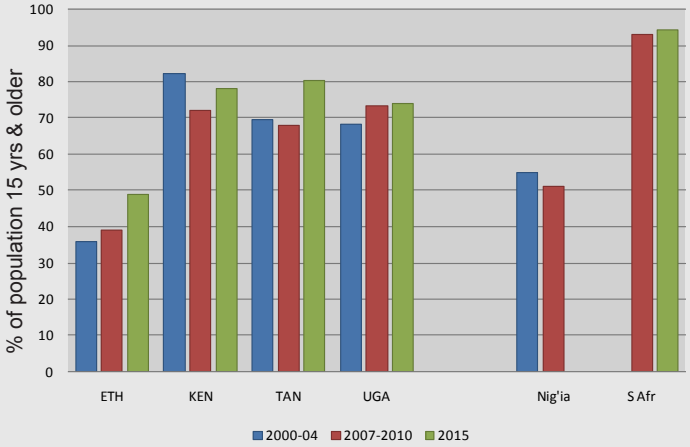


% of population in urban areas historic & projections to 2050

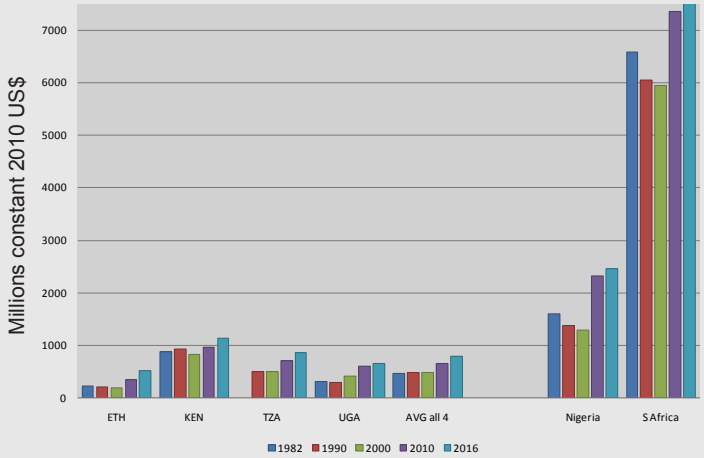


N.B. Striped bars = projections

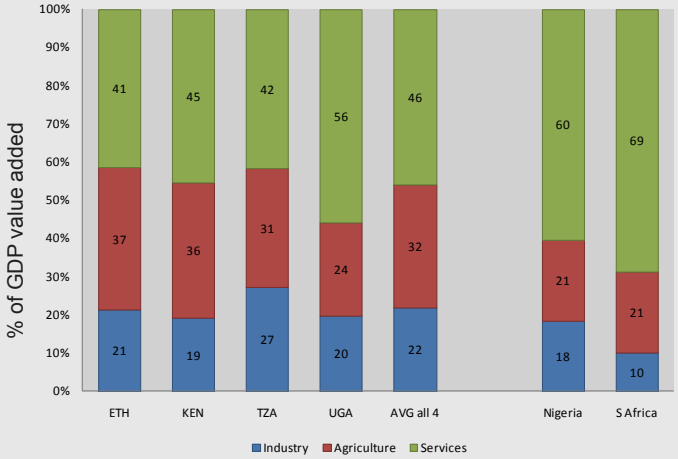
Adult Literacy - 2000-2015
Eastern Africa v Nigeria & South Africa



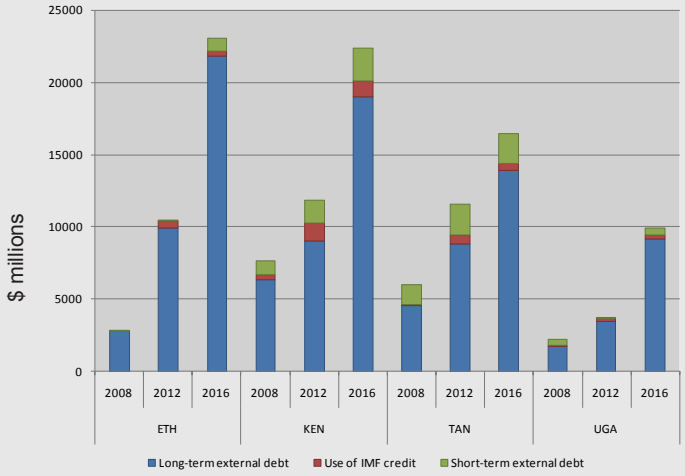
GDP per capita in Eastern Africa v Nigeria & S Africa 1982-2016



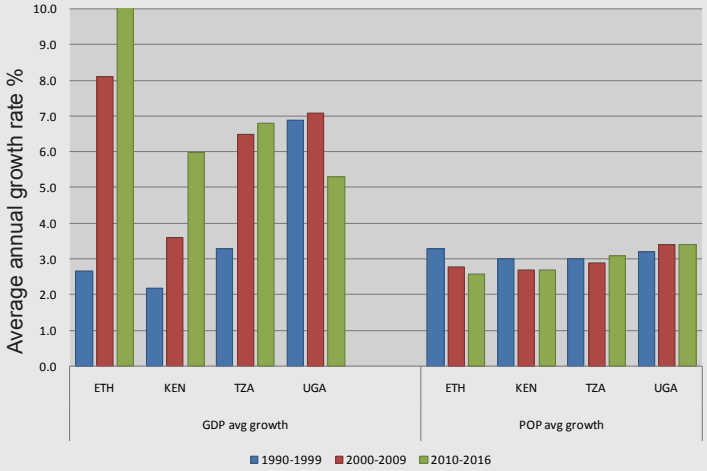
Economic Structure 2016: Eastern Africa v Nigeria & South Africa



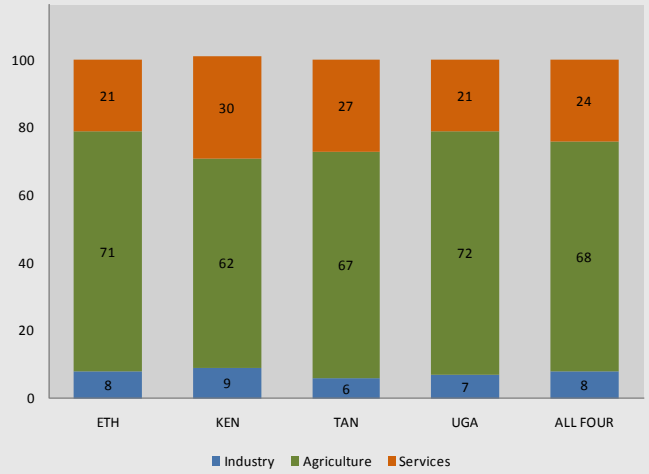
Growth of external debt in Eastern Africa 2008-2016



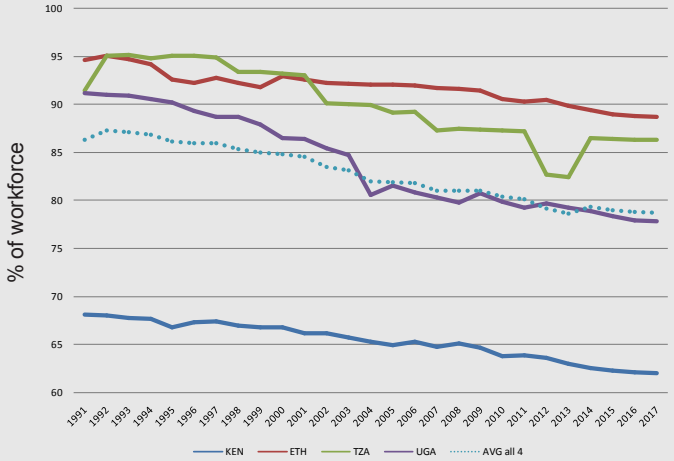
GDP growth v POP growth 1990-2016



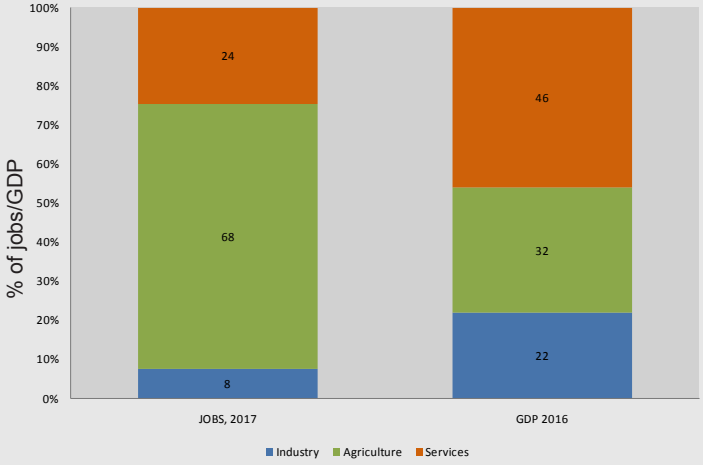
Most jobs are still in agriculture 2017



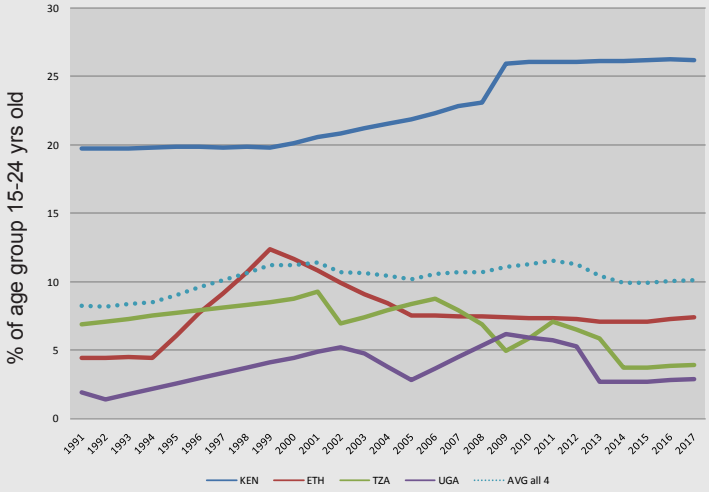
% who are self-employed



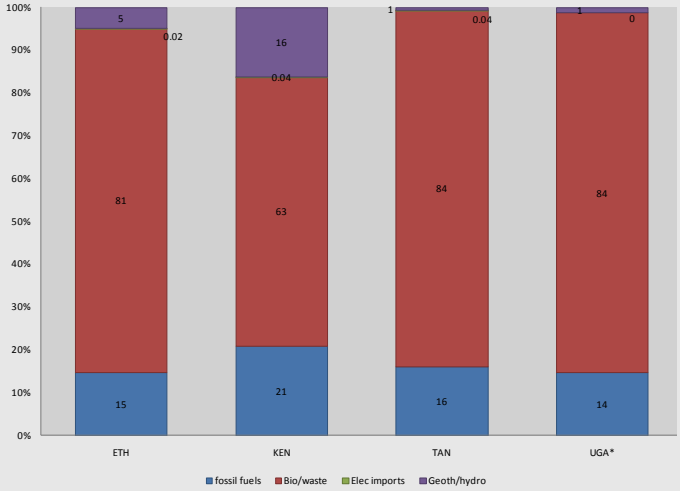
Structure of Eastern Africa economies 2016/17 - Jobs v GDP



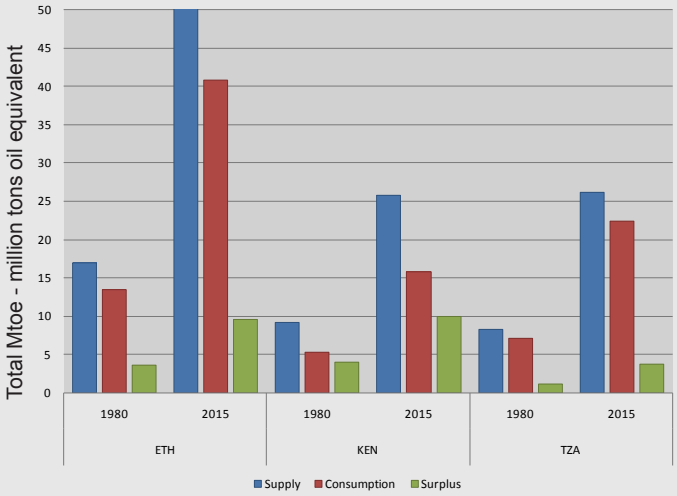
Youth unemployment 1991-2017



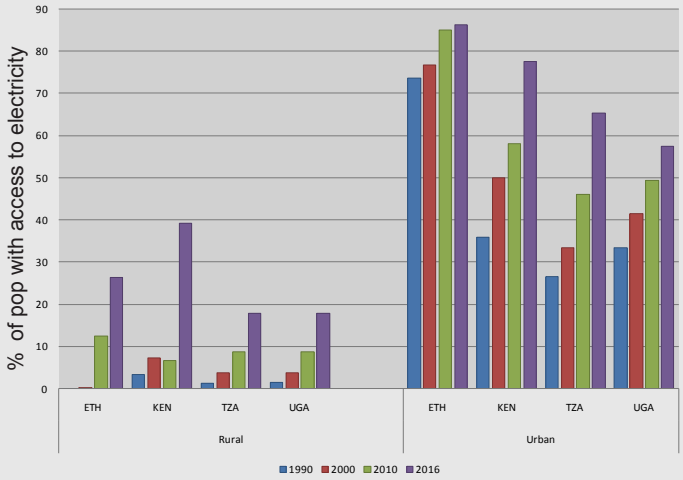
Mix of total primary energy supply** 2015



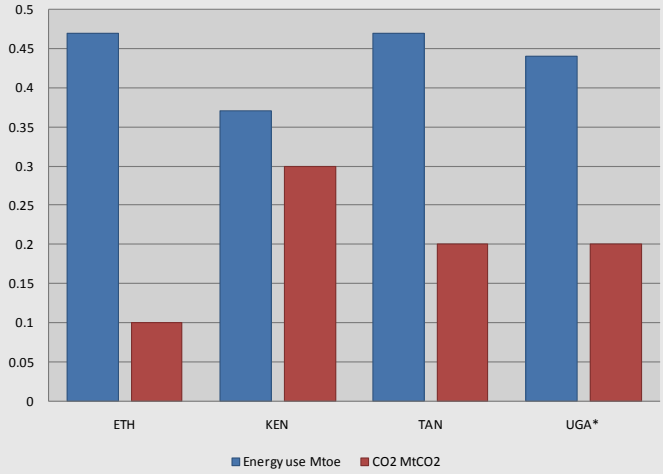
Energy supply v consumption 1980 v 2015



Rural v Urban Access to Electricity



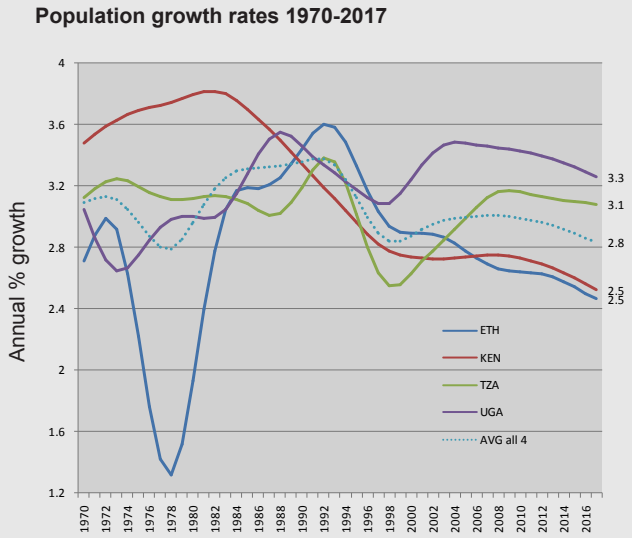
Per capita energy use & CO_2 emissions, 2015

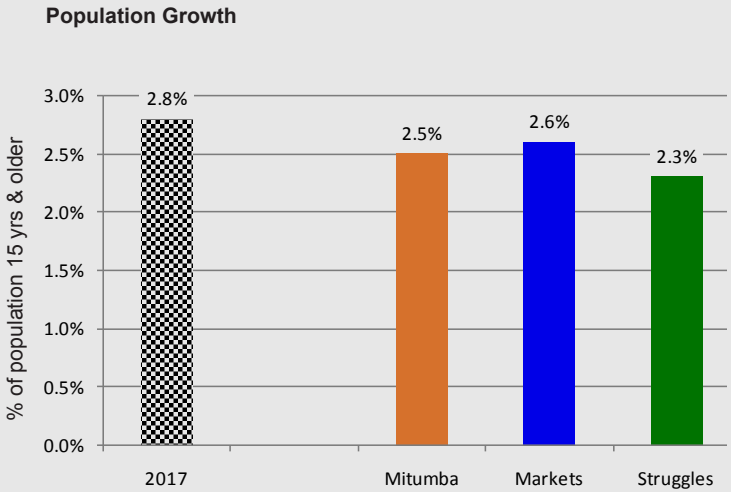


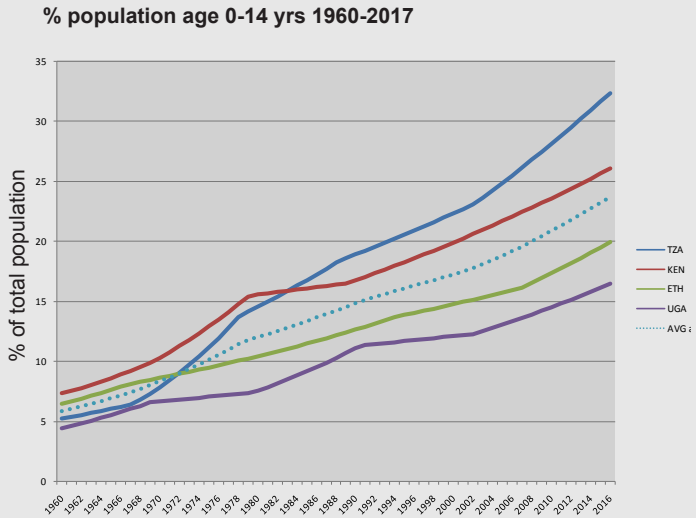
** Supply = local production + imports

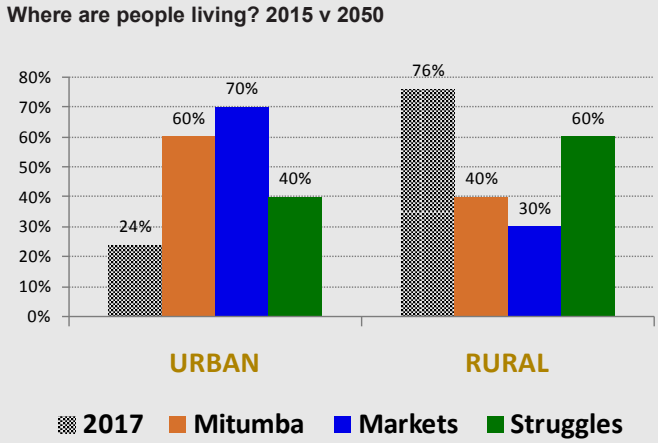
UGA* is estimated based on per capita averages for other three countries x Uganda population

Eastern Africa's Future: scenarios compared

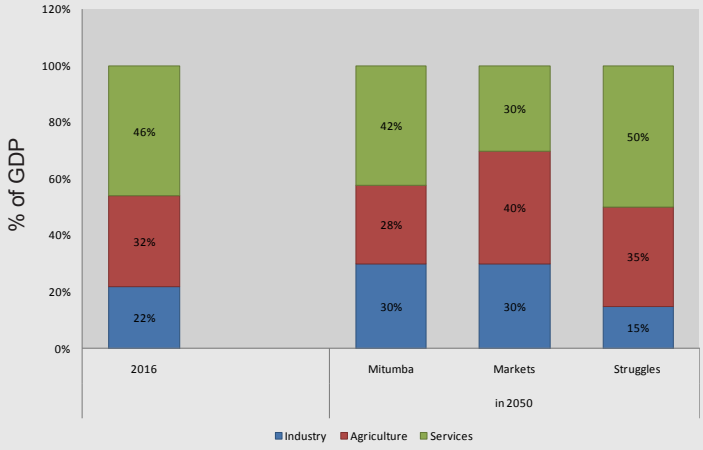




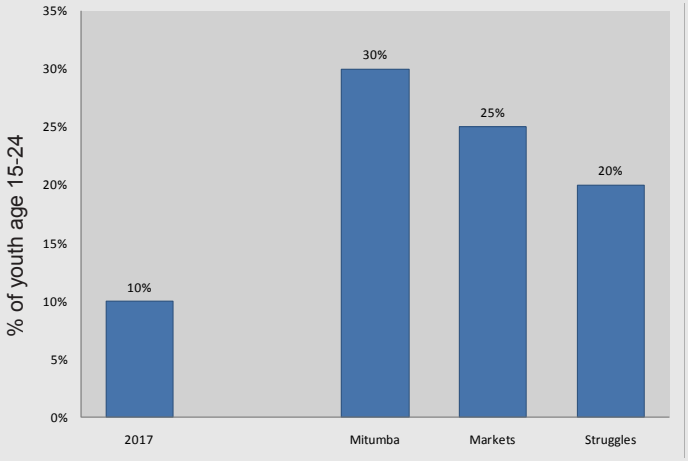




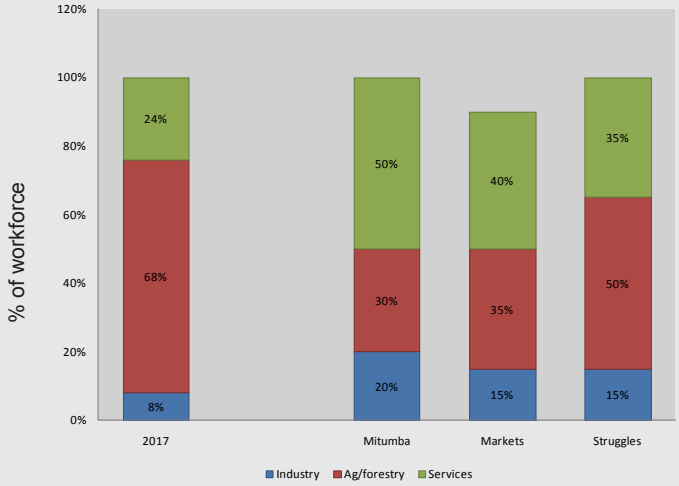
Where will GDP be created in 2050?



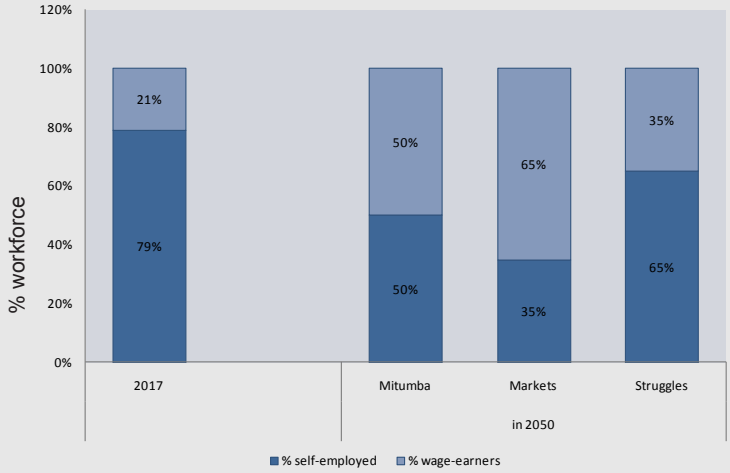
How many of our youth are unemployed in 2050?



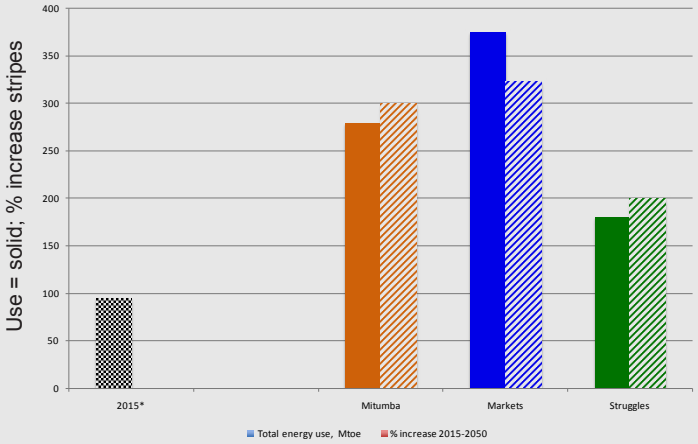
Where will the jobs be in 2050?



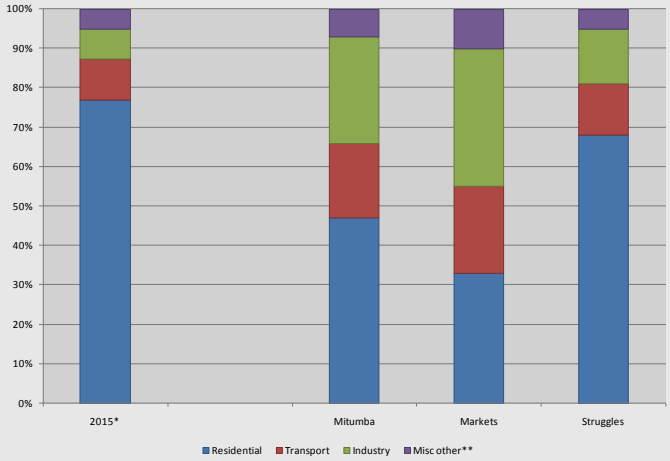
Will we be self-employed or earning a wage in 2050?



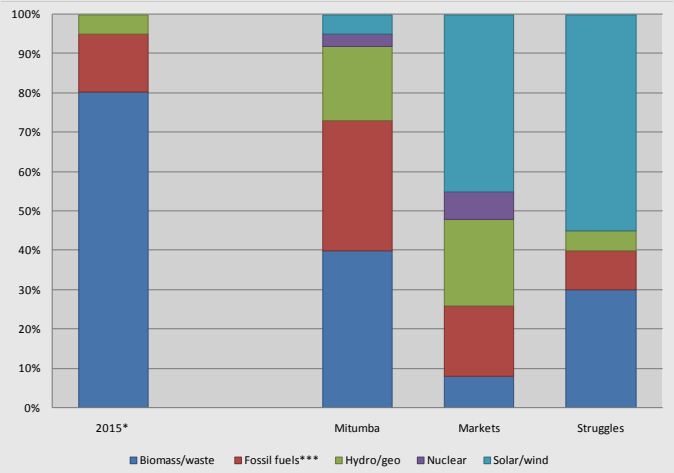
How much energy will we use in 2050? as Mtoe & % increase



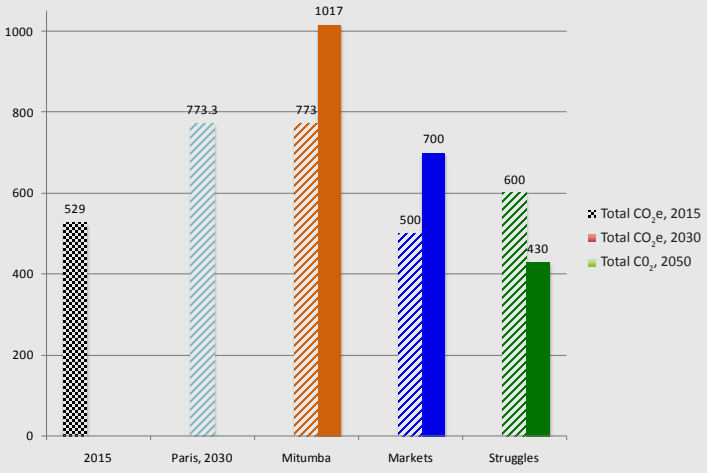
Where will we use our energy, 2050?



What will be the primary energy mix in 2050?



How much CO_2 is emitted? 2015 v 2030 & 2050



Glossary

Term	Explanation
Biomass energy	Biomass energy comes directly from plant material such as wood, charcoal (made from wood) and agricultural wastes. While in theory biomass energy is sustainable, if the biomass is being burnt faster than it can regrow, then it is not sustainable. Charcoal that comes from sources that are not regenerating, is often called 'charcoal mining'.
Carbon footprint	Carbon footprint is how much greenhouse gas is produced by any action or fuel. An old car getting 4km/litre produces more CO_2 than a hybrid electric car which gets 43km/litre. The carbon footprint of the hybrid electric car is therefore much smaller than the old car.
Carbon markets, cap and trade	Carbon markets today are based on all participants agreeing that only a certain amount of carbon can be emitted by all their operations. There is a 'cap' put on the total allowed emissions. Each participant is then allocated a share of that limited amount of carbon. Any participant who produces less than his share can sell the balance to another participant who is producing more than his share. These are known as cap and trade systems. They are most effective when the cap is low enough to raise the price of buying the right to produce more carbon, which forces high emitters to lower their emissions.
Carbon price	A carbon price is the amount of money a user has to pay for burning a fuel that produces CO_2 or another greenhouse gas. This price might take the form of a tax on carbon emissions or be the cost of buying the right to produce that carbon through a cap and trade system
Carbon tax	Another way to put a price on carbon is for a government to tax greenhouse gas emissions. In some schemes, there is a plan to return some of the tax to citizens who might be hurt by paying more for their fuel. When that happens, the tax is called 'revenue neutral'.
Climate change	When fossil fuels are burnt, or land is cleared, greenhouse gases that had been underground or held in the biomass of the landscape, are released into the atmosphere. These gases linger for a long time and trap solar radiation beneath them, raising the temperature of the earth. As the temperature rises, normal weather patterns are disrupted. There is also a risk of flipping into a radically different climate from the one we have known over the past 10,000 years. Both the disruption and potential for radical shifts are known as climate change.

Term	Explanation
CO_2	$CO_2$is the chemical symbol for carbon dioxide. This is one of the main gases produced by burning fossil fuels. It rises in the atmosphere where it stays like the glass roof of a greenhouse hovering over the Earth. It is one of the 'greenhouse gases' that is raising the temperature of the Earth. Methane, also used as an energy source, is another greenhouse gas.
CO_2e	CO_2 is the most common of several gases that contribute to global warming. CO_2 is the measure of all the greenhouse gases being emitted by a country or operation, converted to their equivalent in carbon dioxide.
Emissions	Emissions are the greenhouse gases that result from burning fossil fuels as well as changes in land use and other sources.
Energy justice	An energy system that offers greater energy justice will provide the weakest segments of the population with access to clean and reliable energy at an affordable price.
Energy mix	The energy mix is the variety of fuels used to provide energy, either directly or indirectly, to users.
Energy poverty	Energy poverty is a lack of access to cleaner, more convenient fuels (e.g. electricity for light rather than kerosene, gas for cooking rather than charcoal or wood) because they are unavailable or unaffordable.
Energy system	An 'energy system' includes the fuels, energy technologies, distribution networks and policies that provide energy for society. These systems both shape, and are shaped by, our social structures, policy choices and economies.
Fossil fuels	Fossil fuels are burnable minerals that are mined from underground. Coal, oil and natural gas are all fossil fuels. They are called fossil fuels because they consist of the dead plants and animals from deep in geological time that have 'fossilised' to become fuel a burnable solid (coal) liquid (oil) or gas. Because fossil fuels were created in the geological past, millions of years ago, they are not renewable within a human lifetime.
Gas or natural gas	Gas has been a by-product of oil wells, but is now being mined for its own sake. For a long time it was released into the atmosphere or 'flared', i.e. burnt off at the well site. As it contains methane, it is a potent greenhouse gas, but when burnt as fuel it has a lower carbon footprint than coal or oil.
Geothermal energy	Geothermal energy exploits the higher temperatures below the ground. Where there are geological faultlines, geothermal energy is hotter and more abundant. Iceland is largely run on geothermal energy. Kenya's Rift Valley is also producing geothermal energy.
Hybrid electric vehicle	A hybrid electric vehicle will run on a battery charged with electric energy, currently offering about 121 kilometres of travel. After that, the engine uses a mixture of battery powered electrical energy and petrol.

Term	Explanation
Hydro, or hydro power	Hydro power is energy produced by capturing and releasing water through machinery that converts the flow of water to energy. Hydro power can be as small as a waterwheel that turns a millstone to grind corn or as large as a major dam which produces electricity in a large system of turbines.
Hydrocarbons	Fossil fuels are also called hydrocarbons.
Nuclear energy	Nuclear power is electricity produced by nuclear fission or fusion from uranium. It requires expensive equipment, high trained professionals and is seen as very risky because the waste products are radioactive. However, nuclear power does not release greenhouse gases, so some believe it should be used to reduce climate change risks.
Paris commitments	When the Paris Climate Agreement was signed, every nation agreed to keeps its emissions of greenhouse gases within a limit each nation had set for itself. These commitments are the first step in limiting the greenhouse gases that are causing climate change.
Power	Power is shorthand for electrical energy.
Primary fuel	Primary fuels are either used directly (.e.g. wood for a fire), or indirectly (e.g. coal is burnt to generate electricity) to provide energy to consumers.
Renewables	Renewable energy usually refers to energy captured through windmills or solar panels, but also refers to any abundant source of clean energy. It is considered renewable because there will always be wind and sun. Geothermal energy is often considered renewable, as is hydro power.
Sequestration	Sequestration occurs when greenhouse gases are absorbed in natural processes (e.g. the wood of growing trees, or organic matter in soils) or stored underground, a process known as ‘carbon capture and sequestration’ or CCS.
Sustainable energy	Sustainable energy is energy that comes from sources that can regrow. This is a loose term that also includes energy from wind, solar and geothermal sources because they are seen as perpetually abundant.

ENERGY FOR WHOM?

SCENARIOS FOR EASTERN AFRICA

Whereas the momentum of economic development in the 20th century depended on abundant fossil fuels and centralized electric power, countries are now revisiting their energy strategies to reduce the risks of unpredictable climate change. Our countries are not exempt from this dilemma. Should they continue to power their transition from agricultural to industrial societies by exploiting fossil fuels and centralized power? Or is a different energy system possible? Which investments will get priority? Who will benefit from whatever energy system is put into place, and who will be the biggest losers?

This booklet presents and explores possible scenarios that could unfold in four Eastern African countries. The analysis and three stories presented imagine different ways this conundrum of energy needs, politics and limits might play out in the coming decades to 2050.

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