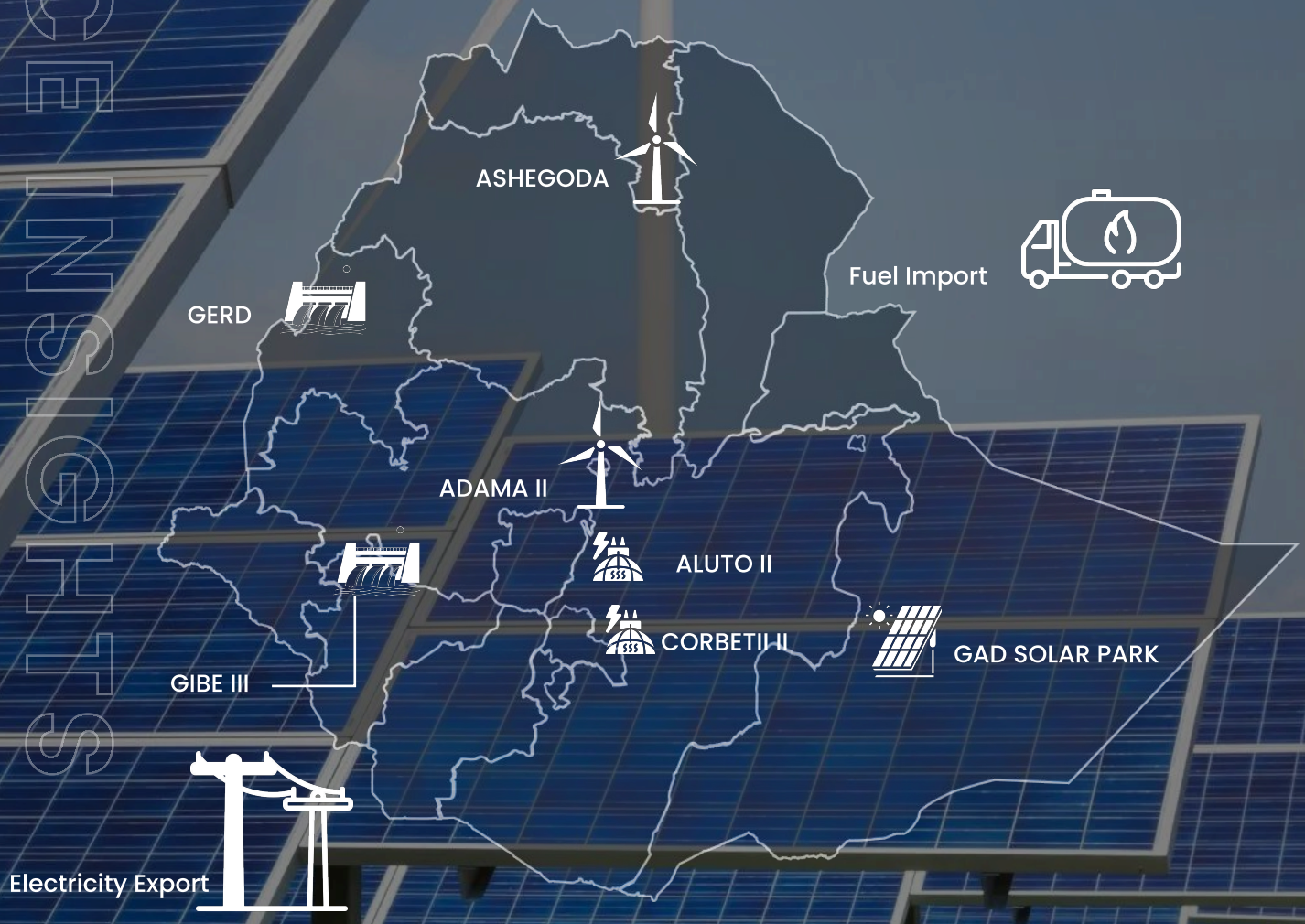
Ethiopia's Energy Dilemma

Vast Resources, Restricted Access



ACE ADVISORS

Introduction: The Energy Challenge in Ethiopia

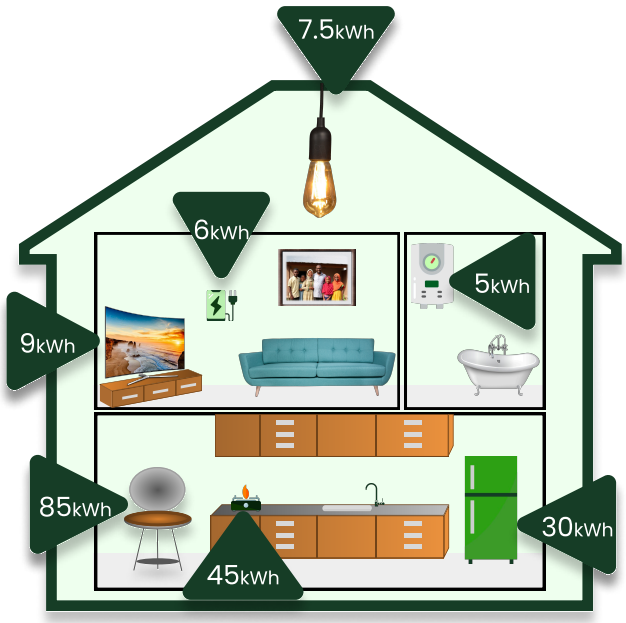
Energy fuels the progress of modern economies, shaping both development speed and daily living standards. In Ethiopia, it serves as both an asset and a hurdle—the nation boasts abundant hydropower, wind, and solar potential, yet reliable electricity access remains scarce.

Despite extensive infrastructure initiatives, only 55% of Ethiopians had electricity in 2022 (Macrotrends). This prompts a crucial question: **Does Ethiopia genuinely have sufficient energy, or are the challenges rooted in production, distribution, and efficiency?**

To explore this, we assess energy consumption trends through an urban household case study, analyze Ethiopia's energy composition, and investigate investment prospects and policy changes influencing the nation's energy trajectory.

Understanding Household Energy Consumption: A Case Study

Meet Zenebe, a 35-year-old small business owner in Addis Ababa. His household energy consumption provides insights into the typical Ethiopian urban experience.





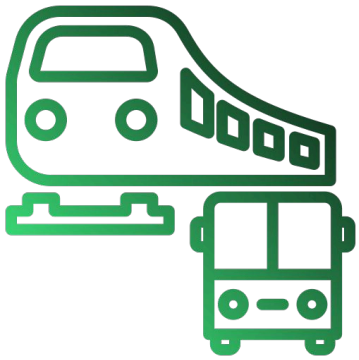
Home appliances:

- Cooking (*electric stove*): 45 kWh
- Cooking (*mitad*): 85 kWh (average)
- Refrigerator: 30 kWh
- Lighting (10 bulbs, 5W each for 5 hours/day): 7.5 kWh
- TV: 9 kWh
- Phone chargers: 6 kWh
- Electric water heater (5 days/month): 5 kWh

His business energy use for the grocery store is:

- Store refrigerator: 60 kWh
- Store lighting: 15 kWh
- Cash register: 3 kWh

For transportation, while Zenebe uses a gas-powered public transport, we can convert his transportation energy cost to electricity equivalent. He traveled an estimated 120 km per month using public transport. Based on fuel consumption, this translates to approximately 7.2 liters of gasoline. Converting this to electricity at a rate of 8.9 kWh per liter results in an estimated energy usage of around 64 kWh.



In total, Zenebe's monthly energy consumption can be summarized as follows:

Household energy consumption: 45 kWh (cooking) + 85 kWh ("mitad") + 30 kWh (fridge) + 7.5 kWh (lighting) + 9 kWh (TV) + 6 kWh (chargers) + 5 kWh (water heater) = **187.5 kWh**

Business energy consumption: 60 kWh (store fridge) + 15 kWh (store lighting) + 3 kWh (cash register) = **78 kWh**

Transportation energy (converted): 64 kWh

Combining these gives a total of approximately **329.5 kWh** per month. Using the current rate of **3.57 ETB per kWh**, Zenebe's monthly energy expense amounts to around **1,176 ETB.**

What Does This Mean?

Zenebe's electricity bill is relatively low compared to global standards, but frequent power outages and grid instability increase hidden costs, such as the need for backup power sources. On the other hand compared to the global monthly per capita energy consumption of **1,780 kWh** (Statista, 2023), Ethiopia's energy access remains significantly below international averages.

With Ethiopia's economy transitioning toward an industry-led model, as outlined in strategic policies like the 10-Year Development Plan, and a rapidly growing population now exceeding **120 million** and projected to reach **130 million by 2032**, it is clear that scaling up energy generation must be a national priority.

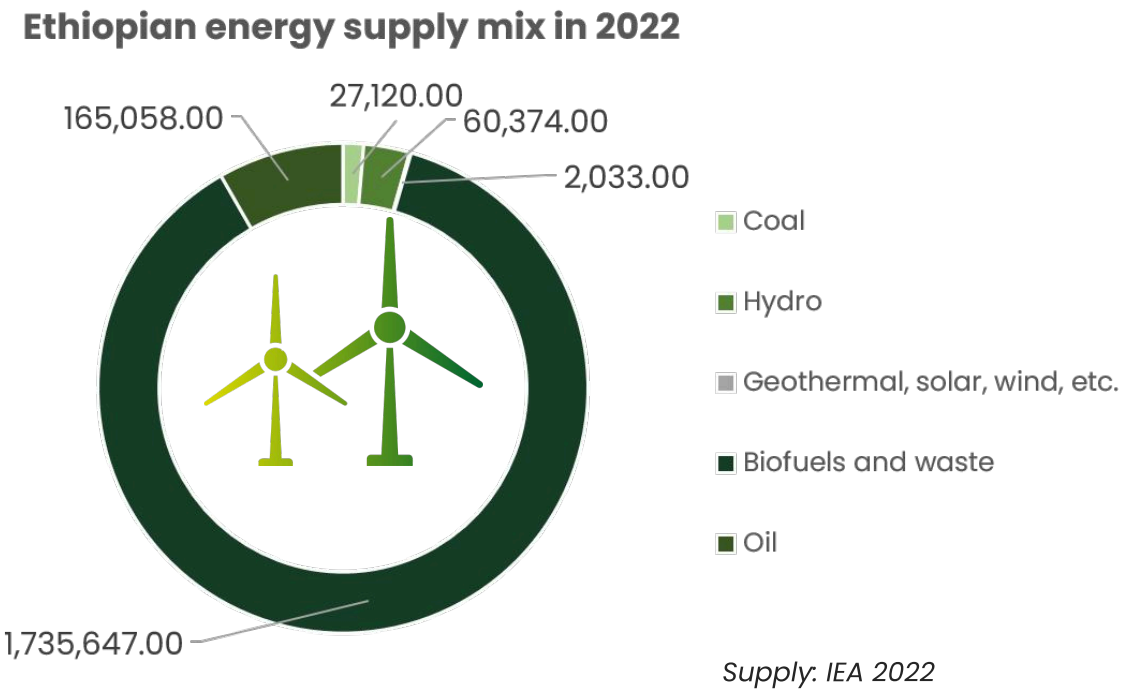
With this in mind, let's delve into Ethiopia's energy sources to gain a deeper understanding of the sector's dynamics. It's important to recognize that energy is not just what households and workplaces consume, transportation and vehicles also play a crucial role in the overall energy landscape.

Ethiopia's Energy Mix

Where Does Power Come From?

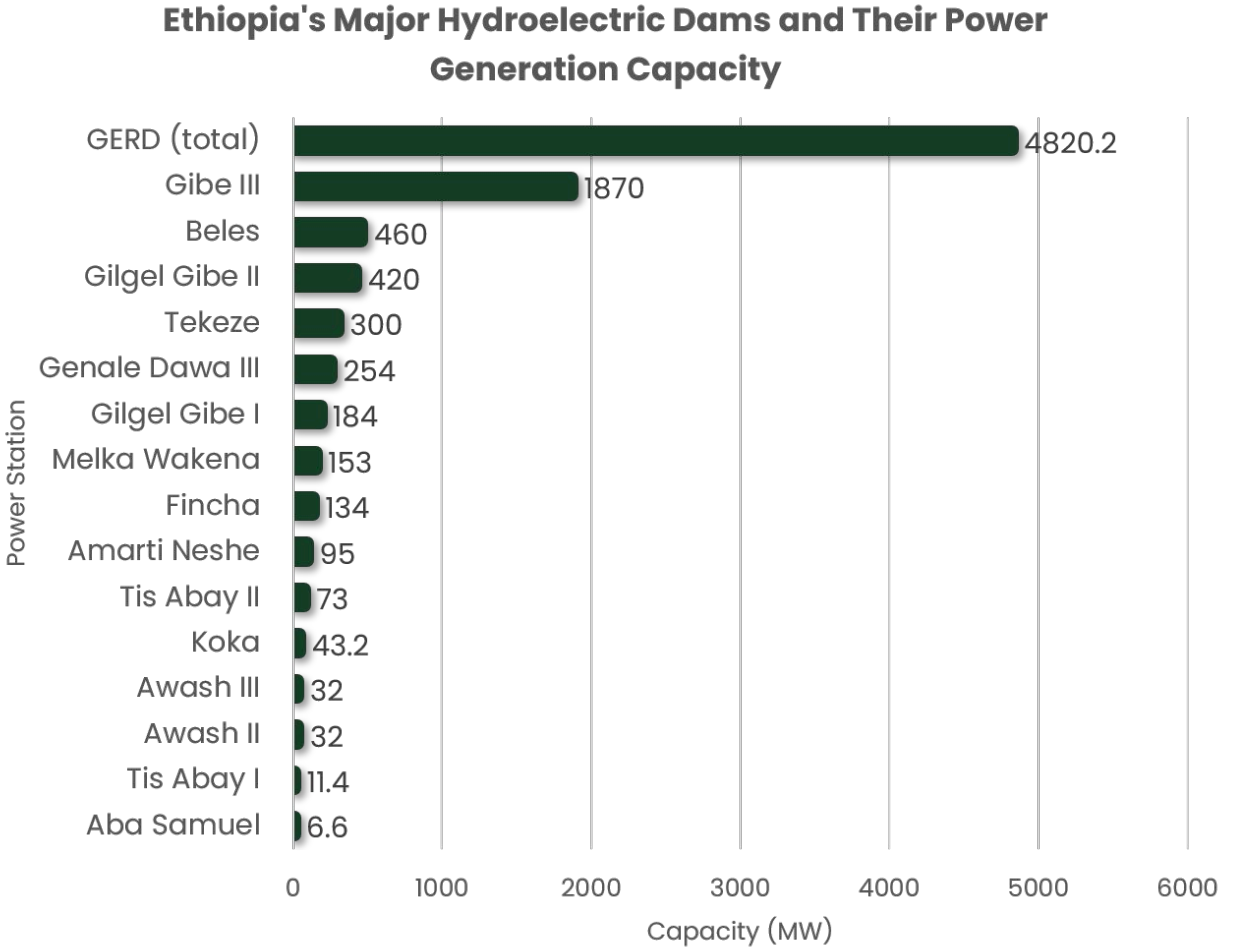
Despite Ethiopia's vast renewable energy potential, its energy supply remains dominated by **biofuel and waste (87%),** with **oil (8%)** and **hydropower (3%)** (IEA, 2022). The heavy reliance on biofuel, mainly for cooking and heating in rural areas, reflects the country's agricultural economy and limited energy infrastructure.

Notably, oil surpasses electricity as a primary source, raising concerns about dependence on imports, power generation efficiency, and grid limitations. The low share of renewables despite abundant resources points to challenges in investment, policy, and access, which will be explored further in our case studies.



Supply: IEA 2022

Ethiopia is actively working to expand its energy capacity through numerous large and medium-sized projects. The Ethiopian Electric Power (EEP) currently manages multiple power-generating stations, with the majority relying on hydro-based sources.



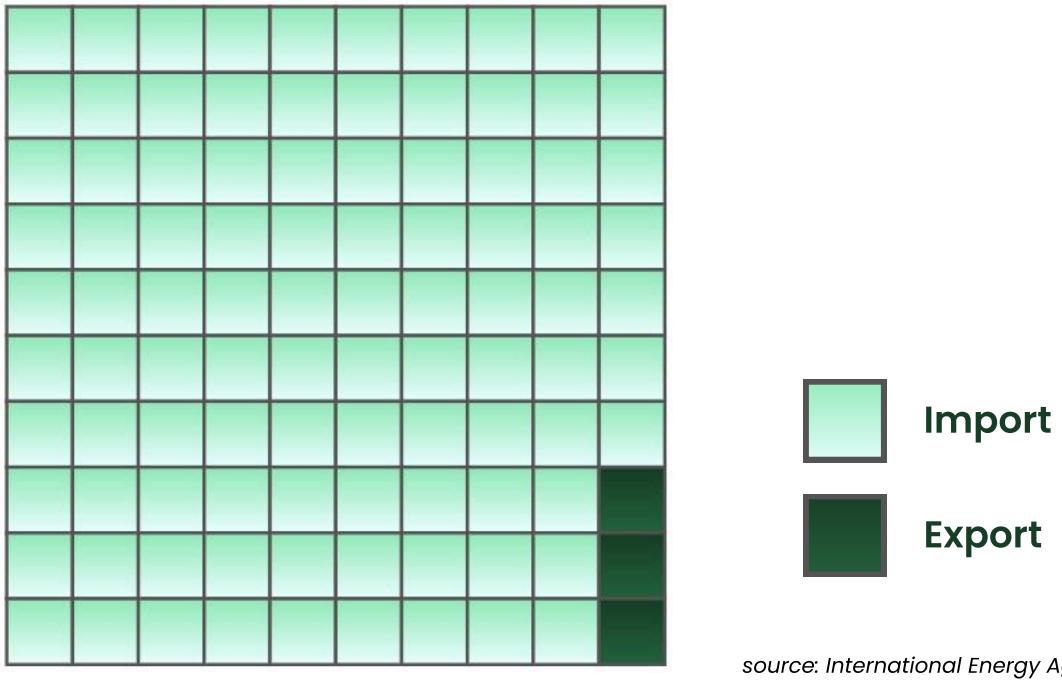
source: Ethiopian electric utility

At first glance, these figures may suggest that Ethiopia possesses enough energy generation to meet its needs, yet the ability to distribute that energy remains a challenge. The fact that only **55%** of the population had access to electricity in 2022 (according to Macrotrends) could further reinforce the belief that Ethiopia's energy issues stem primarily from inadequate grid infrastructure. However, it is important to distinguish between **energy** and **electricity**, while electricity is a key component, energy encompasses a broader range of resources, including fuel and biomass.

A closer examination of the net energy import-export balance and comparisons of energy generation per capita with similar economies reveal a different story. Ethiopia is not in an energy surplus, as the country's total energy generation does not significantly exceed its consumption needs on a per capita basis. Moreover, despite being rich in renewable energy resources such as hydropower, wind, and solar, Ethiopia heavily relies on imported energy sources, particularly petroleum products, rather than fully utilizing its domestic energy potential.

Ethiopia imported around 220,415 TJ of energy in 2022, mainly fuel from the Middle East, while its electricity exports totaled just 6,299 TJ (IEA, NBE). This stark contrast highlights the country's reliance on fuel imports, with petroleum imports reaching Birr 46.8 billion in the fourth quarter of 2023/24.

Ethiopia's Energy Trade Balance: Imports vs. Exports (2023)



source: International Energy Agency, 2023

A comparison with countries of similar economic structures further highlights Ethiopia's limited per capita energy supply. According to Our World in Data, Ethiopia generated only 124.97 kWh per capita in 2022, ranking 200th out of 235 nations. In contrast, Kenya and Sudan produced 228 kWh and 381 kWh per capita, respectively, while Egypt reached 1,809 kWh. This disparity underscores Ethiopia's struggle to expand energy production and accessibility, revealing deep structural inefficiencies.

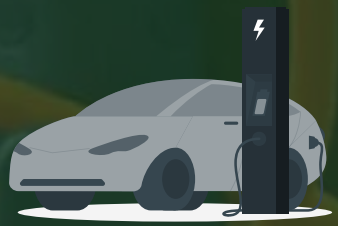
This energy gap has contributed to Ethiopia's rising fuel imports, driven by rapid urbanization and increased reliance on fuel-powered vehicles. However, a strategic shift toward electric vehicles (EVs) aims to reduce fuel dependency while boosting domestic electricity consumption. This transition could significantly reshape Ethiopia's energy balance. The following case study examines the government's EV initiative, its implementation, and its potential impact on the energy sector.

Case Study: The Shift to Electric Vehicles

Fuel-powered vehicles currently make up **90%** of Ethiopia's automotive market, but the government's new EV initiative aims to change that. By 2032, the number of electric vehicles is expected to grow from **30,000 (10% of the fleet) to 500,000,** replacing 95% of fuel-powered cars.

To accelerate this transition, the government has banned fuel-powered vehicle imports and introduced tax incentives, reducing EV import duties to **15%**. Previously, high taxes made car ownership unaffordable, but lower EV costs are driving demand. This shift will also encourage investment in charging infrastructure, battery technology, and local EV assembly.

However, this transformation will lead to a significant rise in electricity demand. With each EV consuming an estimated **4,310.65** kWh annually, Ethiopia will require an additional 2 TWh of electricity per year. The government's energy expansion plan aims to increase power generation from **4,500 MW to 19,900 MW** by 2030, but meeting the rising demand while balancing energy exports and infrastructure growth remains a challenge. Strategic investment will be crucial to ensuring a sustainable and reliable power supply for Ethiopia's electrified future.



Unlocking Ethiopia's Energy Potential for Sustainable Growth

To gain a comprehensive understanding of Ethiopia's energy sector dynamics, it is crucial to assess both the country's total energy generation potential and its current production capacity. According to Energypedia, Ethiopia has an estimated hydropower potential of up to 45,000 MW, making it the second highest in Africa after the Democratic Republic of Congo. Of this, approximately 30,000 MW is considered economically viable, which translates to an electricity generation capacity of 162 terawatt-hours (TWh) per year. However, the country currently produces only 3.98 TWh annually, representing a mere 2.5% utilization of its full hydropower potential. Of this generated electricity, 92% is consumed by domestic households, 4% by the transportation sector, and 3% by industrial applications. Despite this, only 45% of Ethiopia's population currently has access to electricity. *(Degefu et.al 2015)*

Ethiopia's Energy Consumption Pattern



source: International Energy Agency

*With **Industrial electricity** priced at 57.57 ETB per kWh—one of the highest rates set by EEU—the sector consumes only **3%** of the total energy pool. As Ethiopia moves toward an industry-led economy, securing a sustainable and sufficient power supply will be critical.*

Ethiopia also boasts the lowest electricity tariffs in Africa, yet the distribution structure remains heavily skewed towards household consumption, creating a significant financial imbalance between generation costs and revenue recovery.

A moderate market analysis suggests that prioritizing energy allocation for industrial applications, electricity exports, and emerging high value sectors such as large-scale data centers and new technological ventures like Bitcoin mining would be a more sustainable and economically viable strategy. Compared to full reliance on subsidized household consumption at the current generation cost, these alternative uses could provide greater long-term financial sustainability while driving broader economic growth.

Table 1.1 List of African countries with the cheapest electricity prices

Country	Price of electricity (kwh)	Global rank
Ethiopia	$0.006	3rd
Sudan	$0.008	4th
Libya	$0.008	5th
Angola	$0.014	7th
Zimbabwe	$0.015	9th

Source: Business Insider

Cost of electricity production for large dams is 0.02 - 0.19 USD/Kwh

Building on this perspective, we will explore high return energy investment opportunities and demonstrate how they can enhance the sustainability of Ethiopia's energy sector. In the long run, these strategic investments will also contribute to expanding grid electricity access, ensuring that the remaining population benefits from reliable and sustainable energy.



Unveiling Energy Export Dynamics: Market Potential and Future Prospects

According to the IEA, Ethiopia exported over **1.7 billion kWh** of electricity in 2022, reinforcing its role in the regional energy trade. According to the Water and Energy Minister, the country has generated more than **$1 billion** from electricity exports to neighboring countries within just **18 months**. This reflects both the growing demand for Ethiopia's renewable energy and the country's progress in the sector, even though a vast portion of its energy potential remains untapped.

Ethiopia's energy export capacity has been steadily growing, with current exports including 200 MW to Kenya, which is set to expand to 400 MW, 100 MW to Sudan with a target of 400 MW, and 66 MW to Djibouti, which is also expected to increase to 300 MW. Plans are also underway to extend exports to Tanzania, Uganda, and Zambia. While these figures indicate significant progress in establishing a strong presence in the energy export market, Ethiopia still faces challenges in meeting the full demand. Moges Mekonnen, the head of public relations at the Ethiopian Electric Power (EEP), specifically pointed out that despite Sudan's request for **1,200 MW**, Ethiopia is only capable of supplying up to **200 MW** at the moment. This highlights the untapped potential in the energy export market, considering Ethiopia's generation capacity and current limitations.

If Ethiopia is generating over **$1 billion** from electricity exports while utilizing only a fraction of its renewable energy capacity, then the potential for higher revenues is substantial. With growing regional demand and full optimization of its energy resources, Ethiopia could significantly increase its exports. If the country can expand production to meet and exceed current demand, it could potentially double or even triple its current revenue, surpassing **$2 billion** or **$3 billion** in earnings. However, achieving this requires strategic investments in additional generation projects, transmission infrastructure, and regional power agreements. By addressing these gaps, Ethiopia can position itself as a dominant energy supplier in Africa, unlocking a new economic frontier through its vast renewable resources.



Case Study
The Emergence of Bitcoin Mining & Data Centers

Ethiopia has rapidly emerged as a key player in global Bitcoin mining, leveraging its abundant and affordable renewable energy. With approximately 95% of its electricity coming from hydropower, the country enjoys a substantial energy surplus, making it an attractive destination for crypto mining companies seeking low-cost power. This surplus, coupled with electricity priced at just **3.2 cents** per kilowatt-hour, has drawn several Chinese firms, including Bitmain-backed BitFuFu and BIT Mining, following China's 2021 cryptocurrency mining ban. These investments have generated over **$55 million** in just eight months, with further growth anticipated.

However, the expansion of Bitcoin mining presents challenges. Each mining company consumes between **10MW and 100MW**, placing a significant strain on the national power grid. While this industry offers substantial economic benefits, it also raises concerns about diverting electricity from communities still lacking access. Lessons from Kazakhstan, where unregulated mining led to blackouts and policy reversals, highlight the importance of proactive regulation. Ethiopia must establish policies that balance economic gains with energy security, such as capping energy allocations, requiring reinvestment into grid expansion, and implementing flexible tariffs that adjust based on demand.

Beyond Bitcoin mining, Ethiopia is also witnessing growth in the data center industry. Companies like Wingu Africa, Redfox, and Raxio have invested millions to establish facilities, recognizing Ethiopia's potential as a regional digital hub. For instance, Raxio's **$30 million** investment in a 2,000-square-meter data center and Wingu Africa's **$50 million** facility highlight the sector's rapid expansion. These data centers require significant electricity, with Wingu Africa alone operating with a **10MW** capacity. As the demand for data storage and processing grows, Ethiopia must ensure its energy infrastructure can support both industrial-scale mining and digital services. If managed well, Bitcoin mining and data centers could become catalysts for national electrification, transforming Ethiopia's energy landscape while driving economic development.

Conclusion and Recommendations

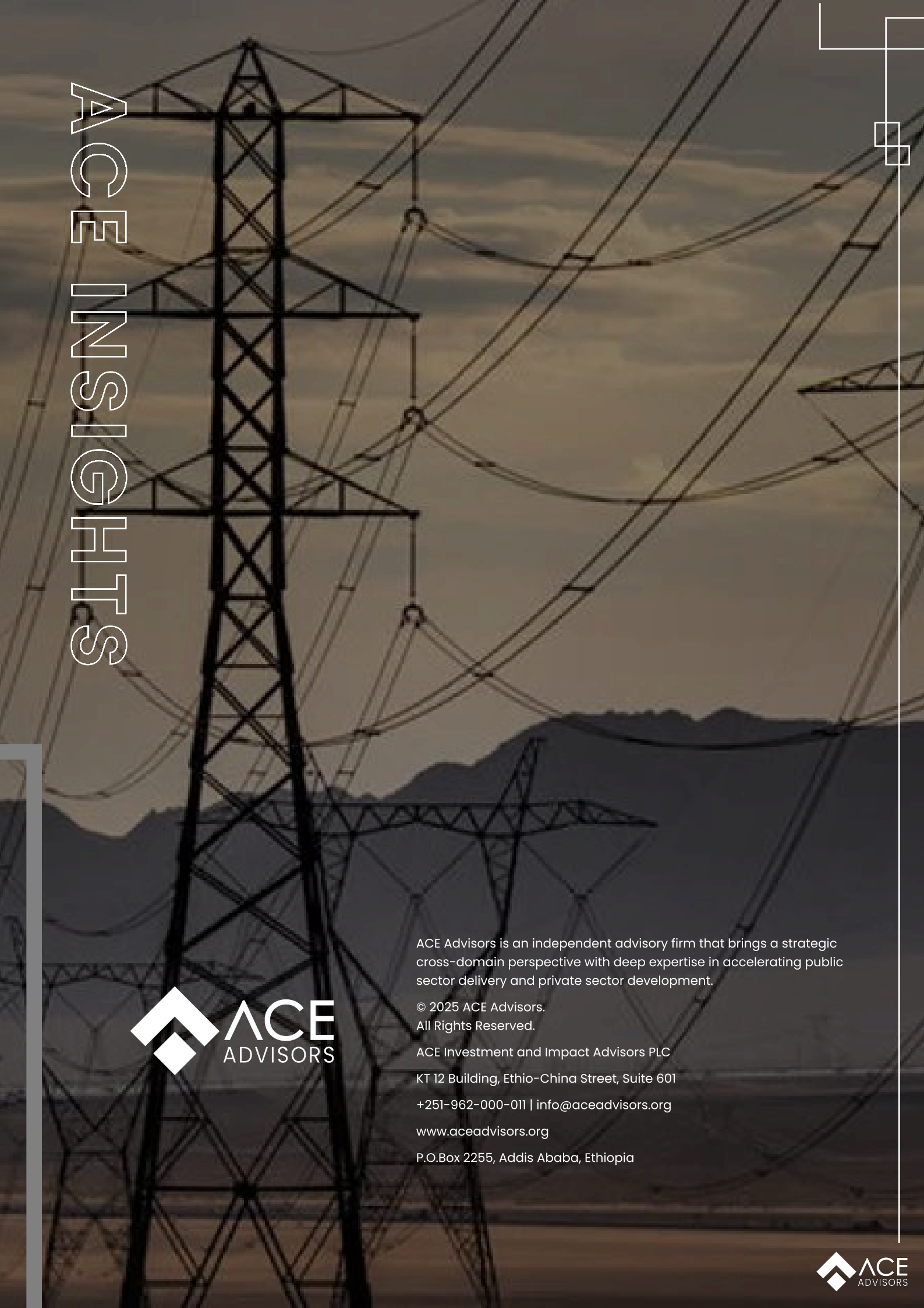
Ethiopia stands at a critical juncture in its energy development. While the country possesses vast renewable resources, the challenge lies in optimizing efficiency, expanding access, and attracting investment. Initiatives like the promotion of electric vehicles and large-scale hydropower projects mark progress, but without significant improvements in grid infrastructure and energy market regulations, these efforts may fall short.

With electricity demand surging across households, industries, and emerging sectors such as Bitcoin mining and data centers, Ethiopia must find a balance between powering economic growth and ensuring equitable energy access. Strategic infrastructure development, forward-looking policies, and enhanced regulatory frameworks will be essential in unlocking Ethiopia's full energy potential.

To ensure a sustainable energy future, we recommend the following actions:

- Diversify Energy Sources: Reduce reliance on hydroelectric power by expanding solar, wind, and off-grid solutions, particularly in rural communities.
- Strengthen Grid Infrastructure: Modernize and upgrade the power grid to improve efficiency, reliability, and accommodate increasing energy demand.
- Explore Long-Term Investments: Assess the viability of large-scale energy solutions, such as nuclear power, to sustain industrial growth.
- Enhance Policy and Regulation: Develop clear and balanced energy policies that support both domestic consumption and industrial expansion while ensuring affordability and sustainability.
- Support Local Innovation: Invest in emerging energy technologies and local enterprises to harness Ethiopia's untapped renewable energy potential.

Unlocking Ethiopia's energy potential requires bold action and sustained commitment. By prioritizing investment in diverse renewable sources, modernizing infrastructure, and fostering a regulatory environment that supports innovation, Ethiopia can not only meet its growing energy needs but also establish itself as a renewable energy hub in Africa. A well-executed strategy will drive economic resilience, attract global investment, and ensure reliable electricity access for all.



ACE INSIGHTS

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