

REPORT SERIES | CLEAN HYDROGEN PROJECTS IN THE GLOBAL SOUTH

Clean hydrogen as a transition strategy for coal-reliant economies: The case for Zimbabwe

H2Global Foundation

Table of contents

IMAGE CREDIT: SHUTTERSTOCK / JOHNOLIVERCREATIVES

About this report

Contributions

Valuable contributions to the final report were provided by Julian Reul and Hanna Graul (H2Global Foundation), as well as Christoph Zink and Benedikt Häckner (Fraunhofer IEE).

The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of the Board of Trustees or the Board of Executive Directors of the H2Global Foundation, its subsidiary Hintco GmbH, or the funders of this project.

The H2Global Foundation does not guarantee the accuracy of the data included in this work.

The report is part of the research program "H2Global meets Africa," sponsored by the 7th Energy Research Program funded by the German Federal Ministry of Education and Research.

Acknowledgements

Gratitude is extended to our esteemed peer reviewers, Rachel Bernice Perks (World Bank Group) and Tanyarwandza Gumbo (independent expert), for their important feedback that helped shape the report.

Lastly, the input and guidance of Susana Moreira (Executive Director of the H2Global Foundation) is greatly appreciated.

Rights and permissions

Author

Leah Mpinga, H2Global Foundation

Publisher

Department—Analysis and Research

Trostbrücke 1
20457 Hamburg

H2Global Foundation

Federal Ministry of Education and Research

Executive summary

Clean hydrogen and its derivatives are poised to become a cornerstone of the global energy transition, offering pathways for green industrialization and deep decarbonization. For economies heavily reliant on fossil fuels, such as Zimbabwe, this shift presents a unique opportunity to address persistent energy insecurity and foster socioeconomic development. However, realizing this potential requires navigating significant political, infrastructural, and financial hurdles.

Analysis and context

The analysis confirms that Zimbabwe's energy crisis, driven by reduced baseload generation from the Kariba Dam and the decommissioning of aging coal plants in early 2024, has created an urgent need for sustainable solutions.

Clean hydrogen may be a path for Zimbabwe to help address its energy crisis and develop a more resilient and diversified economy.

Clean hydrogen may be a path for Zimbabwe to help address its energy crisis and develop a more resilient and diversified economy. The H2Global Foundation's African hydrogen country-clustering analysis identifies Zimbabwe as a momentum builder within the clean hydrogen landscape. This is due to its abundant renewable energy potential, notably 155 GW of solar and 2.2 GW of wind capacity in highly suitable areas with low water stress, and its existing domestic anchor demand for hydrogen products in the fertilizer, crude steel, and mining sectors.

A closer look at three distinct transitional pathways for Zimbabwe to shift its energy system (see Table 1) suggests that a renewables-to-hydrogen approach may hold the key to a more sustainable future, but it comes with challenges.

The cancellation of the Hydrogène de France (HDF) Energy project confirms that the primary obstacle to exploring Zimbabwe's vast clean hydrogen potential is not technical, but rather macroeconomic instability, unstable fiscal policy, high national debt, and external debt arrears. Overcoming the country risk premium is essential to unlock Zimbabwe's potential and secure a just energy transition.

Table 1: Transitional pathways from coal to low-emission energy and clean hydrogen

Pathway	Primary goal	Assessment	Key constraint
1: Retrofitting coal plants	Carbon capture, utilization, and storage (CCUS) on existing infrastructure	Economically unsound	Mass decommissioning of plants (average 75-year lifespan) makes the prohibitive capital expenditure (CAPEX) required for CCUS illogical.
2: Coal-to-hydrogen (CCUS)	Low-carbon hydrogen production from coal	Financially challenging	High CAPEX, amplified by the country's high weighted average cost of capital (WACC) and country risk, limits access to development finance.
3: Renewables-to-hydrogen	24/7 power and industrial feedstock	Optimal long-term strategy	Project bankability barrier: The Hydrogène de France (HDF) Energy Renewstable project was terminated in October 2025 due to macroeconomic instability and high country risk.

Clean hydrogen offers avenues for green industrialization through local value creation in the following areas:

- **Fertilizer production:** Renewable hydrogen can significantly decrease reliance on imports, which cost the country USD 955 million between 2016 and 2021. The Sable Chemicals project is actively pursuing a dual green strategy in Zimbabwe: securing green ammonia imports from Namibia and developing a planned 400 MW solar park in Zimbabwe.

- **Steel manufacturing:** The new USD 1.5 billion Mvuma Steel Plant requires a transition to green steel to maintain global competitiveness. Relying on domestic renewable hydrogen, rather than imported gas or declining domestic coal production, will make the supply chain more resilient.

- **Mining sector:** In the near term, renewable hydrogen provides a critical solution for ensuring a 24/7 energy supply for mining operations, which have been significantly affected by recurrent power outages.

As a coal-producing front runner in hydrogen development, South Africa offers valuable lessons for Zimbabwe. South Africa's success is based on key strategic pillars:

- **Policy coherence:** Publishing the Hydrogen Society Roadmap for South Africa and aligning it with existing industrial and climate policies (such as the Integrated Resource Plan) anchors the transition.

- **Private-sector mobilization:** Robust support for projects, notably through securing Power Purchase Agreements (PPAs), provides long-term revenue guarantees that de-risk projects and enhance bankability.

- **Strategic partnerships:** Leveraging Just Energy Transition Partnerships (JETPs) provides the financial and technical resources necessary for a gradual phase-out of coal and support for coal-dependent communities.

To attract investment and solidify its position, Zimbabwe must prioritize institutional and financial reforms that enhance market trust to unlock the country's potential and secure a just energy transition.

IMAGE CREDIT: ADOBE STOCK / ILGUN

Table 2: Recommendations

Pillar	Recommendation	Actionable details
Policy and strategy	Establish a national hydrogen strategy	Develop a comprehensive strategy by the mid-2030s to provide clarity and direction for investors and to outline key use cases.
	Establish a national coal transition strategy	Develop a roadmap from the mid-2030s to 2050 to solidify the commitment to phasing out coal and increasing renewable energy integration.
Investment and bankability	Create a stable environment	Publish clear regulatory frameworks to promote policy consistency, transparency, and macroeconomic stability, thereby lowering perceived investment risks.
	Mobilize financial instruments	Develop tailored financial tools and risk-sharing mechanisms (e.g., through partnerships with development finance institutions—DFIs) to support project bankability and accelerate market entry.
Infrastructure and workforce	Upgrade grid infrastructure	Invest in modernizing the electricity grid in line with the 2030 National Renewable Energy Policy (NREP) target and increase capacity for renewables integration.
	Regional cooperation	Leverage existing partnerships in Southern Africa, such as the Southern African Development Community (SADC), to develop regional value chains and accelerate shared hydrogen infrastructure.

Energy in Zimbabwe: The role of coal and renewables in the energy transition

The global energy transition prioritizes the reduction of coal in the energy mix. As of 2024, coal constituted 27.9% of the world's energy supply, making it the second-largest energy source globally.[1] Primarily utilized for electricity generation, coal supplies over a third of global electricity and accounts for more than 40% of global carbon emissions, with coal-fired power plants alone contributing 20% of worldwide greenhouse gas emissions.[2] In 2024, coal used for power generation reached its highest recorded level despite slowing annual demand growth. Consequently, the early phasing out of coal plants—that is, retiring assets before their technical lifetimes expire—has become a crucial strategy to meet the 2050 net-zero emissions target outlined in the 2015 Paris Agreement.

In contrast to global climate ambitions, coal demand in Africa is projected to grow from 194 Mt in 2024 to 203 Mt by 2027.[3] In 2022, Africa accounted for 3% of the world's coal supply and 13% of total energy exports.[4] Despite the projected increase in coal demand until 2027, several African nations, including South Africa and Senegal, are actively leading the transition from coal dependency toward increased renewable energy capacity.[5]

Zimbabwe stands as one of Africa's largest coal producers and consumers. Over the past decade, the government has expanded coal operations by allocating new concessions and increasing overall coal output to 0.5 Mt in 2022, generating substantial national revenue.

The mining sector is a cornerstone of Zimbabwe's economy, contributing approximately 12% to the country's GDP, over 60% of exports, and a significant share of foreign direct investment (FDI).[6,7] In 2021, it was reported that over 37,000 people were formally employed in the mining sector, while the number of artisanal miners in recent years is estimated to have risen to 1.5 million.

While coal mining is expanding in Zimbabwe, most of the extracted coal is destined for export. At the same time, three out of four operational coal-fired thermal power plants were closed in early 2024 due to aging infrastructure, exacerbating an energy crisis in Zimbabwe. The primary driver of this crisis is the reduced water flow in the Zambezi River—a consequence of climate change—which supplies 68% of the country's electricity through hydropower from the Kariba Dam.[8,9]

IMAGE CREDIT: ADOBE STOCK / ABDELAZIZ@771

What is clean hydrogen?

Clean hydrogen can be produced in various ways, including via electrolysis powered by renewable energy sources (known as renewable hydrogen) or through steam reforming of natural gas combined with carbon capture, utilization and storage (CCUS) (known as low-carbon hydrogen). Once produced, hydrogen is typically either transported through a pipeline network or converted into a suitable form for shipping.

However, this crisis paradoxically presents a significant opportunity for Zimbabwe to accelerate its transition toward greater investment in renewable energy for affordable, reliable, and clean power.[10]

Clean hydrogen and its derivatives are emerging as critical components of the global energy transition. This low-carbon energy carrier is poised to decarbonize hard-to-abate sectors such as transport, industry, and the built environment. Furthermore, clean hydrogen offers avenues for green industrialization through the potential emergence of domestic fertilizer production and low-carbon steel manufacturing. The development of renewable hydrogen production in Zimbabwe could also yield significant socioeconomic benefits, including local value creation, increased energy access, and enhanced food security.

The H2Global Foundation's country clustering analysis, which assessed the potential of African nations to produce renewable hydrogen and foster local economic value, identified Zimbabwe as a "momentum builder".[11] This designation reflects Zimbabwe's high renewable energy potential (a prerequisite for renewable hydrogen production), sufficient water availability, domestic offtake opportunities for renewable hydrogen products, and nascent renewable hydrogen projects. Together, these factors create a compelling opportunity for Zimbabwe to leverage its renewable hydrogen potential to develop new industries.

As Zimbabwe transitions away from coal toward clean energy, it is imperative to address associated risks and ensure a just transition. This requires identifying the least disruptive pathways that support increased energy access, protect local workforces, and involve participatory processes with communities in coal-producing regions.

This report posits that clean hydrogen presents a viable pathway for Zimbabwe to reduce its dependence on coal while offering opportunities for decarbonization, industrial development, and a just energy transition. However, realizing this potential requires addressing specific challenges related to policy, infrastructure, investment, and social equity. The following sections examine Zimbabwe's current energy landscape and policy framework, highlight the opportunities for clean hydrogen, and outline pathways for the transition away from coal, emphasizing the importance of a just energy transition. The report then explores the applications of clean hydrogen and its potential demand sectors in Zimbabwe, drawing insights from South Africa's successes in mobilizing clean hydrogen initiatives.

IMAGE CREDIT: ADOBE STOCK / CLIFF

Types of coal

Domestic coal production in Africa is driven by reserves extracted from underground and surface mines. These coal deposits are ranked from high to low grade to determine their industrial applications. Anthracite ores and bituminous coal (also known as metallurgical coal) have higher heating values (International Energy Agency (IEE), 2024). Metallurgical coal is essential for steelmaking and includes cooking coal as well as coal used for pulverised coal injection (PCI) (IEE, 2024).

Lignite and sub-bituminous coal (lower ranked coal) are primarily used for electricity generation.

Zimbabwe’s energy landscape

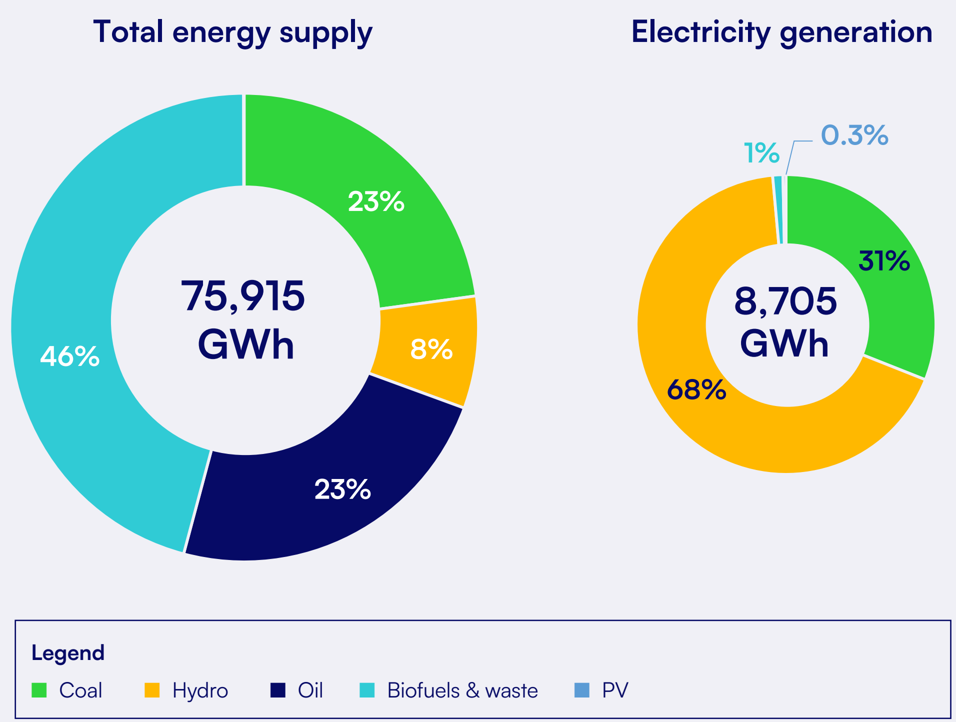
Zimbabwe’s energy supply is characterized by a blend of conventional and renewable sources.[12] In 2022, biofuels constituted the largest share of the country’s energy mix at 45.8%, followed by oil (23.6%), coal (22.8%), and hydropower (7%).[13] The widespread use of traditional biofuels—primarily biomass for domestic cooking and heating—underscores their continued prevalence in Zimbabwe’s energy mix.[14] Although a substantial portion of the country’s energy provision remains fossil-fuel based, there is significant potential to expand existing renewable energy capacity. Hydropower currently dominates Zimbabwe’s renewable energy contributions, accounting for 88% of this capacity, while solar and wind each contribute less than 10%.

Electricity generation in Zimbabwe relies heavily on hydropower from the Kariba Dam, located in the Kariba Gorge of the Zambezi River Basin. With an installed capacity of 1,050 MW, the dam supplies electricity to both Zimbabwe and Zambia.[15] Overall, hydropower contributes approximately 68% of Zimbabwe’s total electricity generation.[16] Coal, on the other hand, contributed 31% of total electricity production in 2022.[17] However, aging infrastructure significantly reduced output at the Harare, Bulawayo, and Munyati coal-fired power stations.[18] These plants were ultimately decommissioned in early 2024 due to exceeding their initial 25-year lifespan and facing escalating road transportation costs for coal.[19]

The combined impact of prolonged droughts affecting the Zambezi River and declining coal-fired production has led to frequent and intensifying power shortages across Zimbabwe. These energy supply challenges are further exacerbated by a substantial gap between the country’s installed energy capacity (2,800 MW) and its peak energy demand (5,000 MW).[20] This energy insecurity has resulted in significant economic losses, estimated at approximately 6.1% of Zimbabwe’s annual GDP.[21]

In response, the Zimbabwe Electricity Supply Authority (ZESA) has initiated efforts to diversify the energy mix and enhance energy security. Measures include improvements to the Hwange Power Plant, notably the addition of a new 335 MW coal-fired unit[22], alongside the promotion of renewable energy projects.[23]

Figure 1: Zimbabwe’s energy supply and electricity generation in 2022



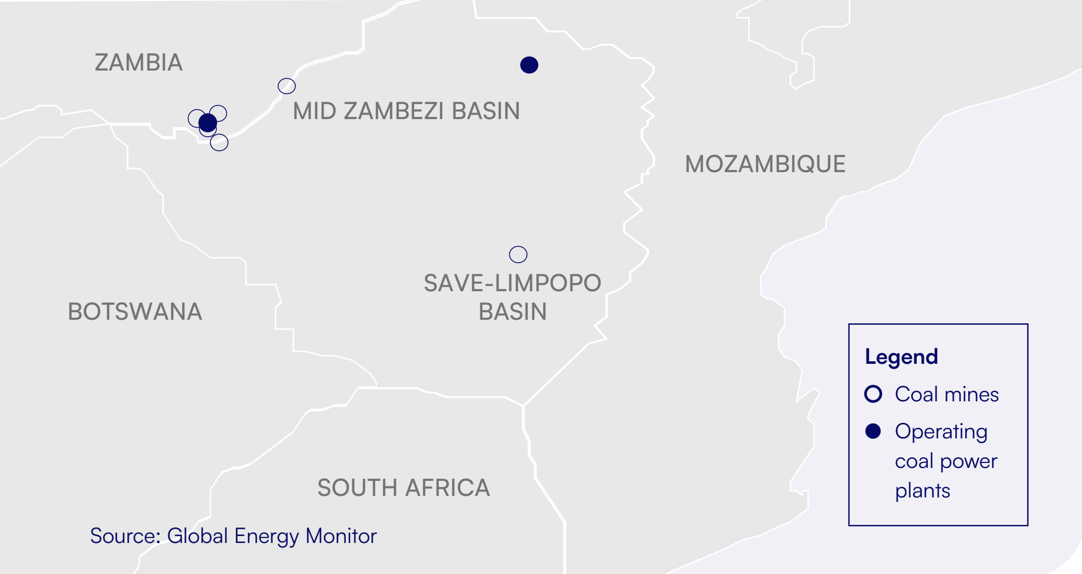
Source: International Energy Agency

Mapping Zimbabwe's coal regions and current production

As of 2022, Zimbabwe was Africa's fourth-largest coal producer, with an annual supply of 62,438 TJ.[24] Despite this, coal accounts for only 0.99% of the country's total exports. The country's most abundant coal regions are concentrated in the mid-Zambezi Basin in northwest Zimbabwe and the Save-Limpopo Basin in the southeast. These coal basins predominantly contain bituminous deposits suitable for both thermal and coking applications.[25]

Table 3 provides an overview of Zimbabwe's existing coal mines and their respective ownership. According to the Africa Energy Tracker Map, there are currently eight operational coal mines in the country. All operating coal-fired power units are owned by ZESA and have a combined installed capacity of 1,620 MW.[26]

Figure 2: Operating coal power plants in Zimbabwe



Source: Global Energy Monitor

Table 3: Coal mines in Zimbabwe and their ownership (based on expert source)

Coal Mines	Ownership
Chiredzi	Steelmakers Zimbabwe Pty Ltd
Hwange Colliery	State-owned
Makomo	Makomo Resources Ltd
Limpopo	Tamuka Mining, Senzile Resources Pty Ltd
Tuli	Tamuka Mining
Murowa	RioZim
Dodge	Raptor Resources Holdings Inc.
Sengwa	RioZim and RZ Murowa
Lubu	Contango
Dinde	Beifa Investments

Zimbabwe's energy transition: Understanding the policy landscape for a just transition

Zimbabwe's approach to climate policy and its energy transition is fundamentally shaped by both constitutional mandates and international commitments, notably the 2015 Paris Agreement and the country's Nationally Determined Contributions (NDCs), which aim to achieve net-zero emissions by 2050. The pace of this transition, however, will depend on how effectively these overarching priorities are translated into national policies that both facilitate the transition and promote the adoption of renewable energy.

According to the African Development Bank's (AfDB) *Green Growth Perspectives* report, Africa's green growth agenda often differs from that of industrialized nations, with the continent's primary focus remaining on development (Moyo, 2024). In the journey towards net-zero greenhouse gas emissions, African countries must simultaneously attract investment, foster local goods and services, ensure access to food and water, and provide clean, affordable energy. An earlier AfDB report emphasized the importance of balancing near-term and long-term risks while ensuring the efficient use of natural resources amid escalating climate-change impacts.[27]

In the journey towards net-zero greenhouse gas emissions, African countries must simultaneously attract investment, foster local goods and services, ensure access to food and water, and provide clean, affordable energy.

In Zimbabwe, the Ministry of Energy and Power Development (MoEPD) is responsible for policy formulation, sector performance and monitoring, and the development and promotion of new and renewable energy sources.[28] The country's first comprehensive National Energy Policy (NEP), introduced in 2012 by the MoEPD, outlines specific goals. These include increasing access to affordable energy across all sectors, stimulating economic growth, promoting research and development, and adopting renewable energy sources to complement conventional ones.

IMAGE CREDIT: ADOBE STOCK / MIGUEL ALMEIDA

The policy also details plans for the MoEPD to establish institutional, legal, and regulatory frameworks in relation to renewable energy. A core objective of the NEP is to enhance stakeholder participation in expanding public—private partnerships (PPPs). The policy strategically aims to improve institutional frameworks within the energy sector to secure future energy services through increased private sector involvement and foreign direct investment (FDI).[29]

Further solidifying its long-term vision, in 2018 the government published *Zimbabwe's Vision 2030*, a roadmap designed to transform the country into an industrialized, knowledge-based, upper-middle-income nation.[30] *Vision 2030* is structured around five strategic pillars: governance; macroeconomic stability and financial re-engagement; inclusive growth; infrastructure and utilities; and social development. This vision proposes a framework for creating an open, efficient, and effective environment that fosters entrepreneurship, attracts higher flows of FDI, and prioritizes a private sector-led economy. Pertaining to energy, infrastructure, and power, *Vision 2030* emphasizes increased power generation through both renewable and non-renewable sources.[31] The government seeks to attract investment primarily through three routes: PPPs, joint ventures, and independent power producers (IPPs).[32]

Vision 2030 is structured around five strategic pillars: governance; macroeconomic stability and financial re-engagement; inclusive growth; infrastructure and utilities; and social development.

To specifically support the transition to clean energy and the national goal of reducing energy emissions by 15.8% between 2017 and 2030, the government passed the National Renewable Energy Policy (NREP) in 2019. The NREP is guided by key principles such as development, sustainability, affordability, accessibility, gender equality, poverty eradication, and employment creation. Alongside these principles, the NREP sets clear goals and milestones for newly installed renewable energy capacity. Currently, renewable energy, excluding hydropower, represents 5% of total electricity demand. Using the NREP as a guideline, the government plans to add 1,100 MW of renewable energy capacity by 2025, aiming to meet 16.5% of national electricity demand.

IMAGE CREDIT: ADOBE STOCK / UNAI

The ultimate NREP goal is to further increase installed renewable energy capacity to 2,100 MW, representing 26.5% of total electricity demand, by 2030. The policy also identifies key barriers to renewable energy uptake, including:

- renewable energy market assessments remain limited in scope;
- a lack of efficient funding mechanisms,
- gaps in skills development and local manufacturing; and
- a lack of institutional structures dedicated to renewable energy development.

To overcome these challenges, the NREP defines the roles of key stakeholders—the MoEPD, the regulator, and the transmission utility—in supporting the successful integration of renewable energy into the national energy mix.[33] Following the NREP, the government passed the National Energy Efficiency Policy (NEEP) in 2025, which aims to reduce the consumption of electricity and petroleum fuels in the mining, manufacturing, industrial, and agricultural sectors. The NEEP aims to promote efficient, low-carbon energy systems through targeted regulation and the widespread use of technologies that lower energy intensity. These policies directly support *Vision 2030*'s objectives of improving power and infrastructure and enhancing energy resilience. Currently the NREP is being revised by the MoEPD, with plans to anchor the NEEP through an Energy Efficiency Law and National Energy Efficiency Strategy.

Zimbabwe's recent energy policy frameworks outline ambitious plans to develop a robust renewable energy market.[34] This ambition has largely been driven by the urgent need to address the country's ongoing energy crisis, as current energy deficits are considered unsustainable for continued economic growth. In this context, renewable energy is positioned as a crucial solution, offering cost-competitive alternative sources with significant potential for industrial applications. Renewable energy technologies can be deployed for power generation across various sectors—including manufacturing, mining, agriculture, and commercial enterprises—thereby reducing reliance on the national grid and mitigating the impacts of frequent power outages. Thus, industries across Zimbabwe are increasingly recognizing the opportunities and benefits associated with integrating renewable energy into their operations.[35]

IMAGE CREDIT: ADOBE STOCK / DEWALD

Another significant application of renewable energy lies in the production of renewable hydrogen, which has already gained traction in Zimbabwe through production initiatives drawing on solar and hydropower sources. The Zimbabwe Hydrogen Society is actively collaborating with industry partners to establish a hydrogen pilot plant, aiming to demonstrate both the production and utilization of hydrogen as a clean energy carrier.[36]

Across the African continent, several countries have published policies and created initiatives to foster the development of a clean hydrogen economy. Nations such as Mauritania, Egypt, and Kenya have released renewable hydrogen strategies and have deepened their commitment to this emerging sector by expanding supportive policies and incentives to attract private investment into renewable hydrogen projects.

In Mauritania, the *Green Hydrogen Code* establishes clear legal and regulatory frameworks, under the authority of the Ministry of Energy, for renewable hydrogen project development. The code also outlines the government's plans to provide tax incentives, including exemptions on VAT and corporate tax, to attract both foreign and domestic investors.[37]

Similarly, in Egypt, the *Green Hydrogen Incentive* offers reductions equivalent to 33% to 55% on tax paid on income derived from activities related to clean hydrogen projects.[38] Beyond tax incentives, Egyptian policy has emphasized land allocation and local content creation to facilitate the emergence of a clean hydrogen industry.

In Kenya, the allocation of Special Economic Zones (SEZs) for renewable hydrogen projects enables the co-location of renewable energy production and electrolyzer demand. The designation of SEZs in Naivasha, Dongo Kunda, and Konza was informed by the "hydrogen valley" concept. Kenya's existing regulatory framework for SEZs allows green hydrogen investments to benefit from sector-specific incentives, business-enabling policies, and sector-appropriate infrastructure and utilities.[39]

As Zimbabwe, along with other African nations, strives to shift toward renewable energy, clean hydrogen is increasingly recognized as a key transition pathway. The following section further highlights the specific opportunities for clean hydrogen in Zimbabwe.

As Zimbabwe, along with other African nations, strives to shift toward renewable energy, clean hydrogen is increasingly recognized as a key transition pathway.

IMAGE CREDIT: ADOBE STOCK / HALIM KARYA ART

The hydrogen opportunity

Clean hydrogen and its derivatives are poised to become a cornerstone of the global energy transition. The shift toward clean hydrogen production offers a unique opportunity for the deep decarbonization of hard-to-abate sectors, including transport, the built environment, and heavy industry. While barriers to widespread adoption remain, hydrogen produced through electrolysis powered by renewable energy (renewable hydrogen) is emerging as one of the most promising pathways, offering minimal lifecycle emissions at both the production point and during electricity generation.[40] Additionally, low-emissions hydrogen produced via steam methane reforming (SMR) or autothermal methane reforming (ATR), coupled with carbon capture, utilization, and storage (CCUS), plays a pivotal role in transitioning from unabated fossil-based hydrogen to cleaner alternatives. To meet the ambitious 2050 net-zero targets, clean hydrogen production must escalate significantly, with projections indicating an increase of 40 Mt by 2030—two-thirds of which is expected to come from renewable hydrogen.[41]

The continent holds an estimated 60% of the world's solar energy resources yet currently utilizes only

1%

of this capacity.

Africa presents a particularly promising landscape for renewable hydrogen production, largely due to its abundant renewable energy potential. The continent holds an estimated 60% of the world's solar energy resources yet currently utilizes only 1% of this capacity as installed solar.[42] Leveraging this untapped potential, it is estimated that Africa could produce over 50 Mt per year of cost-competitive renewable hydrogen. This substantial production capacity could not only meet local demand but also significantly foster and strengthen value chains in key industries such as renewable ammonia for fertilizer production, green steel, and methanol.[43]

IMAGE CREDIT: ADOBE STOCK / BEING IMAGINATIVE

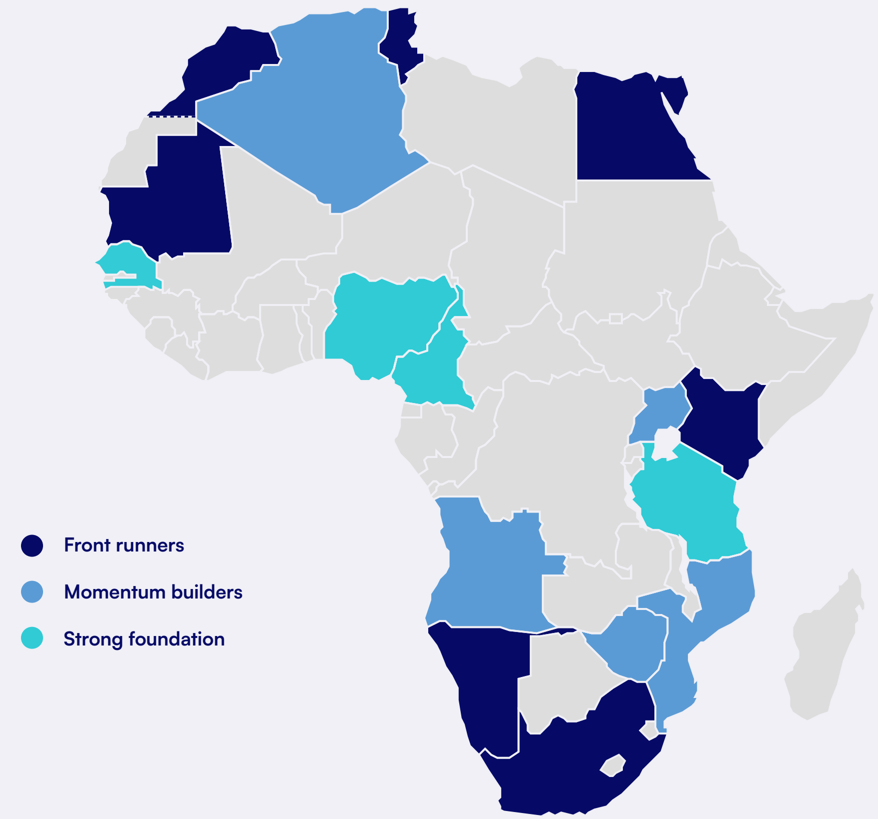
Country clustering analysis of the hydrogen market potential of African countries

The H2Global Foundation conducted a comprehensive country clustering analysis to identify the African nations best positioned to establish a national hydrogen economy. The study introduced a robust framework to evaluate readiness across five key dimensions: water and renewable energy potential, national hydrogen commitment, domestic anchor demand, country risk, and export infrastructure. By integrating these diverse aspects, the analysis transcends the limitations of existing analyses, offering practical insights crucial for successful hydrogen market creation in Africa.

Zimbabwe has been identified as a momentum builder in Africa's nascent hydrogen economy, alongside Algeria, Angola, Mozambique, and Uganda.

The assessment grouped African countries with the potential for hydrogen market creation into three categories: **front runners**, **momentum builders**, and **strong foundation**. Despite their differences, all groups share two essential characteristics for renewable hydrogen production: medium to high water availability and significant renewable energy potential, alongside the presence of domestic anchor demand, which is vital for initiating hydrogen projects. The primary distinctions among these groups stem from their respective levels of national hydrogen commitment and country risk profiles.

Figure 3: Africa country clustering results



Zimbabwe has been identified as a **momentum builder** in Africa's nascent hydrogen economy, alongside Algeria, Angola, Mozambique, and Uganda. These nations possess strong potential but require concerted action to sustain their momentum. Unlike **front runners** such as Egypt, Kenya, and Mauritania, **momentum builders** generally have less mature policy frameworks and investment landscapes. To attract market interest, these countries should prioritize publishing national hydrogen strategies, advancing early-stage projects, showcasing their hydrogen sector potential more effectively, and addressing infrastructure gaps and investment risks.

Zimbabwe holds significant potential for large-scale hydrogen production, with approximately 0.5% of its land area classified as highly suitable.

Detailed Geographic Information System (GIS) analysis reveals that Zimbabwe holds significant potential for large-scale hydrogen production, with approximately 0.5% of its land area classified as highly suitable (see Table 4). These opportune areas benefit from proximity to water sources (such as open water bodies or seawater), existing road networks, and small cities, all within a 100-kilometer radius. This corresponds to an estimated renewable energy potential of approximately 155 GW of photovoltaic (PV) solar and 2.2 GW of wind capacity. Crucially, all this renewable potential is situated in regions with low water stress—a critical factor for renewable hydrogen production in Zimbabwe, especially given the country's varying water availability.

When water stress is not considered an exclusion criterion, the estimated renewable energy potential increases significantly to 101 GW of wind and 958 GW of PV capacity.[44] Furthermore, Zimbabwe has considerable untapped hydropower potential, estimated at 29 GW.[45]

Table 4: Country clustering results for Zimbabwe

Rating	Dimensions	Results
Medium rating	H2O and RE potential	PV: 1,864 km^2 Wind: 89 km^2 Hydropower: 29 GW Geothermal: 0 GW
Medium rating	National hydrogen commitment	No hydrogen strategy 2 projects in concept phase
High rating	Domestic anchor demand	Fertilizer production: 240,000 t/a Crude steel production: 1,200,000 t/a Mineral production: 710,845 t/a
Low rating	Country risk	Medium risk classification: 7/7
Low rating	Export infrastructure	No liquefied natural gas (LNG) terminal, ammonia terminal, or methanol terminal

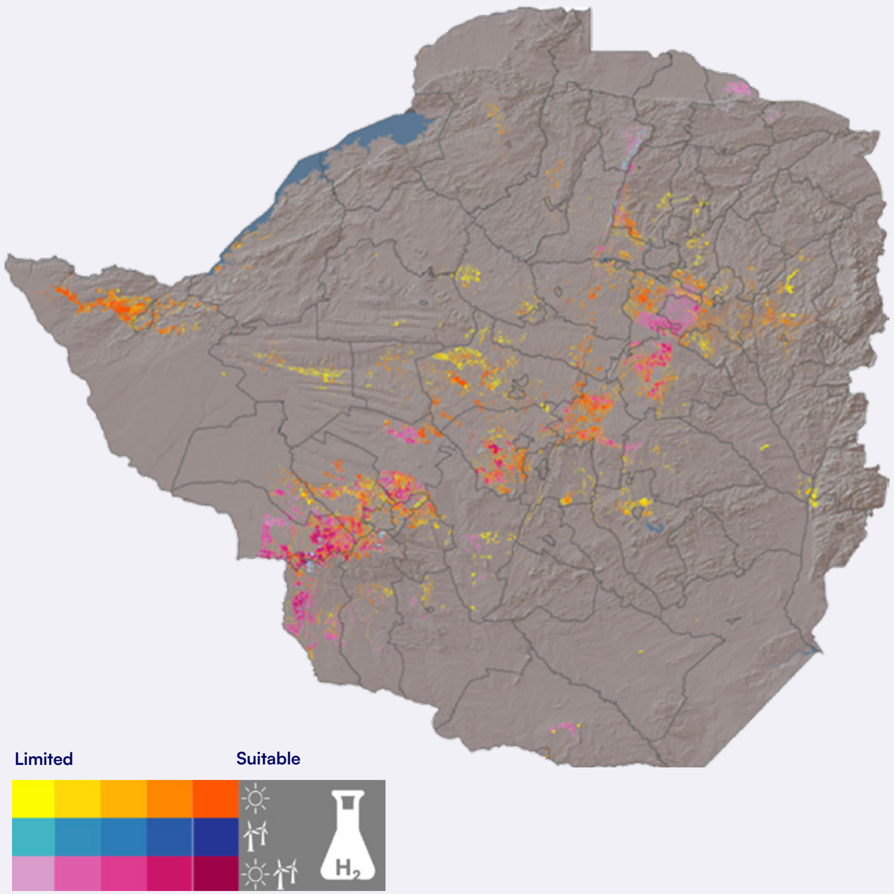
Legend
High rating | Medium rating | Low rating

Zimbabwe has a historical precedent in hydrogen utilization, having operated a renewable hydrogen project from 1972 to 2015 that used 100 MW of alkaline electrolysis to produce ammonia for fertilizer production. Today, a notable large-scale renewable hydrogen project is under development by Hydrogène de France (HDF) Energy, which includes 128 MW of PV and is aiming for a hydrogen production of 1150 t/a.[46] While details on this project remain limited, Zimbabwe's domestic anchor demand for hydrogen is primarily driven by three key sectors: fertilizer production,[47] crude steel manufacturing,[48]and mining.[49]

Zimbabwe has a historical precedent in hydrogen utilization, having operated a renewable 2015 that used 100 MW of alkaline electrolysis to produce ammonia for fertilizer production.

Despite this promising potential, Zimbabwe faces several challenges, including the absence of both a clear regulatory framework and a national hydrogen policy, and limited infrastructure. As a landlocked country, Zimbabwe lacks gas pipelines connecting it to neighboring nations, posing a significant hurdle to exporting hydrogen and its derivatives. Consequently, Zimbabwe will need to collaborate with neighbors such as South Africa (identified as a **front runner**) and Mozambique (another **momentum builder**) to develop shared regional hydrogen infrastructure. High perceived country risk, which leads to elevated capital costs, remains a significant deterrent to attracting the substantial investment required for hydrogen projects.[50] Addressing this barrier through strategic financial mechanisms and partnerships will be essential to unlocking Zimbabwe's full hydrogen potential and solidifying its position as a **momentum builder** in the global hydrogen market.

Figure 4: Suitable renewable hydrogen production in Zimbabwe



Transitional pathways from coal to low-emission energy and clean hydrogen

Zimbabwe currently lacks public policies that specifically address a transition away from coal. Shifting from fossil-based energy to low-emission renewable energy systems is crucial for achieving a just and fair transition, which involves ensuring decent work, social inclusion, and poverty eradication while moving toward a sustainable clean energy economy.[51]

The transition to new energy markets must align with the core goals of a just transition and should therefore not exacerbate socioeconomic vulnerabilities

All low-carbon transitions must address the socioeconomic impacts on both the formal and informal segments of the coal economy through a combination of local and national policies, along with analysis of coal employment dynamics at both the national and subnational levels. Formal mining refers to large-scale, legally regulated operations that typically involve employment contracts, social protection, and safety training. Informal small-scale mining, by contrast, is often unlicensed and labor-intensive, and sometimes involves illegal miners working in unauthorized or abandoned mines. Workers in the informal coal economy receive few social benefits (such as severance pay, social insurance, pensions), as they operate outside formal regulation.

The transition to new energy markets must align with the core goals of a just transition and should therefore not exacerbate socioeconomic vulnerabilities. In the short term, the continuation of the coal sector can positively impact local economies, providing jobs and tax revenues. However, the sector is often subject to boom and bust cycles, which can undermine long-term growth through wage distortion and an oversupply of workers in a single sector. Furthermore, for countries like Zimbabwe, increased production coupled with technological improvements may actually reduce labor demand, leading to concerns that employment opportunities will not keep pace with coal expansion, as seen in regions like Hwange.[52]

IMAGE CREDIT: ADOBE STOCK / GUSTAVSMD

In the event of mine closures, the outsized impact of coal mining jobs can destabilize local economies and leave communities vulnerable to dislocation. To mitigate these risks, governments and policymakers should consider a comprehensive set of initiatives during the phase-out of coal:

- Temporary income support
- Enhancing workers' capacity to qualify for jobs in the renewable energy sector
- Stimulating private sector labor demand as well as local or regional business development (i.e., grant programs)
- Create a business and labor regulatory environment to promote private sector investment and job creation.[53]

Increased gender inclusion is another critical element of a just transition in the Global South. Currently, women make up a small, often poorly paid portion of the formal mining workforce and frequently occupy positions in the informal segments of coal mines and thermal power plants. For a fair transition, policies must recognize women as key stakeholders, ensuring equal access to development and employment programs to increase their representation in vocational occupations and leadership positions. The overall energy transition can and should unlock opportunities for local job creation, fair wages, gender inclusion, and community development.[54]

Several pathways exist for Zimbabwe to transition from coal to clean hydrogen, each with distinct implications.

Pathway 1: Retrofitting existing coal-fired power plants

The first pathway involves retrofitting existing coal-fired power plants. One low-disruption option is installing Carbon Capture, Utilization, and Storage (CCUS) systems to mitigate emissions while maintaining current combustion processes. More transformative retrofitting options include replacing steam turbines with gas turbines to enable operation with clean hydrogen or modifying combustion chambers to allow co-firing with hydrogen-based ammonia. Currently, operations can only co-fire with a 20% input of clean hydrogen, leaving coal as the primary input fuel.

However, this retrofitting pathway is largely impractical and uneconomical for Zimbabwe's current infrastructure. Logistically, the viability of retrofitting is critically limited by the advanced age and diminished capacity of the national coal fleet. As of 2024, the government moved to decommission three aging thermal power stations (Harare, Bulawayo, and Munyati) with a combined capacity of 240 MW, each with an average operational life of more than 75 years. The high running costs of 46 US cents per kWh and the frequent breakdowns at these facilities underscore that major, long-term capital investment is fundamentally illogical for infrastructure already past its lifespan. While the vast majority of remaining operational capacity is concentrated at Hwange Thermal Power Station, even its recently rehabilitated units suffer from chronic inefficiencies, leaving an insufficient and unreliable base for a high-cost technological overhaul.

Table 5: Overview of retrofits for Pathway 1 and related CAPEX and OPEX requirements

Retrofits needed for Pathway 1	CAPEX requirements (Low/Medium/High)	OPEX requirements (Low/Medium/High)
CCUS installation	**High CAPEX:** Carbon capture technology, compression, transportation infrastructure, and storage/utilization facilities.	**Low OPEX:** OPEX covers sorbent, solvent replacement, and ongoing maintenance.
Combustion chamber modification	**Medium CAPEX:** This involves CAPEX for modifying the combustion chamber and potentially upgrading fuel-handling infrastructure.	**Medium OPEX:** OPEX will depend on the cost of the co-fired fuel (ammonia) and any efficiency changes.

Furthermore, the required capital expenditure (CAPEX) for CCUS technology is prohibitive, demonstrating poor economics for an aging, unreliable fleet. As detailed in Tables 5 and 6, the costs for carbon storage alone reach USD 433 million in CAPEX and nearly USD 90 million in operational expenditure (OPEX) annually. The investment necessary to install CCUS, which merely mitigates emissions while preserving an outdated combustion process, is simply too great for assets facing mass decommissioning due to unviability. This makes the retrofitting pathway not just challenging, but economically unsound.

Pathway 2: Shifting coal use to hydrogen production

The second pathway proposes redirecting coal resources away from traditional power generation and exports toward low-carbon hydrogen production (using coal with CCUS) to supply emerging domestic, value-added industries. This transition faces significant financial and logistical hurdles. The technology requires substantial CAPEX and OPEX, as outlined in Table 7. These costs are further amplified by Zimbabwe's infrastructure constraints and the typically higher weighted average cost of capital (WACC) applied to project investments.

The investment necessary to install CCUS, which merely mitigates emissions while preserving an outdated combustion process, is simply too great for assets facing mass decommissioning due to unviability.

Furthermore, the large volumes of coal required raise serious questions about the long-term viability of this approach, given the finite resource base and the accelerating global shift away from coal. This is reinforced by the adverse international finance climate, where approximately USD 150 billion was invested in renewable energy technologies across the Middle East and Africa in 2024 alone, highlighting the strong financial preference for non-coal projects.

Table 6: Overview of CAPEX and OPEX cost for modelled CCUS coal and power plant in Indonesia (Kimura et al,. 2022)

	CAPEX (USD million)	OPEX (USD million)
Carbon storage	433.0	89.6
Pipeline costs[55]	18-30	1.1
Transportation costs	0.05 — 0.7	Not provided in study

Table 7: Retrofits needed for Pathway 2 and related CAPEX and OPEX requirements

Retrofits needed for Pathway 2	CAPEX requirements (Low/Medium/High)	OPEX requirements (Low/Medium/High)
Coal gasification plant	**High CAPEX:** High upfront costs due to the complexity of coal feedstock handling, the carbon capture unit, CO2 compression, transportation and storage/utilization infrastructure, water-gas shift reactor, and syngas cleaning and conditioning.	**High OPEX:** OPEX covers coal feedstock costs—a major expense dependent on coal type, mining, transportation, and market prices.

Pathway 3: Transitioning to renewable energy and hydrogen

This pathway centers on developing a sustainable and resilient energy future based on renewable energy production and renewable hydrogen. Prioritizing renewables and hydrogen provides long-term energy security, economic diversification, and improved social well-being, even though Zimbabwe's coal emissions account for only 0.03% of the global total. Zimbabwe aims to increase its electricity generation capacity from 2,300 MW to 6,000 MW by 2025, while currently relying on coal for baseload supply.

A significant advantage is the potential for increased access to more affordable and reliable energy sources. Surpluses from renewable energy generation can be integrated into the national grid—a crucial benefit considering that in 2023, only 50% of Zimbabwe's population had access to energy and frequent power blackouts severely impacted households and industries.[56,57] Projects like HDF Energy's MiddleSabi Renewstable, which aimed to provide 24/7 electricity through solar-powered hydrogen storage, exemplify this potential.[58]

Integrating clean hydrogen into sectors such as mining, steel manufacturing, and fertilizer production is a key strategy for phasing down coal, creating new domestic value chains, and enhancing global export competitiveness.

Integrating clean hydrogen into sectors such as mining, steel manufacturing, and fertilizer production is a key strategy for phasing down coal, creating new domestic value chains, and enhancing global export competitiveness. Collaborations between the National Chamber of Mines, ZESA, and the MoEPD, as well as initiatives like Solarcentury's planned 60 MW of PV for mining operations, demonstrate the mining sector's recognition of renewable energy's importance for stable and reliable power. By ensuring that mineral exports, particularly critical minerals like lithium, comply with the EU's Carbon Border Adjustment Mechanism (CBAM), Zimbabwe can maximize the marketability of its significant lithium reserves (the largest in Africa and fifth globally) (Mkodzongi, 2024). This focus on local applications of clean hydrogen can be further strengthened through investments in skills development and prioritizing local procurement.[59]

Table 8: Infrastructure costs needed for Pathway 3

Infrastructure needed for Pathway 3	CAPEX requirements (Low/Medium/High)	OPEX requirements (Low/Medium/High)
Renewable energy generation system	**Medium CAPEX:** The total amount of money spent on renewable energy infrastructure (wind and PV) depends on the scale of the project and/or if the renewable energy is generated on-site. Local costs for land and infrastructure must also be considered, particularly infrastructure connecting the renewable energy source to the electrolyzer and the grid. (such as inverters and transformers).	**Low OPEX:** Although electricity costs make up a large portion of OPEX, the source of electricity (wind and PV) makes costs relatively low.
Electrolyzer system, balance of plant (BOP), compression and storage	**High CAPEX:** Large portion of the capital needed to realize a renewable hydrogen project; the cost of capital can depend on the technology and material required by electrolyzer type.	**Low OPEX:** Regular operating and maintenance of electrolyzer stacks, compression and storage systems, and balance-of-plant equipment.
Infrastructure and ancilliary systems	**High CAPEX:** Large capital required for buildings and civil works, electrical infrastructure, water supply and treatment, safety systems, pipelines, and other systems.	**Medium OPEX:** General maintenance for plant operation, i.e., water costs and labor supply.

While the long-term economic benefits are clear, the transition to large-scale renewable energy and hydrogen faces substantial barriers (see Table 9). The most immediate challenge is the high upfront financing requirement: the pathway demands substantial upfront CAPEX for solar and wind farms, grid upgrades, and hydrogen electrolyser capacity. These investments are often subject to the same high WACC that constrains Pathway 2. In parallel, the displacement of coal-fired generation leads to stranded asset risks for existing infrastructure and a short-term loss of revenue from coal exports and associated taxes.

In addition to these financial hurdles, the pathway faces significant non-financial barriers, notably Zimbabwe's complex land tenure system. Addressing land use considerations, conservation priorities, and the protection of livelihoods associated with arable land will be crucial for ensuring a just transition. Experiences in coal-producing areas, such as the reported displacement of 480 households in Hwange for power plant expansion,[60] underscore the vital need for careful planning and community engagement when shifting to renewables.

These costs and barriers are typically offset over the medium to long term by several core advantages: significantly lower marginal OPEX; reduced negative externalities, including lower healthcare costs due to improved air quality; and enhanced energy security through diversification and reliance on domestic, predictable resources.

Table 9: Overview of advantages and disadvantages associated with Pathway 1, 2 and 3

Pathway	Advantages	Disadvantages
Pathway 1: Retrofitting existing coal-fired power plants	Less disruptive pathway	• High CAPEX • High OPEX • Limited local content creation • Limited DFI/IFI financing tool for fossil projects
Pathway 2: Gasification	Less disruptive pathway	• High CAPEX • High OPEX • No existing production of fossil-based hydrogen for gasification • Limited local content creation • Limited DFI/IFI financing for fossil fuel projects
Pathway 3: Transitioning to renewable energy and hydrogen	• Low-emissions pathway • Low OPEX • Increased renewable energy capacity, in line with Zimbabwe's national policies • Applicable to different industrial sectors: mining, fertilizers, steel production • More competitive global exports	• More disruptive pathway • High CAPEX • Lack of policy and regulatory framework for the emergence of renewable hydrogen economy • Higher investments needed into the re-skilling of workforce

Applying hydrogen and its derivatives to Zimbabwe's existing industries and global markets

The transition to clean hydrogen offers significant opportunities for green industrialization, promoting deep economic diversification within Zimbabwe's domestic industrial sectors. Renewable hydrogen holds substantial potential for application in three primary industries: fertilizer production, steel manufacturing, and mining.

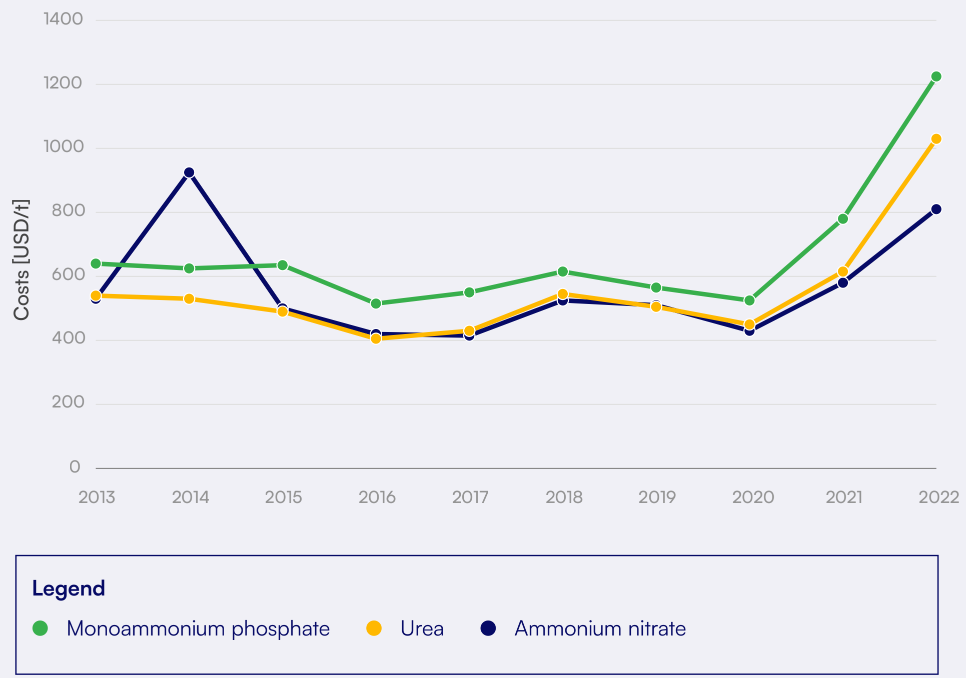
Fertilizer production: An economic imperative

Africa's status as a large net importer of fertilizers leaves the continent vulnerable to global market fluctuations and supply risks.[61] In Zimbabwe, the agricultural sector, though contributing 4.11% to annual GDP in 2023, is economically crucial: it employs 70% of the population and supplies 60% of raw materials for various industrial uses. Establishing resilient, regional fertilizer production is therefore a relevant and vital application for renewable hydrogen.

The country's dependence on imports highlights the issue. While Zimbabwe has an annual installed capacity for fertilizer production of two million metric tons (far exceeding the national demand of 350,000 tons[62]), only 25% of ammonium nitrate and 27% of phosphate fertilizers are produced locally. The remaining 75% of compounds and blends (calcium ammonium nitrate, urea, and diammonium phosphate) are imported, leading to a significant drain on foreign currency: USD 955 million was spent on fertilizer imports between 2016 and 2021. The production of renewable ammonia has the potential to significantly decrease this import reliance, particularly as it was successfully produced in Zimbabwe until 2015.

The cost factor strengthens the case for domestic renewable production. Figure 5 illustrates the specific costs of fertilizer imports in 2022, which peaked in the aftermath of the global energy crisis triggered by Russia's invasion of Ukraine, underscoring the volatility of import reliance.

Figure 5: Cost of fertilizer imports from 2013—2022, based on the UN's Food & Agriculture Organization (FAO) data



An assessment of renewable fertilizer production costs in Kenya, a country with comparable renewable energy potential, showed that domestic production from renewable ammonia could achieve costs between 436—595 EUR/ton for calcium ammonium nitrate (CAN) and 742—1,009 EUR/ton for urea.[63] Although Zimbabwe's elevated risk profile suggests these costs may be somewhat higher, the estimates indicate a narrowing price gap between renewable and conventional fertilizer products in the domestic market.

This transition also has a tangible operational starting point: the country already operates a large-scale ammonium nitrate fertilizer plant in Kwekwe, owned by Sable Chemicals, with a capacity of 240,000 t/a. Sable Chemicals announced plans for renewable ammonia production in January 2019. Achieving cost-competitive renewable ammonia production at this site would require approximately 50,000 tons of ammonia per annum, which in turn would demand an electrolyzer capacity of 100 MW.

The country's vast renewable energy potential could support the operation of approximately 60 GW of installed electric electrolyzer capacity, equivalent to around

30

large-scale hydrogen projects.

Zimbabwe's resource base could support a transformational shift. The country's vast renewable energy potential—estimated at 155 GW of solar and 2.2 GW of wind capacity in areas not affected by high water stress—could support the operation of approximately 60 GW of installed electric electrolyzer capacity. This theoretical scale is equivalent to around 30 large-scale hydrogen projects, each comparable in size to NEOM, the world's largest clean hydrogen project in Saudi Arabia. While this potential is theoretical and subject to real-world constraints, it underscores the significant development opportunity that renewable hydrogen presents for domestic fertilizer production at a scale many times larger than current national needs.

IMAGE CREDIT: ADOBE STOCK / YARM_SASHA

Steel manufacturing

Crude steel production transforms raw materials into steel primarily through two methods: the blast furnace-basic oxygen furnace (BF-BOF) route and the electric arc furnace (EAF) route. Today, 70% of global steel production uses the BF-BOF route, while only 30% employs EAF methods.[64]

Steel imports place a significant economic burden on the African continent. In Sub-Saharan Africa, countries are planning to reduce steel imports in line with the African Union's Agenda 2063.[65] This development framework aims to promote low-emissions arc furnace steelmaking at the domestic level to position Africa as a key contributor to the global economy. Since the closure of Ziscosteel in 2008, steel imports into Zimbabwe have cost over USD one billion annually.

In June 2024, Dinson Iron and Steel Company, a subsidiary of China's Tsingshan Holding Group, began steel production at the Mvuma Steel Plant. This facility is expected to increase national steel production, producing 0.6 million tons annually in its first phase and currently operating at 60% capacity. Zimbabwe aims to become Africa's largest steel producer, with this USD 1.5 billion plant projected to create 10,000 new jobs. The Engineering, Iron and Steel Association of Zimbabwe (EISAZ) estimates that reviving Zimbabwe's steel industry could generate USD six billion in exports each year.[66]

The accelerated production of steel in Zimbabwe, centered on the new Mvuma Steel Plant, presents a unique opportunity to accelerate the transition toward renewable hydrogen. Globally, current efforts to decarbonize the steel industry promote carbon capture, utilization, and storage (CCUS) as a near-term, interim solution for mitigating emissions from existing processes and sustaining steel exports. Nevertheless, the high capital expenditure (CAPEX) required to retrofit steel plants with CCUS technology makes it an unlikely option for the new Mvuma facility.

Still, the long-term goal for the sector should be the production of renewable steel using renewable hydrogen. Moving to domestically produced renewable hydrogen—rather than relying on imported natural gas or declining coal reserves—would make the supply chain inherently more resilient and shield the industry from volatile global fossil fuel market fluctuations. Achieving this goal after 2030 will require the continued evolution and scaling of direct reduction technologies, coupled with significant reductions in the CAPEX required to construct new renewable steel projects.[67]

IMAGE CREDIT: ADOBE STOCK / BADAN

Mining sector

Zimbabwe has a vast mining industry, with large-scale production of gold, Platinum Group Metals (PGMs), diamonds, nickel, chrome, coal, lithium, and black granite.[68] The mining sector contributes 12% of the country's GDP and accounts for 60% of total exports. In recent years, however, production across the sector has been significantly affected by recurrent power outages. Even minor grid outages can lead to hours of production and processing delays, reducing financial returns.

In 2024, ferrochrome production was most affected by power outages, but with increasing global lithium demand and a 224% increase in the country's lithium output, large mines connected to the national grid now require enhanced power security.[69] Currently, Zimbabwe's largest mine, Delta Gold Zimbabwe, supplements grid electricity with a 12-MW diesel generator to ensure continuity of supply.[70]

One potential near-term application for renewable hydrogen in the mining sector is providing 24/7 energy supply for mining operations. Currently, mining and manufacturing companies exporting to European markets are reviewing their carbon footprint and developing their own solar power plants in an effort to decrease carbon emissions. As previously mentioned, the Chamber of Mines is engaged in ongoing discussions with Solarcentury to diversify power supply to mining operations across the country. Additionally, HDF Energy's proposed hydrogen project in the Manicaland Province was planned to supply electricity from stored hydrogen to the national grid until its cancellation in October 2025.

In the long term, non-stationary uses in mining represent a key future demand sector for clean hydrogen. For example, hydrogen-based solutions could power conveyor belts for ore transportation or catenaries for electric mining vehicles. In 2021, Anglo American and ENGIE began testing a prototype mining haul truck in South Africa, supported by 35 MW of on-site clean hydrogen production. However, the widespread use of clean hydrogen in mining activities is unlikely before 2030 due to limited infrastructure and technological maturity.[71]

IMAGE CREDIT: ADOBE STOCK / MICHAEL EVANS

First movers: Sable Chemicals and Hydrogène de la France Renewstable

Sable Chemicals

Sable Chemicals, located in Kwekwe, is Zimbabwe's sole manufacturer of ammonium nitrate (AN) fertilizer and has been operational since the mid-1960s. The facility has a unique history, having commissioned its own pioneering alkaline water electrolysis plant in 1972 to produce carbon-free ammonia on-site[72]—a process that significantly reduced the country's import quota. However, this initial electrolysis plant was decommissioned in 2015 due to escalating electricity prices and a severe shortage of renewable power supply, exacerbated by drought conditions that affected hydroelectric generation from the Kariba Dam.[73] Following this, the company relied on imported fossil-based ammonia from South Africa.[74]

Sable Chemicals, located in Kwekwe, is Zimbabwe's sole manufacturer of ammonium nitrate fertilizer. It commissioned its own pioneering alkaline water electrolysis plant in 1972 to produce carbon-free ammonia.

In the immediate term, the company is focused on restoring capacity to meet urgent domestic demand. To achieve this, in 2021 Sable secured a USD 11 million investment from the African Export-Import Bank (Afreximbank) to retool its remaining infrastructure, aiming to improve efficiency and increase AN production to 200,000 tons by late 2023. Despite this short-term reliance on imported fossil-based ammonia, Sable is actively pursuing a return to its renewable hydrogen roots as part of Zimbabwe's national decarbonization strategy, following a dual strategy of future domestic production and regional green ammonia imports.

Figure 6: Announced hydrogen projects in Zimbabwe

The proposed renewable ammonia project at the Sable Chemicals site (see Figure 7) will be developed by the government's Climate Change Management Department with support from the Green Climate Fund.[75] A planned 400 MW solar park, developed by Sable Chemicals and Sable's sister company, Katanga Solar Energy, will power the electrolyzer.[76] The Zimbabwe Energy Regulatory Authority (ZERA) has already issued a power generation license for the construction of a 50 MW first-phase solar park. This solar park aims to meet industrial energy needs and improve associated electrical infrastructure in Kwekwe.[77]

This plant presents a strong opportunity for renewable ammonia production due to its existing infrastructure, which includes an air separation unit for nitrogen supply and an ammonia synthesis loop for the Haber—Bosch process.[78] Figure 7 illustrates the current and planned infrastructure at the Sable Chemicals Site, which currently produces fossil-based ammonium nitrate.

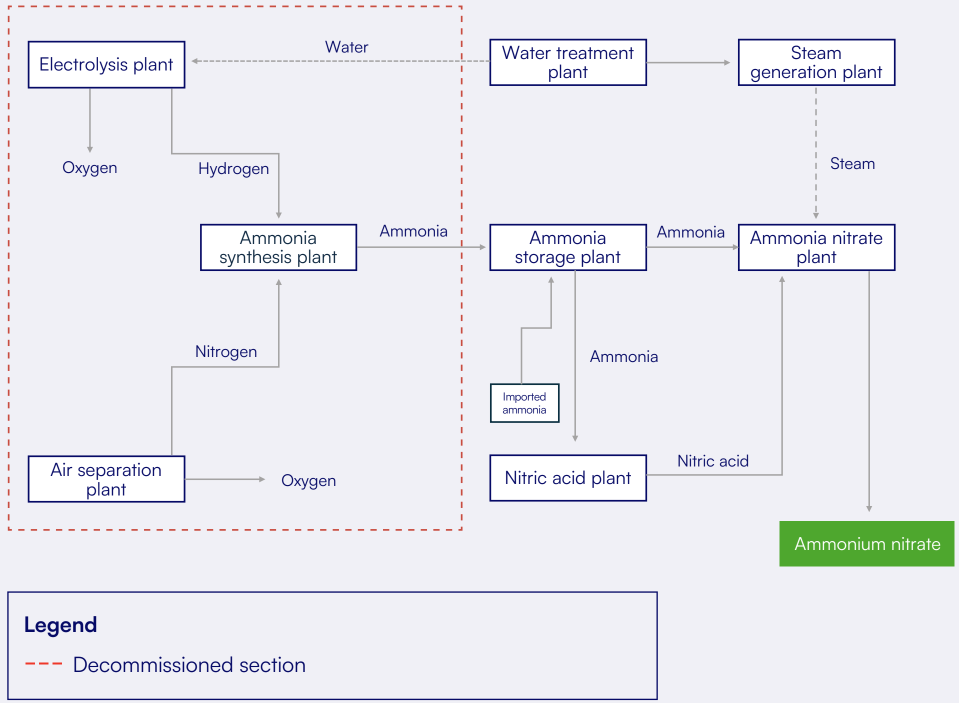
To ensure a stable long-term supply of clean feedstock, Sable Chemicals has signed a nonbinding offtake agreement with the Daures Green Hydrogen Consortium in Namibia to import up to

40,000 tons

of renewable ammonia.

To ensure a stable long-term supply of clean feedstock, Sable Chemicals has signed a non-binding offtake agreement with the Daures Green Hydrogen Consortium in Namibia to import up to 40,000 tons of renewable ammonia. This demonstrates a key commitment to securing clean feedstock from across the region, while balancing the risks associated with developing its own large-scale renewable power infrastructure.

Figure 7: Existing and planned infrastructure at Sable Chemicals



Hydrogène de la France (HDF) Energy — MiddleSabi Renewstable

The development of the Middle Sabi Renewstable® project, intended to be Zimbabwe's first high-powered green hydrogen facility, began with the signing of a Memorandum of Understanding (MoU) between Hydrogène de France (HDF) Energy and the Zimbabwe Electricity Transmission and Distribution Company (ZETDC) in March 2023.[79] The project was planned for the Chipangayi Renewable Energy Technology Park (RETPark).

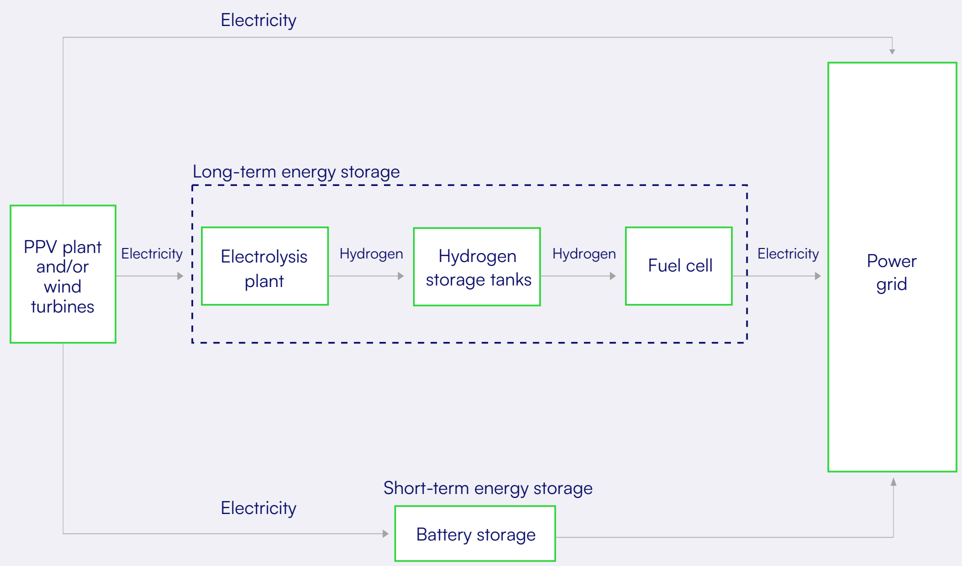
The core of the project (see Figure 8) would have utilized HDF's Renewstable® technology, which integrates photovoltaic (PV) solar with an on-site electrolyzer and hydrogen fuel cells to deliver firm, dispatchable, 24/7 green electricity.[80] The expected 178 GWh of annual production would cover an estimated 6.25% of Zimbabwe's energy deficit and expand energy access to an additional 220,000 inhabitants.[81,82,83] The project was strategically located to create jobs and contribute to GDP growth in Manicaland Province, one of Zimbabwe's poorest provinces.[84]

While HDF Energy had initially expected to reach financial close and commence construction in 2024/2025, there was no public announcement confirming that this critical milestone had been achieved. The project was ultimately terminated when, in October 2025, HDF withdrew from its engagements in Zimbabwe due to fundamental project bankability issues.

The primary constraint remains the country's significant macroeconomic instability. Market challenges, such as unstable fiscal policy and foreign exchange rationing, have led to periods of recession and hyperinflation, severely limiting Zimbabwe's overall economic growth. Additionally, the country's high national debt and external debt arrears reduce its access to capital from strategic stakeholders, such as development finance institutions, thereby increasing its country risk premium. These persistent challenges constrain private sector investment, directly slowing the adoption of renewable hydrogen projects. To unlock private investment, Zimbabwe must leverage its comparative advantages to seize existing and future opportunities, despite limited fiscal space and weak foreign investment inflows.

To unlock private investment, Zimbabwe must leverage its comparative advantages to seize existing and future opportunities, despite limited fiscal space and weak foreign investment inflows.

Figure 8: Planned infrastructure for HDF MiddleSabi Renewstable



Front runners on the continent: Lessons for Zimbabwe from South Africa

IMAGE CREDIT: ADOBE STOCK / OMID

Both South Africa and Zimbabwe rely heavily on coal for domestic electricity generation, accounting for 79% and 31% of their power supply respectively. South Africa has emerged as one of Africa's leading countries in renewable hydrogen development, offering valuable insights for Zimbabwe's energy transition.

South Africa has substantial renewable energy potential and sufficient water resources to support electrolysis (see Table 9). As discussed earlier, it also benefits from strong domestic anchor demand across the fertilizer, crude steel, and mining sectors, creating robust opportunities for local hydrogen use and value creation. Moreover, its access to the sea, and existing terminals for methanol and ammonia, positions South Africa to become a significant exporter of renewable hydrogen.

As a coal-producing **front runner** in hydrogen development, South Africa's commitment to establishing a clean hydrogen economy presents a potential pathway for Zimbabwe. Developing a well-designed national hydrogen strategy is crucial, as it anchors the transition away from coal and demonstrates national commitment to fostering a hydrogen economy. South Africa's Department of Science and Innovation (DSI) published the *Hydrogen Society Roadmap for South Africa*, which sets out specific targets over a two-decade period (2021—2040). Its 2025—2030 targets include deploying 10 GW of electrolysis capacity in the Northern Cape region, focused primarily on the transport and power sectors.[85]

Beyond this dedicated roadmap, South Africa has leveraged existing industrial and climate policies, such as the *Green Transport Strategy for South Africa*, the *Integrated Resource Plan*, and the *2030 National Development Plan*, to support its hydrogen ambitions.[86] By similarly aligning and drawing on existing Zimbabwean policy frameworks, such as *Vision 2030*, the National Renewable Energy Policy (NREP), and the *Zimbabwe Economic Update*, Zimbabwe can establish a coherent national commitment to clean hydrogen. Such policy alignment is critical for encouraging investment and securing industry buy-in for the transition.

Furthermore, strong support for both announced and planned clean hydrogen projects has been central to South Africa's emergence as a **front-runner**. This momentum is reinforced by effective public—private partnerships. For instance, the DSI, in collaboration with private sector companies (Anglo American, Bambili Energy, Sonnedix, and ENGIE), is actively exploring opportunities to transform the broader region around Johannesburg, Mogalakwena, and Durban into a "Hydrogen Valley."

A critical challenge for Zimbabwe is attracting private investment and fostering public—private partnerships to fund the infrastructure required for clean hydrogen production. In South Africa, major private sector players, such as the chemicals giant Sasol and steel producer ArcelorMittal, are actively involved. In 2024, Sasol secured its first power allocation under a Power Procurement Plan for the Msenge Emoyeni Wind Farm in the Eastern Cape, as part of its broader strategy to ensure power supply for its planned renewable hydrogen projects. The company has secured 757 MW of power through Power Purchase Agreements (PPAs) and aims to procure 1,200 MW by 2030.[87]

A critical challenge for Zimbabwe is attracting private investment and fostering public—private partnerships to fund the infrastructure required for clean hydrogen production.

The role of PPAs in Zimbabwe should not be underestimated in attracting and mobilizing private sector investment. PPAs provide long-term revenue guarantees for investors by securing the sale of renewable energy at a fixed price, thereby de-risking projects and enhancing their overall bankability. They also serve as the primary mechanism for integrating Independent Power Producers (IPPs) into the national grid—an essential objective for the Zimbabwe's energy sector under the country's *Vision 2030*.

Table 10: Country clustering dimension results for South Africa

Rating	Dimensions	Results
High rating	H_2O and RE potential	PV: 18,632 km² Wind: 4,622 km² Hydropower: 21 GW Geothermal: 0 GW
High rating	National hydrogen commitment	Published hydrogen strategy 11 projects (1 operational, 1 under construction, 5 in feasibility study phase, 4 in concept phase)
High rating	Domestic anchor demand	Fertilizer production: 168,000 t/a Crude steel production: 8,100,000 t/a Mineral production: 67,164,390 t/a
High rating	Country risk	Low risk classification: 4/7
High rating	Export infrastructure	No liquefied natural gas (LNG) terminal, 1 ammonia terminal, 4 methanol terminals

Legend
High rating | Medium rating | Low rating

Transparent and stable PPAs further incentivize Development Finance Institutions (DFIs) to support early-stage projects. Ultimately, mobilizing investment in the critical infrastructure needed to scale up the hydrogen economy will depend on both strategic partnerships and the establishment of frameworks that effectively de-risk Zimbabwe's investment landscape.

Zimbabwe can also leverage existing regional partnerships in Southern Africa to accelerate hydrogen development both domestically and across the wider region. The Southern African Development Community (SADC) provides an example of a regional partnership that promotes industrialization. One of SADC's core priorities is the creation of regional value chains and increased participation in global markets. Its focus on industrialization aims to facilitate major economic and technological transformation at both national and regional scales. The Regional Indicative Strategic Development Plan (RISDP) further highlights the importance of sustainably developing green and blue economies, which have the potential to generate revenue and create jobs across the region.[88]

Zimbabwe can also leverage existing regional partnerships in Southern Africa to accelerate hydrogen development both domestically and across the wider region.

SADC comprises 16 member states. Six of these are identified in the H2Global Foundation's country clustering analysis: two **front runners** (South Africa and Namibia), three **momentum builders** (Angola, Mozambique, and Zimbabwe), and one **strong foundation** country (Tanzania). By building upon the RISDP, countries with renewable hydrogen production potential can collaborate to mobilize a regional hydrogen economy, thereby strengthening both local and regional value chains.

IMAGE CREDIT: ADOBE STOCK / SERHII

Additionally, for the transition away from coal, Zimbabwe can consider leveraging the emergence of Just Energy Transition Partnerships (JETPs). These partnerships provide developing countries with financial and technical support to decarbonize and phase out coal from their electricity sectors. South Africa's Just Energy Transition Partnership (JET-P), backed by USD 8.5 billion in funding, specifically aims to support its coal phase-out.[89] As part of this JET-P, the German development bank KfW signed a EUR 23 million contract with South Africa's state-owned Industrial Development Corporation to finance reference projects for the large-scale production of renewable hydrogen and its derivatives.[90]

The subsequent JET-Investment Plan outlines how to support coal-dependent regions, coal mine workers, women, and youth. The JET-IP will be implemented in two phases that address specific investment priorities. Phase 1 focuses on demonstration projects in communities where mines are scheduled to close, including workforce re-skilling, mobility schemes, and related social infrastructure. Phase 2 will involve major infrastructure efforts related to coal power plant closure, decommissioning, and repurposing, as well as large-scale support schemes for indirect workers—often women and youth. Phase 2 will also target the development of small, medium, and microenterprises (SMMEs), as well as increasing stakeholder engagement to evaluate how different interventions impact a just transition. For the Mpumalanga region, the JET-IP dedicated ZAR 60.4 million to nine investment priorities, including the repurposing of coal plants, the reallocation of coal mining land, and capacity-building initiatives for local communities.

Following South Africa's lead in launching the first JETP in 2021, countries such as Indonesia, Vietnam, and Senegal have since developed their own partnerships with international partner groups.[91]

To establish itself as a continental leader in clean hydrogen production, Zimbabwe must address existing policy gaps and significantly strengthen collaboration between the public and private sectors, demonstrating substantial commitment to developing the sector.

World Bank — Managing Mine Closure: A Just Transition for All Framework[92]

The narrow economic base of coal mining regions requires careful mitigation of coal mine closure impacts where mono-industry coal towns and regions face multiple impacts such as loss of employment and other dependent sectors.

The World Bank's framework for achieving a Just Transition for All in coal mine closure is built around three mutually reinforcing pillars. First, policies and strategy development ensure clear direction, adequate budgets, and strong coordination across government agencies. Second, people and communities are supported through temporary income assistance, active labor market programs, and community-focused measures to reduce social and economic shocks. Third, land and environmental remediation addresses physical closure, reclamation, and long-term monitoring. Across all pillars, early planning, continuous stakeholder engagement, and comprehensive social protection are essential for minimizing disruption and fostering equitable outcomes.

IMAGE CREDIT: ADOBE STOCK / BASHI

Recommendations

Coal remains a crucial element of Zimbabwe's energy system. It currently accounts for 23% of the country's energy supply, making it the third most important source after biofuels and waste (46%) and oil (24%). In electricity generation, coal-fired power plants contribute 31%, while hydroelectric power from the aging Kariba Dam covers 68%.

In the context of the global transition toward greenhouse gas-neutral energy supply, Zimbabwe must carefully consider the long-term implications of its continued reliance on coal. A key aspect is the changing landscape of international finance: capital is increasingly flowing into clean energy investments, while support for fossil fuel-based power generation is diminishing. As a result, Zimbabwe may face growing challenges in securing financing for the refurbishment of existing coal-fired power plants or the development of new ones. Yet, it is important to recognize that both current and historical greenhouse gas emissions from Zimbabwe's coal sector are negligible in global comparison. The country's foremost priorities remain increasing electricity access, advancing socioeconomic development, and improving the quality of life for its citizens.

While coal provides a stable and secure energy supply, an ill-designed phase-down could pose serious risks to Zimbabwe's future socioeconomic progress. Therefore, any transition away from coal should be meticulously planned as part of a just transition—one that supports inclusive development, energy security, and social equity.

The report presents viable pathways for transitioning Zimbabwe's coal industry. A key enabling element in these pathways is the production of clean hydrogen, either through coal gasification coupled with carbon capture, utilization, and storage (CCUS) or through renewable energy-based electrolysis. To stimulate the development of clean hydrogen projects in Zimbabwe following a just transition approach, the following recommendations are proposed for policymakers.

IMAGE CREDIT: ADOBE STOCK / DAVID

Policy and strategy

Establish a national hydrogen strategy

Develop a comprehensive hydrogen strategy by the mid-2030s to provide clarity and direction for stakeholders, project developers, and investors. The strategy should outline national goals, key use cases, regulatory frameworks, and infrastructure priorities for clean hydrogen.

Establish a national strategy for the transition away from coal

Develop a comprehensive national strategy to guide the transition from coal toward increased renewable energy integration in the energy mix. This policy should provide a roadmap from the mid- 2030s to 2050 and solidify the country's commitment to cleaner energy sources to improve energy access and support the broader energy transition.

Align the political agenda with global net-zero ambitions

In the absence of a dedicated clean hydrogen strategy, hydrogen should be integrated into new and updated climate and energy policies, such as the Nationally Determined Contribution (NDC). This alignment will improve Zimbabwe's appeal to international investors in renewable energy and clean hydrogen by explicitly supporting the global shift toward net-zero emissions.

Project development and investment

Support early-stage clean hydrogen projects

Continue targeted support for initial clean hydrogen projects to build technical and institutional experience and reduce project risk.

Strengthen local demand and offtake opportunities

Enhance domestic offtake potential by fostering partnerships and incentives in key sectors such as fertilizers, steel manufacturing, and mining, which offer high potential for clean hydrogen applications.

Mobilize existing private sector players

The Government of Zimbabwe, along with early-stage hydrogen project developers, can engage existing private sector stakeholders in the domestic energy sector, such as Anglo American, TotalEnergies, and RioZim. Globally, companies in hydrocarbon and related industries have leveraged synergies between renewable hydrogen and their core business. Involving such private sector players can help develop the hydrogen value chain.

Create a stable and investor-friendly environment

The Government of Zimbabwe should publish clear regulatory and legal frameworks for clean hydrogen production, covering key aspects such as environmental regulations, safety standards, transportation rules, and land-use planning. This will help promote policy consistency, transparency, and macroeconomic stability, lowering perceived investment risks and attracting long-term foreign capital into clean energy and hydrogen-related sectors.

Mobilize financial instruments and de-risking mechanisms

Develop tailored financial tools and risk-sharing mechanisms in collaboration with international public and private partners to improve project bankability and accelerate market entry for clean hydrogen.

Infrastructure and workforce

Upgrade and repurpose electricity grid infrastructure

The Government of Zimbabwe should invest in expanding renewable energy capacity and modernizing the national electricity grid in line with the 2030 National Renewable Energy Policy (NREP) target. Opportunities in other sectors with high energy demand also create space for private and public sector engagement in the development of renewable energy technologies.

Invest in skills development and workforce training

Implement targeted capacity-building programs to prepare the local workforce for employment opportunities across the clean hydrogen value chain, ensuring that the energy transition delivers tangible social and economic benefits.

Regional cooperation

Mobilize existing regional cooperation

Leverage existing partnerships in Southern Africa, such as those within the Southern African Development Community (SADC), to enhance local value chains and promote industrialization. Strengthening these collaborations will help promote intraregional trade and development, foster sustainable local growth, and enable participation in emerging global industries.

Endnotes

1 Statistical Review of World Energy — 74th Edition (energy institute, 2025), https://www.energyinst.org/statistical-review.

2 International Energy Agency, *Coal 2024: Analysis and Forecast to 2027* (IEA, 2024).

3 International Energy Agency, *Coal 2024: Analysis and Forecast to 2027*.

4 International Energy Agency, *Coal 2024: Analysis and Forecast to 2027*.

5 NewClimate Institute and Institute for Climate Economics, *Financing Coal Phase-Out: Public Development Banks' Role in the Early Retirement of Coal Plants* (New Climate Institute, 2024).

6 AfDB, *Country Focus Report 2023 Zimbabwe: Mobilizing Private Sector Financing for Climate and Green Growth* (African Development Bank Group, 2023).

7 Swedish Trade & Invest Council, *Unlocking Opportunities in Zimbabwe's Mining Sector* (Swedish Trade & Invest Council, 2025).

8 International Energy Agency, 'Zimbabwe', IEA, n.d., https://www.iea.org/countries/zimbabwe.

9 Farai Shawn Matiashe, 'Dry Zimbabwe Hit by Blackouts but Renewables Still Underfunded', Context, January 2025 https://www.context.news/climate-risks/dry-zimbabwe-hit-by-blackouts-but-renewables-still-underfunded.

10 Ikeoluwa Ogungbange, 'Zimbabwe Shuts Down Aging Coal Plants Embraces Green Future', The Zimbabwe Advocate, 26 February 2024, https://zimadvocate.com/2024/02/26/zimbabwe-shuts-down-aging-coal-plants-embraces-green-future/.

11 H2Global Stiftung, *Opportunities for Renewable Hydrogen Development in Africa: Insights from an Innovative Country Clustering Analysis* (H2Global Stiftung, 2025).

12 Joseph Akpan, Hagreaves Kumba, and Oludolapo Olanrewaju, *Sustainable Energies in Zimbabwe — Status, Challenges and Solutions*, 2024.

13 International Energy Agency, 'Zimbabwe'.

14 Akpan, Kumba, and Olanrewaju, *Sustainable Energies in Zimbabwe — Status, Challenges and Solutions*.

15 Zambezi River Authority, 'Kariba HES Technical Data', Zambezi River Authority, n.d., https://www.zambezira.org/hydro-electric-schemes/kariba-hes/kariba-hes-technical-data.

16 International Energy Agency, 'Zimbabwe'.

17 International Energy Agency, 'Zimbabwe'.

18 Akpan, Kumba, and Olanrewaju, *Sustainable Energies in Zimbabwe — Status, Challenges and Solutions*.

19 Ogungbange, 'Zimbabwe Shuts Down Aging Coal Plants Embraces Green Future'.

20 International Trade Administration, 'Zimbabwe Country Commercial Guide', International Trade Administration, 29 February 2024, https://www.trade.gov/country-commercial-guides/zimbabwe-energy.

21 Akpan, Kumba, and Olanrewaju, *Sustainable Energies in Zimbabwe — Status, Challenges and Solutions*.

22 International Energy Agency, *Coal 2024: Analysis and Forecast to 2027*.

23 Akpan, Kumba, and Olanrewaju, *Sustainable Energies in Zimbabwe — Status, Challenges and Solutions*.

24 International Energy Agency, 'Zimbabwe'.

25 World Bank Group, 'CCDR Coal and Cooking', 2024.

26 Global Energy Monitor, 'Africa Energy Tracker', April 2025, https://globalenergymonitor.org/projects/africa-energy-tracker/tracker-map/.

27 Theresa Moyo, 'Green Economy/Growth Policies and Their Implementation in the Context of the Renewable Energy Sector: The Case of Mozambique, South Africa and Zimbabwe', *International Journal of African Renaissance Studies — Multi-, Inter- and Transdisciplinarity*, 9.2 (2014), pp. 39—60, doi:https://doi.org/10.1080/18186874.2014.987954.

28 Moyo, 'Green Economy/Growth Policies and Their Implementation in the Context of the Renewable Energy Sector: The Case of Mozambique, South Africa and Zimbabwe'.

29 Ministry of Energy and Power Development, 'National Energy Policy', Republic of Zimbabwe, Ministry of Energy and Power Development, 2012.

30 Republic of Zimbabwe, 'Vision 2030', September 2018.

31 Republic of Zimbabwe, 'Vision 2030'.

32 Republic of Zimbabwe, 'Vision 2030'.

33 Republic of Zimbabwe, Ministry of Energy and Power Development, 'National Renewable Energy Policy', Republic of Zimbabwe, Ministry of Energy and Power Development, August 2019.

34 Akpan, Kumba, and Olanrewaju, *Sustainable Energies in Zimbabwe — Status, Challenges and Solutions*.

35 Akpan, Kumba, and Olanrewaju, *Sustainable Energies in Zimbabwe — Status, Challenges and Solutions*.

36 Akpan, Kumba, and Olanrewaju, *Sustainable Energies in Zimbabwe — Status, Challenges and Solutions*.

37 Investment Policy Monitor, 'Mauritania Adopts Dedicated Framework to Attract Investment in Green Hydrogen', UN Trade & Development: Investment Policy Hub, 8 October 2024, https://investmentpolicy.unctad.org/investment-policy-monitor/measures/4861/mauritania-adopts-dedicated-framework-to-attract-investment-in-green-hydrogen#:~:text=On%208%20October%202024%2C%20Mauritania,focus%20on%20green%20hydrogen%20development.

38 Green Hydrogen Organisation, 'Egypt', Green Hydrogen Organisation, n.d., https://gh2.org/countries/egypt.

39 Ministry of Energy and Petroleum Kenya, 'Green Hydrogen and Strategy Roadmap for Kenya', September 2023.

40 Swetha Ravikumar Bhagwat and Maria Olczak, *Green Hydrogen: Bridging the Energy Transition in Africa and Europe* (2020), https://cadmus.eui.eu/handle/1814/68677.

41 World Bank Group and others, *Scaling Hydrogen Financing for Development* (2024), doi:10.1787/0287b22e-en.

42 International Energy Agency, *Africa Energy Outlook 2022* (International Energy Agency, 2023).

43 Corporate Value Associates, *Africa's Extraordinary Green Hydrogen Potential* (Corporate Value Associates; European Investment Bank; African Union; International Solar Alliance, 2022).

44 Benedikt Häckner and others, 'GIS-Based Evaluation of Suitability and Implementation Prospects for Solar PV Energy in Africa', 2024, pp. 1—7, doi:10.1109/PowerAfrica61624.2024.10759431; H2Global Stiftung, Fraunhofer IEE, and Strathmore University, *Renewable Ammonia: Kenya's Business Case* (2025), https://www.h2-global.org/library/renewable-ammonia-kenyas-business-case [accessed 6 May 2025].

45 Hoes O.A.C., 'Global Potential Hydropower Locations', with TU Delft, Faculty Of Civil Engineering And Geosciences, Department Of Water Management, version 1, TU-Delft, 16 October 2014, shapefile; adf raster data media types: application/octet-stream, application/zip, text/plain, doi:10.4121/UUID:99B42E30-5A69-4A53-8E77-C954F11DBC76; IRENA, *Renewable Capacity Statistics 2024* (2024), https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2024/Mar/IRENA_RE_Capacity_Statistics_2024.pdf [accessed 20 November 2024].

46 HDF Energy, 'Middle Sabi Renewstable', n.d., https://www.middlesabi-renewstable.com/, [accessed 14 March 2025].

47 AfricaFertilizer, *2024 Register of Fertilizer Manufacturing and Processing Facilities in Sub-Saharan Africa* (2024), https://api.hub.ifdc.org/server/api/core/bitstreams/91b410bd-6c1c-4341-84d8-1bfc0ef4e33f/content, [accessed 20 November 2024].

48 OECD, *Latest Developments in Steelmaking Capacity and Outlook until 2026* (2024), https://one.oecd.org/document/DSTI/SC(2024)3/FINAL/en/pdf [accessed 20 November 2024].

49 C. Reichl and M. Schatz, *World Mining Data 2023*, Volume 38 (Federal Ministry Republic of Austria Finance; International Organizing Comittee for the World Mining Congresses, 2023), https://world-mining-data.info/wmd/downloads/PDF/WMD2023.pdf.

50 OECD, *Country Risk Classifications of the Participants to the Arrangement on Officially Supported Export Credits* (2024), https://www.oecd.org/content/dam/oecd/en/topics/policy-sub-issues/country-risk-classification/cre-crc-current-english.pdf [accessed 20 November 2024].

51 United Nations Global Compact, *Introduction to Just Transition: A Business Brief* (United Nations Global Compact, 2022).

52 Xue Gong and Corbus Van Standen, *China-Driven Coal Power: Lessons from Zimbabwe and Indonesia* (South African Institute of International Affairs, 2021).

53 Elizabeth Bulmer Ruppert and others, *Global Perspective on Coal Jobs and Managing Labor Transition out of Coal* (World Bank, 2021).

54 Kuntala Lahiri-Dutt, *Just Transition for All: A Feminist Approach for the Coal Sector* (World Bank, 2022).

55 The potential costs of a 50 km long, 12-inch pipeline

56 IRENA, *Renewable Capacity Statistics 2024*.

57 Matiashe, 'Dry Zimbabwe Hit by Blackouts but Renewables Still Underfunded'.

58 HDF Energy, 'HDF MiddleSabi Renewstable', The Technology: Green Power Available 24/7, 2023, https://www.middlesabi-renewstable.com/technology.

59 New Climate Institute, *The Role of Green Hydrogen in a Just, Paris-Compatible Transition* (NewClimate Institute, 2023).

60 In Hwange, it was reported that plans to expand the Hwange Colliery power plant would displace 480 households in the village of Iguala for a 310km transmission line.

61 National Competitiveness Comission, *Fertilizer Value Chain Report* (National Competitiveness Institution, 2022).

62 National Competitiveness Comission, *Fertilizer Value Chain Report*.

63 H2Global Stiftung, Fraunhofer IEE, and Strathmore University, *Renewable Ammonia: Kenya's Business Case*.

64 'Raw Materials', World Steel Association, n.d., https://worldsteel.org/other-topics/raw-materials/.

ENDNOTES

65 IRENA, *Renewable Energy Market Analysis: Africa and Its Region* (Internatonal Renewable Energy Agency, African Development Bank, 2022).

66 Oliver Kazunga, 'Engineering, Iron and Steel Sector Eyes US$6bn by 2026', News, The Herald, 8 November 2023, https://www.herald.co.zw/engineering-iron-and-steel-sector-eyes-us6bn-by-2026/.

67 World Bank Group and others, *Scaling Hydrogen Financing for Development*.

68 Chamber of Mines of Zimbabwe, 'Chamber of Mines of Zimbabwe', Chamber of Mines of Zimbabwe, n.d., https://www.chamines.co.zw/home/overview.

69 Chamber of Mines of Zimbabwe, *Quarterly Members Brief* (Chamber of Mines of Zimbabwe, 2024).

70 Himoinsa, 'CASE STUDY | 12 MW OF POWER AT ONE OF ZIMBABWE'S LARGEST MINES', Himoinsa, n.d., https://www.himoinsa.com/12-mw-zimbabwe/case-studies/news-list/news/136/.

71 IEA, *Hydrogen in Latin America. From near-Term Opportunities to Large-Scale Deployment* (IEA, 2021), https://iea.blob.core.windows.net/assets/65d4d887-c04d-4a1b-8d4c-2bec908a1737/IEA_HydrogeninLatinAmerica_Fullreport.pdf.

72 Tatanga Energy, 'Sable Chemicals Green Ammonia Project', Tatanga Energy, n.d., https://tatangaenergy.com/green-ammonia/.

73 Ammonia Energy Association, 'Ammonia Project Features: Renewable Ammonia Projects in Sub-Saharan Africa', 23 November 2022, https://ammoniaenergy.org/wp-content/uploads/2022/11/Project-Features-November-2022-speaker-slides.pdf, [accessed 14 March 2025].

74 Kevin Rouwenhorst, 'Renewable Ammonia & Fertilizers in Sub-Saharan Africa', Ammonia Energy Association, 6 December 2022, https://ammoniaenergy.org/articles/renewable-ammonia-fertilizers-in-sub-saharan-africa/.

75 Wallace Mawire, 'Zimbabwe's Proposes Green Hydrogen For Increased Fertilizer Production', Pan African Visions, 2024, https://panafricanvisions.com/2024/01/zimbabwes-proposes-green-hydrogen-for-increased-fertilizer-production/.

76 Tatanga Energy, 'Sable Chemicals, Tatanga Energy Plan 400MW Solar Park for Kwekwe', Tantanga Energy, 19 September 2022, https://tatangaenergy.com/sable-chemicals-tatanga-energy-plan-400mw-solar-park-for-kwekwe/.

77 Tatanga Energy, 'Sable Chemicals, Tatanga Energy Plan 400MW Solar Park for Kwekwe'.

78 Ammonia Energy Association, 'Ammonia Project Features: Renewable Ammonia Projects in Sub-Saharan Africa'.

79 HDF Energy, 'Middle Sabi Renewstable'.

80 'Chipangayi Renewable Energy Technology Park (RETPark)', EMC Continental, n.d. https://emccontinental.com/portfolio/chipangayi-renewable-energy-technology-park-retpark/#:~:text=The%20RETPark%20is%20conceptualized%20as,wind%2C%20and%20hybrid%20power%20plants.

81 Sandile Mtetwa-Omuhe, *HDF's Green Hydrogen Plans in Zimbabwe* (Intergrated Africa Power, 2023).

82 HDF Energy, 'HDF MiddleSabi Renewstable'.

83 HDF Energy, 'Middle Sabi Renewstable'.

84 HDF Energy, 'Middle Sabi Renewstable'.

85 Department of Science and Innovation, *Hydrogen Society Roadmap For South Africa 2021* (2021), https://www.dst.gov.za/index.php/resource-center/reports/strategies-and-reports/3574-hydrogen-society-roadmap-for-south-africa-2021.

86 Department of Science and Innovation, *Hydrogen Society Roadmap For South Africa 2021*.

87 Jov Onsat, 'Sasol Receives First Power under Procurement Plan for Hydrogen Production', Rigzone, 14 October 2024, https://www.rigzone.com/news/sasol_receives_first_power_under_procurement_plan_for_hydrogen_production-14-oct-2024-178402-article/.

88 'Industrial Development & Market Creation', Southern African Development Community, n.d., https://www.sadc.int/pillars/industrial-development-market-integration.

89 KfW, 'Launch of Green Hydrogen in South Africa: Harnessing the Extraordinary Potential of Renewable Sources of Energy', 7 November 2023, https://www.kfw.de/About-KfW/Newsroom/Latest-News/Pressemitteilungen-Details_786048.html.

90 KfW, 'Launch of Green Hydrogen in South Africa: Harnessing the Extraordinary Potential of Renewable Sources of Energy'.

91 NewClimate Institute and Institute for Climate Economics, *Financing Coal Phase-Out: Public Development Banks' Role in the Early Retirement of Coal Plants*.

92 World Bank Group, *Managing Coal Mining Closure: Achieving a Just Transition for All* (World Bank Group, 2018), https://hdl.handle.net/10986/31020.

H2Global Foundation

T: +49 40 36197500
E: info@h2-global.org

www.h2-global.org