IMPULSE PAPER ON DECARBONISING THE SOUTH AFRICAN MINING SECTOR: FOCUS GREEN AMMONIA

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Executive Summary

South Africa's mining sector is central to its economy, but also one of its most carbon-intensive industries. As the country works toward meeting its Nationally Determined Contribution (NDC) under the Paris Agreement and implementing its recently enacted Climate Change Act (2024), the pressure to decarbonise is mounting. However, this pressure does not stem from national policy alone. Increasingly, global market dynamics, such as emerging carbon border adjustment mechanisms, green supply chain mandates from international buyers, and ESG-focused investor requirements, are shaping how South African mining companies operate and compete. As value chains become more climate-conscious, the ability to demonstrate low-carbon operations is becoming a precondition for sustained market access and trade competitiveness.

Green ammonia, produced using green renewable ("green") hydrogen, offers a viable and immediate solution to reduce the embedded emissions associated with mining explosives, particularly ammonium nitrate. While direct Scope 1 reductions from blasting may be limited, the substitution of fossil-based ammonia with green ammonia significantly lowers upstream (Scope 3) emissions and supports climate performance across the mining value chain. In addition to these direct reductions, the adoption of green ammonia enables further Scope 2 and Scope 3 emissions reductions by facilitating renewable electricity integration and cleaner input materials across the supply chain. This alignment with global ESG expectations can unlock access to green finance, strengthen the credibility of climate commitments, and position South African mining more competitively in international markets.

Despite its potential, the high-cost differential between conventional (grey) and green ammonia remains a key barrier to uptake. To address this, the impulse paper proposes a suite of targeted policy instruments aimed at incentivising early adoption and de-risking investment by the mining industry. These include:

- A green premium compensation scheme to subsidise price differentials;
- Access to carbon credits for Verified Emissions Reductions (VERs) generated through certified use of green ammonia;
- Accelerated depreciation of capital investments in green input infrastructure (e.g., ammonia blending and storage systems, renewable-powered hydrogen supply equipment);
- Green procurement mandates for state-linked mining projects to create anchor demand;
- A regional green ammonia certification framework to drive harmonisation and market integration across the SADC region.

These recommendations are aligned with South Africa's broader strategic objectives, including the Just Energy Transition Investment Plan (JET-IP), the Hydrogen Society Roadmap, and ongoing reforms to the Carbon Tax Act. In this context, references to "low-carbon inputs" encompass technologies and materials that significantly reduce emissions intensity compared to conventional alternatives, especially green hydrogen, green ammonia, and renewable based feedstocks. Ultimately, the proposed policy package aims not only to position South Africa as a leader in climate-smart mining but also to unlock long-term industrial competitiveness, environmental resilience, and regional trade in green value chains.

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Introduction

South Africa has the highest greenhouse gas (GHG) emissions in Africa, primarily driven by its coal-dependent energy sector and electricity generation system. As part of its commitment to a greener, more sustainable economy, the country's National Development Plan (NDP) envisions a transition toward a low-carbon development pathway. A key lever in this transition is the implementation of a carbon tax, which currently applies to approximately 90% of the nation's total GHG emissions, excluding agriculture, forestry, land use, and waste. However, while the coverage appears broad, there are substantial exemption in place, most notable for Eskom, the country's largest emitter. Moreover, the current carbon price remains too low to materially shift investment decisions towards low-carbon technologies. That said, the Department of Forestry, Fisheries and the Environment (DFFE) has indicated plans to progressively raise the carbon tax rate in the coming years to strengthen its impact and align with South Africa's climate commitments (Baker, 2022; Gustafsson, 2021).

Within this broader climate and economic policy context, South Africa's mining industry, one of its most energy- and-carbon intensive sectors, is under mounting pressure to reduce its emissions footprint to maintain international competitiveness. Green ammonia, derived from green hydrogen, presents a compelling opportunity for the mining sector to decarbonise key inputs such as explosives, primarily by reducing upstream and value chain-related emissions (Scope 3), and to align more closely with emerging carbon markets and environmental, social, and governance (ESG) expectations. This impulse paper explores targeted policy instruments to accelerate the mining sector's adoption of green ammonia, positioning it as a leader in South Africa's green industrial transition.

Rationale – Why Green Ammonia for Mining?

South Africa has a carbon tax policy that operates on a polluter-pays principle and serves as a central pillar in the country's climate change response. As part of its Nationally Determined Contribution (NDC), South Africa has committed to reducing GHG emissions and achieving carbon neutrality in the long-term (Mantlana, Maoela and Nhamo, 2021). The recently enacted Climate Change Act (2024) provides a national legal framework for both mitigation and adaptation efforts (South Africa Government, 2024).

While South Africa is regarded as an innovator in climate governance across the continent, the effectiveness of its carbon tax regime is diminished by numerous exemptions, resulting in a relatively low effective carbon price across the economy.

Within this broader climate and economic policy context, South Africa's mining industry – one of its most energy-and carbon-intensive sectors, is under mounting pressure to reduce its emission footprints to maintain and enhance international competitiveness. This pressure stems not only from national legislation such as the Climate Change Act (2024) and the country's Nationally Determined Contribution (NDC), but also from increasing expectations across global value chains, particularly in commodities like green steel, batteries, and EV supply chains that demand verified low-carbon products.

Green ammonia, derived from green hydrogen and used in manufacturing ammonium nitrate explosives, presents an opportunity to decarbonise Scope 1 emissions associated with blasting operations, particularly when the production of green ammonia, nitric acid, and fuel oil is conducted on-site under the mine's operational control, thereby bringing the emissions profile within the mine's direct reporting boundary. This transition could support Scope 2 reductions if the renewable electricity capacity for the green ammonia synthesis is oversized and produces renewable electricity for other operations, and potentially Scope 3 reductions for off-takers by providing lower-carbon products across the value chain. While the magnitude of emission reductions will vary by operation, data from Australia suggest that switching to green explosives would increase mining costs by less than 0.4%, while significantly reducing upstream (Scope 3) emissions from purchased explosives (IEEFA, 2024). For instance, IEEFA's analysis estimated that a full transition to green ammonia-based explosives by 2030 would increase mining operating costs by up to 0.4%, equating to a potential reduction of just 0.7% in profit margins. Even an interim 20% switch by 2025 would raise costs by less than 0.1%, making the shift both financially manageable and operationally feasible.

Moreover, localised production of green ammonia and ammonium nitrate in South Africa could enhance supply chain resilience, reduce dependency on imports, cut transport-related emissions and costs, and improve energy security, especially relevant given disruptions observed in recent global chemical markets.

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Mining accounts for approximately 5 to 7% of South Africa's total GHG emissions, largely driven by its electricity consumption and onsite process emissions (Votteler, 2016). Given its centrality to South Africa's economy and its position as an ammonia derivatives user, the mining sector is well-positioned to become both a high-impact early off-taker and strategic partner in scaling domestic green ammonia production. This paper explores targeted incentives to accelerate that shift, including carbon credits, price premium bridging, and preferential procurement frameworks.

Furthermore, the adoption of green ammonia in mining supports improved environmental, social, and governance (ESG) performance-criteria that are increasingly embedded in the procurement frameworks of global buyers and the investment decisions of ESG-aligned funds. Environmentally, while green ammonia does not significantly reduce direct emissions from blasting, it lowers the upstream carbon intensity of explosives inputs, thereby contributing to broader value chain emissions reduction and stimulating green job creation in regions adjacent to mining operations. From a governance perspective, sourcing certified green products fosters traceability and transparency in emission reporting, both of which are critical in meeting evolving international carbon pricing such as the EU Carbon Boarder Adjustment Mechanism (CBAM). According to PwC (2023), mining companies that demonstrably align with ESG priorities are more likely to secure sustainable finance and maintain global competitiveness. In this way, incentivising the use of green ammonia in the mining sector is not only environmentally responsible, but also economically strategically aligned with South Africa's broader climate and industrial development ambitions.

Policy Alignment and Strategic Gaps

South Africa's energy policy landscape is defined by the 1998 White Paper on Energy, the Electricity Regulation Act (ERA) of 2006, and the Integrated Resource Plan (IRP), which guides long-term electricity generation planning. While the IRP 2019 demonstrates progress in transitioning toward renewable energy, it does not explicitly include green hydrogen or ammonia in its framework, despite their increasing global importance.

Additionally, South Africa's Hydrogen South Africa (HySA) program, established in 2007 to drive innovation in hydrogen fuel cell technology, has laid the groundwork for sectoral ambition, but lacks an integrated policy and investment strategy to enable market uptake. This has led to a disconnect between policy ambition and sector-level implementation.

Nonetheless, strong political intent is evident through the inclusion of nine Strategic Integrated Projects (SIPs) in 2022, many of which are dedicated to green hydrogen and green ammonia infrastructure. This creates a vital window to mainstream green ammonia in energy and industrial policy. Aligning green ammonia incentives with the IRP, JET-IP, and national climate instruments will bridge existing policy gaps and create an enabling ecosystem for scale-up.

Mining Sector as a Critical Offtaker and Producer

South Africa's mining sector is a major player in the national energy landscape, accounting for approximately 30% of Eskom's electricity consumption, making it one of the country's largest industrial energy users. It is also a significant contributor to GHG emissions due to its reliance on coal and carbon-intensive processes (Manyane and Nembahe, 2024).

However, the sector's role in the green transition extends beyond being a consumer of green ammonia. Mining companies are strategically positioned to support the production of green hydrogen and green ammonia by leveraging South Africa's abundant reserves of critical minerals like platinum, vanadium, and manganese, key components in electrolysers, hydrogen storage technologies, and other clean energy applications.

Companies such as Anglo American (now known as Valterra Platinum) have already pioneered this approach, unveiling the world's largest hydrogen-powered mine haul truck prototype in 2022. Yet, Valterra Platinum remains one of the few mining firms with a direct stake in hydrogen development, underscoring a significant opportunity for broader industry engagement. With the right public-private partnerships and enabling policy frameworks, the mining sector can become both a high-impact off-taker and a co-developer of green ammonia value chains.

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Strategic Integrated Green Hydrogen Projects in South Africa

The scale of opportunity is evidenced by the government's designation of nine green hydrogen projects as Strategic Integrated Projects (SIPs) in 2022, reflecting its seriousness about advancing a Just Energy Transition. These projects include:

1. Prieska Power Reserve (Northern Cape) – green ammonia production
2. The Ubuntu Green Energy Hydrogen Development Programme
3. Boegoebaai Green Hydrogen Development Programme (Northern Cape)
4. Atlanthia Green Hydrogen (Western Cape)
5. Upilanga Solar and Green Hydrogen Park (Northern Cape)
6. Sasolburg Green Hydrogen Programme (Free State)
7. SASOL HySHIFT (Secunda, Mpumalanga)
8. Hydrogen Valley Programme by Anglo American (Limpopo and Gauteng to KwaZulu-Natal)

Despite the sector's potential, Valterra Platinum remains the only major mining company currently engaged in these SIPs. This gap presents a clear opportunity for the broader mining industry to collaborate, invest, and lead within the green hydrogen economy.

Policy Instruments to Incentivise Offtake on Mining

A suite of policy instruments and strategic actions are needed to accelerate green ammonia uptake in South Africa's mining sector. These mechanisms aim to de-risk early adoption, create price parity, and build alignment with broader decarbonisation efforts such as the Just Transition Investment Plan (JET-IP) and Hydrogen Society Roadmap.

1. Green Premium Compensation Scheme

Rationale: Green ammonia is currently more expensive than conventional (grey) ammonia due to high electrolyser and renewable energy costs.
Design: Government could offer time-bound subsidies or production-linked incentives to explosives manufacturers or mines that source certified green ammonia.
Objectives: Offset the price gap to encourage early demand until economies of scale and cost declines improve competitiveness.

2. Carbon Credit Eligibility for Green Explosive Use

Rationale: Mines that switch to low-carbon inputs should be able to monetise their emissions reductions.
Design: Recognise the use of certified green ammonia in explosives as eligible for generating Verified Emission Reductions (VERs) under South Africa's carbon offsets regulations. This would allow mining companies to trade credits either in voluntary carbon markets or for compliance under the Carbon Tax Act.
Objectives: Reward emissions reduction activities and attract low-carbon finance.

3. Fast-Tracked Depreciation for Equipment Upgrades

Rationale: The transition to green ammonia may require capital upgrades to blending systems, storage infrastructure, and safety equipment.
Design: Amend tax policy to allow accelerated depreciation (e.g., within 3 years) of capital expenditure linked to green ammonia use.
Objective: Improve internal rates of return (IRR), enhance early cash flow, and support investment decisions.

4. Green Procurement Mandates for State-Linked Mining Projects

Rationale: State-owned or state-supported mines can play a catalytic role by anchoring demand.
Design: Introduce procurement guidelines requiring State Owned Enterprise (SOE)-backed mining projects (e.g., Alexkor, Mintek) to source a percentage of their explosives from suppliers using certified green ammonia.

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Objective: Create a reliable early market signal for green ammonia producers and build public sector credibility.

5. **SADC Regional Green Standards and Market Integration**

Rationale: Many mining companies operate across multiple Southern African countries and face fragmented environmental standards.
Design: Develop a SADC-wide certification mechanism for green ammonia, modelled after international schemes like Guarantees of Origin, to harmonise definitions and enable tax/tariff benefits for certified products.
Objectives: Encourage cross-border offtake, reduce trade frictions, and support regional hydrogen/ammonia market development.

Scope Emissions Reductions and ESG Value

While green ammonia cannot resolve all emissions challenges in mining, it offers specific benefits within the broader decarbonisation efforts, particularly in relation to upstream input sourcing and environmental transparency. Its contribution to emissions reduction can be categorised as follows:

- **Scope 1**: Green ammonia-based explosives may have limited direct impact on Scope 1 emissions at mine sites. Blasting with ammonium nitrate-based explosives (e.g., ANFO) results in on-site emissions primarily as NOx and some CO_2. The use of green ammonia in their manufacture does not significantly alter the detonation-related emission profile. Broader Scope 1 reductions in mining will likely require the adoption of alternative, lower-emission explosive technologies or fuel-switching strategies (e.g., electrification or green hydrogen for haul trucks, such as Anglo American implemented) (Anglo American, 2024).
- **Scope 2**: These refer to indirect emissions from electricity purchased and consumed by mining operations. Unless green ammonia is produced on-site from grid electricity or self-produced renewable electricity, the use of green ammonia has minimal impact on a mining company's Scope 2 emissions.
- **Scope 3**: The most relevant category for green ammonia impact. By sourcing explosives made with certified green ammonia, mining companies reduce the embedded (upstream) emissions of their purchased inputs. This contributes to Scope 3 emissions reduction and supports credible low-carbon supply chain positioning – important for ESG disclosures and sustainability-linked offtake contracts (e.g., with green steel or battery manufacturers).

In this way, green ammonia adoption enhances environmental performance most notably through Scope 3 decarbonisation and broader ESG alignment. It enables mining companies to credibly signal environmental responsibility, improve their position with investors and commodity buyers, and support South Africa 's industrial transition towards a greener economy.

Strategic Policy Recommendations

To unlock the full potential of green ammonia decarbonising South Africa's mining sectors, the following strategic actions are recommended at the institutional and policy coordination level:

a. **Launch a Green Mining Input Incentives Scheme (GMIIS):**
Create a dedicated support programme under the Department of Mineral and Resources and Energy (DMRE) and National Treasury, specifically designed to provide targeted incentives, such as green premium compensation, tax benefits, and access to green finance, for mines adopting green ammonia-based explosives and related infrastructure.

b. **Reform the Carbon Tax Act:**
Amend the current carbon tax regime to explicitly recognise low-carbon industrial inputs like green ammonia. This should include eligibility to generate Verified Emissions Reductions (VERs) from certified usage, which can be monetised through either voluntary or compliance markets. This step will align the fiscal systems with decarbonisation incentives.

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c. **Integrate Green Ammonia into National Transition Frameworks:**
Ensure green ammonia is formally embedded within South Africa's Just Transition Investment Plan (JET-IP) and aligned with the Hydrogen Society Roadmap. This will enable access to international climate finance and increase coordination across infrastructure, industrial, and energy development streams.

d. **Support Private Sector Demonstration Projects:**
Facilitate structured pilot partnerships between explosives manufacturers (e.g., AEL, BME) and major mining operations (e.g., Valterra Platinum, Exxaro Resources). These pilots will serve to prove commercial viability, generate operational learning, and de-risk future investment across the sector.

e. **Ensure Fiscal Neutrality Through Revenue Recycling:**
Maintain budgetary balance by earmarking a portion of revenues from carbon tax or climate-linked funding sources to finance green ammonia adoption, including subsidies, infrastructure support, and certification systems. This revenue recycling will ensure the policy remains fiscally responsible while scaling its environmental impact.

Conclusion

Green ammonia presents a timely and strategic opportunity to decarbonise South Africa's mining sector, one of the most emissions-intensive and economically critical industries in the country. While its direct impact on Scope 1 emissions may be modest, its value lies in enabling upstream Scope 3 decarbonisation, enhancing ESG alignment, and building industrial resilience through localised green input production.

This policy brief has outlined a combination of financial incentives, regulatory reforms, and regional market coordination tools designed to accelerate green ammonia offtake. Coupled with strategic recommendations to align with national transition plans and carbon tax reforms, these instruments can help South Africa position its mining sector as a leader in low-carbon industrial innovation.

By acting now, South Africa can capture first-mover advantages in green value chains, unlock access to sustainable finance, and ensure that its mining industry remains competitive in a global economy increasingly shaped by climate-conscious investment and trade standards.

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